RESOURCE CONSERVATION AND RECOVERY ACT PERMIT RENEWAL APPLICATION

SI GROUP, INC.
725 CANNON BRIDGE ROAD
ORANGEBURG, SOUTH CAROLINA 29115

EnSafe Project Number:
0888821679

Prepared for:

SI Group, Inc.
725 Cannon Bridge Road
Orangeburg, South Carolina

Revision: 5; October 2020

5724 Summer Trees Drive
Memphis, Tennessee 38134
901-372-7962 | 800-588-7962
www.ensafe.com

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Prepared by:

Geoff Pope

Reviewed by:

Phillip G. Coop

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ACRONYM LIST

µg/m^3/sec	Micrograms per Cubic Meter per Second
^{o}C	Celsius
^{o}F	Degrees Fahrenheit
AOCs	Areas of Concern
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
AWFCO	Automatic Waste Feed Cutoff
BIF	Boilers and Industrial Furnaces
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
Btu/hr	British Thermal Units per Hour
CAA	Clean Air Act
CBMC	Computerized Boiler Management Controller
CBTs	Computer Based Training
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
Cfm/ft^2	Cubic Feet per Minute per Square-Foot
CO	Carbon Monoxide
CPT	Comprehensive Performance Test
DHEC	Department of Health and Environmental Control
DOT	Department of Transportation
DP	Differential Pressure
DRE	Destruction and Removal Efficiency
dscf	Dry Standard Cubic Feet
EMS	Emergency Medical Service
EMT	Emergency Medical Technician
ERT	Emergency Response Team
FIRM	Flood Insurance Rate Maps
gal	Gallon
g/hr	Grams Per Hour
g/sec	Grams Per Second
gpm	Gallon Per Minute
HazCom	Hazard Communications
HBCA	Health-Based Compliance Alternative
HDPE	High-Density Polyethylene
HWC MACT	Hazardous Waste Combustor Maximum Achievable Control Technology
HWMU	Hazardous Waste Management Unit
lb/hr	Pounds Per Hour
lb/min	Pounds Per Minute
lbs/mm	Pounds Per Millimeter
LDAR	Leak Detection and Repair

LVM	Low Volatility Metal
MACT	Maximum Achievable Control Technology
MCL	Maximum Containment Level
mg/dscm	Milligrams per dry standard cubic meter
MMBtu	Million Britis Thermal Units
msl	Mean Sea Level
NA	Not Applicable
NAVD	North America Vertical Datum
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NetDAHS CEMS	NetDAHS Continuous Emission Monitoring System
NFA	No Further Action
NIC	Notice of Intent to Comply
NOC	Notification of Compliance
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetlands Inventory
O_2	Oxygen
OSHA	Occupational Safety and Health Administration
PA	Public Address
PCDD	Polychlorinated Dibenzo-p-Dioxins
PCDF's	Polychlorinated Dibenzo-p-Furans
P&ID	Piping and Instrumentation Diagram
PLC	Programmable Logic Controller
PM	Particulate Matter
POHC's	Principal Organic Hazardous Constituents
PPE	Personal Protective Equipment
ppm	Parts Per Million
ppmv	Parts Per Million by Volume
ppmw	Parts Per Million by Weight
PR	Preliminary Review
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SAA	Satellite Accumulation Areas
SCBA	Self-Contained Breathing Apparatus
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulations
SVMs	Semi-Volatile Metals
SWMUs	Solid Waste Management Units
TSDF	Treatment, Storage, and Disposal Facility

U.S. EPA	United States Environmental Protection Agency
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
VSI	Visual Site Inspection
VO	Volatile Organics
VOC	Volatile Organic Compound
WAP	Waste Analysis Plan

OMB# 2050-0024; Expires 05/31/2020

United States Environmental Protection Agency
RCRA SUBTITLE C SITE IDENTIFICATION FORM

1. Reason for Submittal (Select only one.)

☐	Obtaining or updating an EPA ID number for an on-going regulated activity that will continue for a period of time. (Includes HSM activity)
☐	Submitting as a component of the Hazardous Waste Report for _____ (Reporting Year)
	☐ Site was a TSD facility and/or generator of > 1,000 kg of hazardous waste, > 1 kg of acute hazardous waste, or > 100 kg of acute hazardous waste spill cleanup in **one or more months of the reporting year** (or State equivalent LQG regulations)
☐	Notifying that regulated activity is no longer occurring at this Site
☐	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
☑	Submitting a new or revised Part A Form

2. Site EPA ID Number

S	C	D	0	4	3	3	8	4	0	7	2

3. Site Name

SI Group, Inc.

4. Site Location Address

Street Address **725 Cannon Bridge Road**		
City, Town, or Village **Orangeburg**		County **Orangeburg**
State **South Carolina**	Country **USA**	Zip Code **29115**

5. Site Mailing Address ☐ Same as Location Address

Street Address **P.O. Box 1028**		
City, Town, or Village **Orangeburg**		
State **South Carolina**	Country **USA**	Zip Code **29116**

6. Site Land Type

☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

7. North American Industry Classification System (NAICS) Code(s) for the Site (at least 5-digit codes)

A. (Primary)	**325412**	C.	
B.	**325199**	D.	

8. Site Contact Information

☑ Same as Location Address

First Name **Lisa**	MI	Last Name **Luna**
Title **Manager - Environmental Compliance**		
Street Address		
City, Town, or Village		
State	Country	Zip Code
Email **lisa.luna@siigroup.com**		
Phone **(803) 539-5490**	Ext	Fax

9. Legal Owner and Operator of the Site

A. Name of Site's Legal Owner

☐ Same as Location Address

Full Name SI Group, Inc.	Date Became Owner (mm/dd/yyyy) 9/1/2014

Owner Type

☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

Street Address 2750 Balltown Road		
City, Town, or Village Schenectady		
State New York	Country **USA**	Zip Code 12301
Email		
Phone (518) 347-4200	Ext	Fax
Comments		

B. Name of Site's Legal Operator

☐ Same as Location Address

Full Name SI Group, Inc.	Date Became Operator (mm/dd/yyyy) 9/1/2014

Operator Type

☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

Street Address **2750 Balltown Road**		
City, Town, or Village **Schenectady**		
State **New York**	Country **USA**	Zip Code **12301**
Email		
Phone **(518) 347-4200**	Ext	Fax
Comments		

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☑ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c		
	☑	a. LQG	-Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
	☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
	☐	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
If "Yes" above, indicate other generator activities in 2 and 3, as applicable.			
☐ Y ☑ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.		
☐ Y ☑ N	3. Mixed Waste (hazardous and radioactive) Generator		
☑ Y ☐ N	4. Treater, Storer or Disposer of Hazardous Waste—Note: A hazardous waste Part B permit is required for these activities.		
☐ Y ☑ N	5. Receives Hazardous Waste from Off-site		
☐ Y ☑ N	6. Recycler of Hazardous Waste		
	☐	a. Recycler who stores prior to recycling	
	☐	b. Recycler who does not store prior to recycling	
☐ Y ☑ N	7. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.		
	☐	a. Small Quantity On-site Burner Exemption	
	☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

D001	D006	D021	D028	D039	F003	P012
D002	D007	D022	D035	D040	F004	P022
D003	D008	D023	D036	D042	F005	P028
D004	D009	D024	D037	F001	F027	
D005	D018	D025	D038	F002	P005	CONT

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

NONE						

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☑ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c		
	☑	a. LQG	-Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
	☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
	☐	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
If "Yes" above, indicate other generator activities in 2 and 3, as applicable.			
☐ Y ☑ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.		
☐ Y ☑ N	3. Mixed Waste (hazardous and radioactive) Generator		
☑ Y ☐ N	4. Treater, Storer or Disposer of Hazardous Waste—Note: A hazardous waste Part B permit is required for these activities.		
☐ Y ☑ N	5. Receives Hazardous Waste from Off-site		
☐ Y ☑ N	6. Recycler of Hazardous Waste		
	☐	a. Recycler who stores prior to recycling	
	☐	b. Recycler who does not store prior to recycling	
☐ Y ☑ N	7. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.		
	☐	a. Small Quantity On-site Burner Exemption	
	☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

P030	U002	U019	U092	U140	U169	U208
P048	U003	U029	U103	U144	U170	U209
P098	U006	U037	U108	U154	U188	U211
P102	U007	U044	U117	U159	U190	
U001	U012	U080	U122	U165	U196	CONT

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

NONE						

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☑ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c		
	☑	a. LQG	-Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
	☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
	☐	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
If "Yes" above, indicate other generator activities in 2 and 3, as applicable.			
☐ Y ☑ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.		
☐ Y ☑ N	3. Mixed Waste (hazardous and radioactive) Generator		
☑ Y ☐ N	4. Treater, Storer or Disposer of Hazardous Waste—Note: A hazardous waste Part B permit is required for these activities.		
☐ Y ☑ N	5. Receives Hazardous Waste from Off-site		
☐ Y ☑ N	6. Recycler of Hazardous Waste		
	☐	a. Recycler who stores prior to recycling	
	☐	b. Recycler who does not store prior to recycling	
☐ Y ☑ N	7. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.		
	☐	a. Small Quantity On-site Burner Exemption	
	☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

U213						
U220						
U223						
U239						

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

NONE						

11. Additional Regulated Waste Activities (NOTE: Refer to your State regulations to determine if a separate permit is required.)

A. Other Waste Activities

☐ Y ☑ N	1. Transporter of Hazardous Waste—If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Underground Injection Control
☐ Y ☑ N	3. United States Importer of Hazardous Waste
☐ Y ☑ N	4. Recognized Trader—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter
☐ Y ☑ N	5. Importer/Exporter of Spent Lead-Acid Batteries (SLABs) under 40 CFR 266 Subpart G—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter

B. Universal Waste Activities

☑ Y ☐ N	1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) - If "Yes" mark all that apply. Note: Refer to your State regulations to determine what is regulated.
☑	a. Batteries
☐	b. Pesticides
☑	c. Mercury containing equipment
☑	d. Lamps
☐	e. Other (specify) _____
☐	f. Other (specify) _____
☐	g. Other (specify) _____
☐ Y ☑ N	2. Destination Facility for Universal Waste Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities

☐ Y ☑ N	1. Used Oil Transporter—If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Used Oil Processor and/or Re-refiner—If "Yes", mark all that apply.
☐	a. Processor
☐	b. Re-refiner
☑ Y ☐ N	3. Off-Specification Used Oil Burner
☐ Y ☑ N	4. Used Oil Fuel Marketer—If "Yes", mark all that apply.
☐	a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☐	b. Marketer Who First Claims the Used Oil Meets the Specifications

12. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR 262 Subpart K.

☐ Y ☑ N	A. Opting into or currently operating under 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories—If "Yes", mark all that apply. Note: See the item-by-item instructions for definitions of types of eligible academic entities.
☐	1. College or University
☐	2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university
☐	3. Non-profit Institute that is owned by or has a formal written affiliation with a college or univer-
☐ Y ☑ N	B. Withdrawing from 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

☐ Y ☑ N	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category. If "Yes", you must fill out the Addendum for Episodic Generator.

14. LQG Consolidation of VSQG Hazardous Waste

☐ Y ☑ N	Are you an LQG notifying of consolidating VSQG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

☐ Y ☑ N	LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility.
	A. ☐ Central Accumulation Area (CAA) ☐ Entire Facility
	B. Expected closure date: _____ mm/dd/yyyy
	C. Requesting new closure date: _____ mm/dd/yyyy
	D. Date closed : _____ mm/dd/yyyy ☐ 1. In compliance with the closure performance standards 40 CFR 262.17(a)(8) ☐ 2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)

16. Notification of Hazardous Secondary Material (HSM) Activity

☐ Y ☑ N	A. Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(a)(23), (24), or (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.
☐ Y ☑ N	B. Are you notifying under 40 CFR 260.43(a)(4)(iii) that the product of your recycling process has levels of hazardous constituents that are not comparable to or unable to be compared to a legitimate product or intermediate but that the recycling is still legitimate? If "Yes", you may provide explanation in Comments section. You must also document that your recycling is still legitimate and maintain that documentation on site.

17. Electronic Manifest Broker

☐ Y ☑ N	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?

18. Comments (include item number for each comment)

This Application is being submitted in response to comments from the 2015 renewal Application and
the 2018 revised Application.

19. Certification I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. **Note: For the RCRA Hazardous Waste Part A permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11).**

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy)
	10/1/2020
Printed Name (First, Middle Initial Last) **Jon Kimmel**	Title **Vice President Manuafacturing - Americas**
Email **Jon.Kimmel@siigroup.com**	

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy)
Printed Name (First, Middle Initial Last)	Title
Email	

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	Lisa	MI		Last Name	Luna
Title	Manager - Environmental Compliance				
Email	lisa.luna@siigroup.com				
Phone	(803) 539-5450	Ext		Fax	

2. Facility Permit Contact Mailing Address

Street Address	P.O. Box 1028				
City, Town, or Village	Orangeburg				
State	South Carolina	Country	USA	Zip Code	29116

3. Facility Existence Date (mm/dd/yyyy)

1/1/1937

4. Other Environmental Permits

A. Permit Type	B. Permit Number	C. Description
E	TV-1860-0004	Title V Air Permit
E	383345-1601	Class 3 Landfill Permit
N	SC0001180	NPDES Permit
R	SCD043384072	RCRA Waste Permit (Fed & State Issued)
E	381N002	Surface Water Permit
E	SCR000000	General Storm Water Permit
		CON'T

5. Nature of Business

SI Group, Inc, operates a industrial organic and specialty chemical intermediates manufacturing plant in Orangeburg County, South Carolina. The products produced are used in the agricultural, pharmaceutical, and petroluem industries.

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	MI	Last Name
Title		
Email		
Phone	Ext	Fax

2. Facility Permit Contact Mailing Address

Street Address		
City, Town, or Village		
State	Country	Zip Code

3. Facility Existence Date (mm/dd/yyyy)

4. Other Environmental Permits

A. Permit Type	B. Permit Number	C. Description
E	SCG160000	NPDES General Permit (Pesticide)
E	336 AMEND #27	Radioactive Material License

5. Nature of Business

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity (1) Amount	B. Process Design Capacity (2) Unit of Measure	C. Process Total Number of Units	D. Unit Name
0	1	S	0	2	100,000	G	001	T-100M-5
0	2	T	0	1	100,000	U	001	T-100M-5
0	3	S	0	2	30,000 (Each)	G	002	T-30M-61 & T-30M-66
0	4	T	0	1	30,000 (Each)	U	002	T-30M-61 & T-30M-66
						CON'T		

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes (1) Process Codes									D. Processes (2) Process Description (if code is not entered in 7.D1))
0	1	D	0	0	1	2821	T	S	0	2	T	8	0				Includes codes below
0	2	D	0	1	8			S	0	2	T	8	0				Included in Above
0	3	F	0	0	2			S	0	2	T	8	0				Included in Above
0	4	F	0	0	3			S	0	2	T	8	0				Included in Above
0	5	F	0	0	5			S	0	2	T	8	0				Included in Above

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		
0	5	S	0	2	10,000	G	001	T-10M-32
0	6	T	0	1	10,000	U	001	T-10M-32
0	7	T	8	0	32,200,000	I	001	Boiler No. 4

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.	A. EPA Hazardous Waste No.	B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes	
				(1) Process Codes	(2) Process Description (if code is not entered in 7.D1))
					Included on Page 11

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

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10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

Appendix A-1
Photographs

Section A: Photographs
725 Cannon Bridge Road SW
Orangeburg, South Carolina

Photo 1: Boiler No. B-4 (Photo taken September 2015).

Photo 2: Hazardous waste storage tanks (Photo taken September 2015).

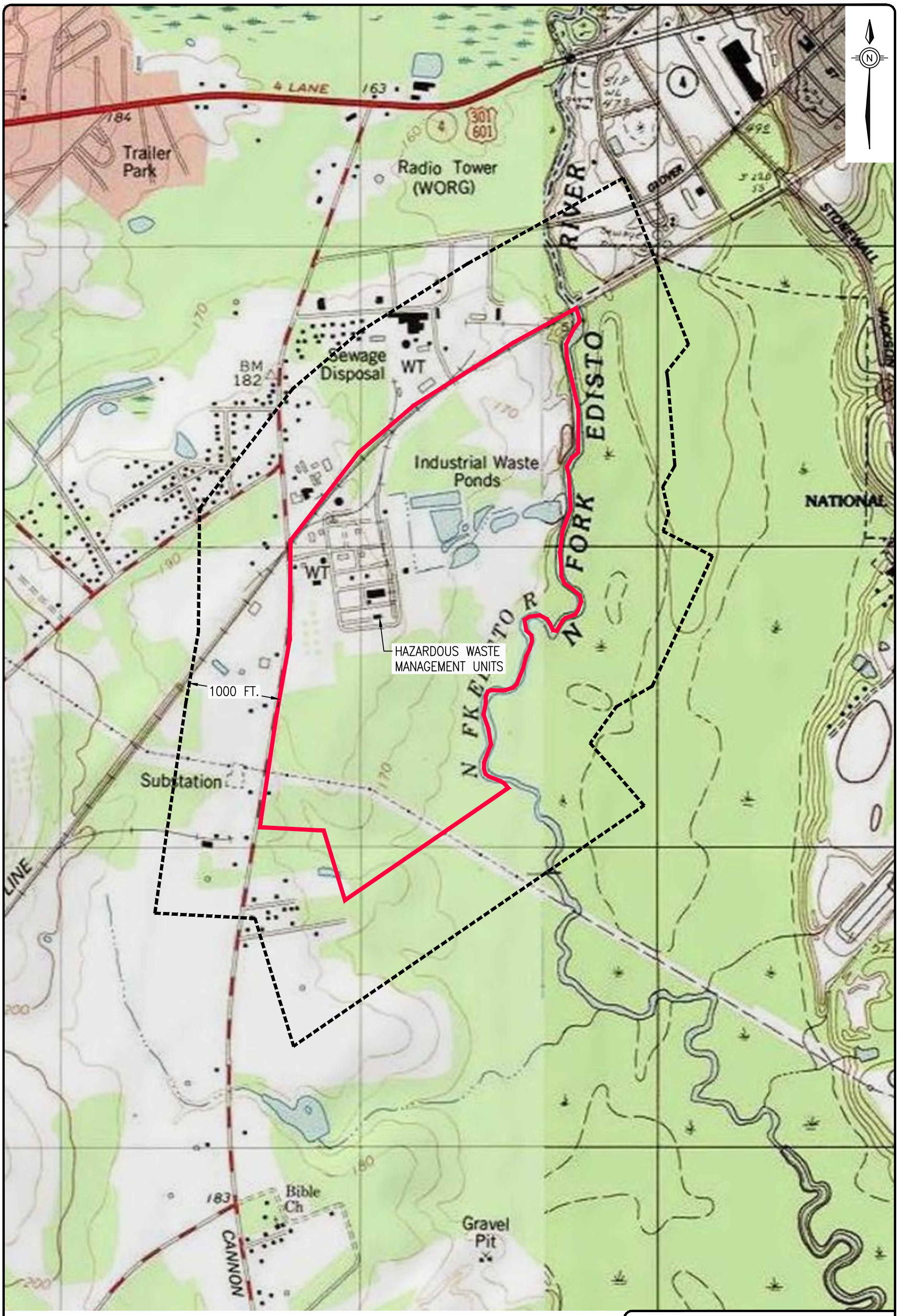
Section A: Photographs
725 Cannon Bridge Road SW
Orangeburg, South Carolina

Photo 3: Hazardous waste storage tanks (Photo taken September 2015).

Photo 4: Truck unloading area at hazardous waste tanks (Photo taken September 2015).

Section A: Photographs
725 Cannon Bridge Road SW
Orangeburg, South Carolina

Photo 5: The hazardous waste storage tanks that feed Boiler No. 4 are vented to this flare. (Photo taken September 2015).



USA Topo Maps – Copyright:© 2013 National Geographic Society, i-cubed

LEGEND
– PROPERTY BOUNDARY
– 1,000 FOOT RADIUS

1000 0 1000
SCALE FEET

FIGURE A-1
TOPOGRAPHIC MAP
SI GROUP
ORANGEBURG, SC 29116-1028

REQUESTED BY:	G.POPE
DRAWN BY:	BRONSON
DWG DATE:	05/12/20
DWG NO:	25569_B002

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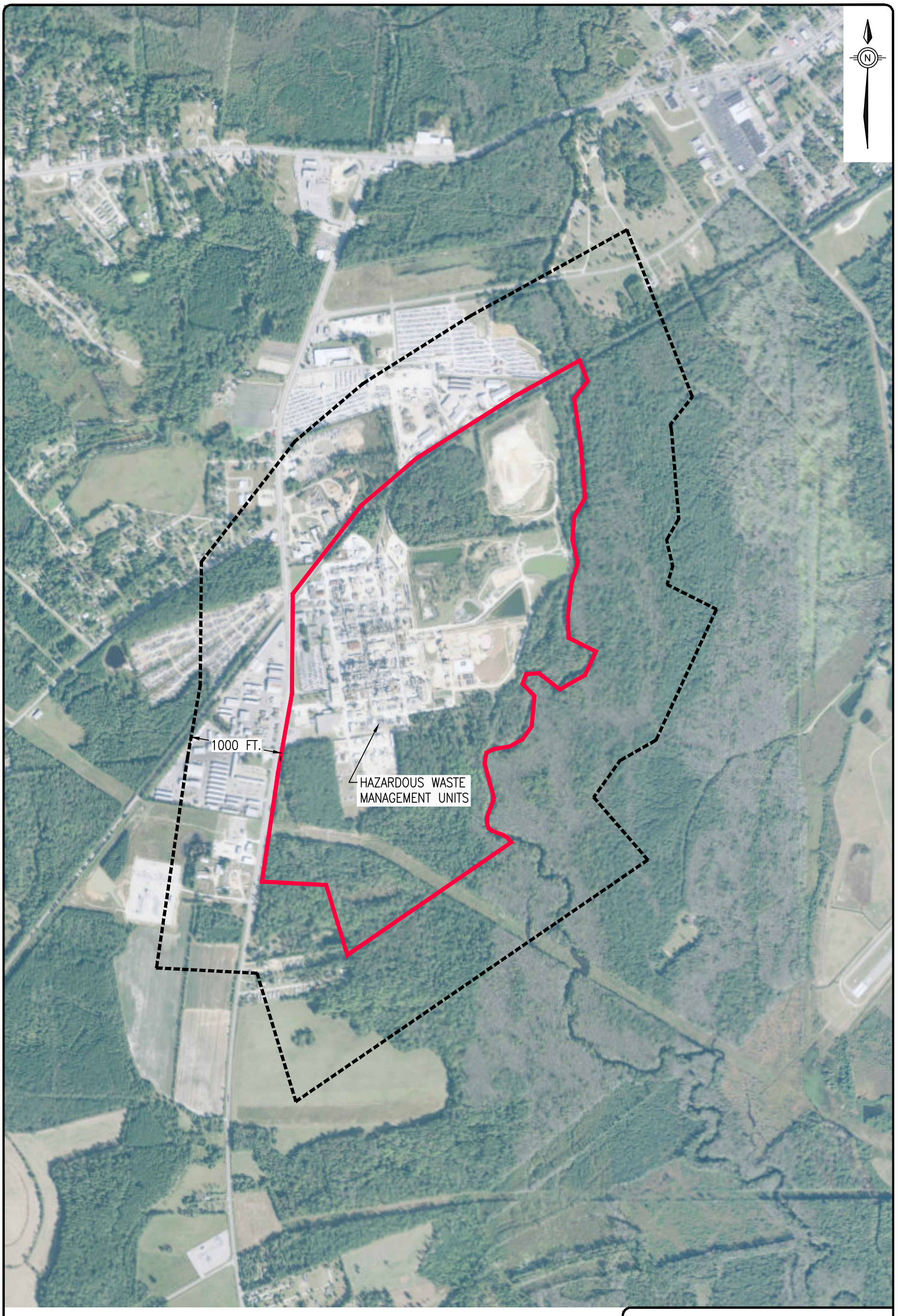

World_Imagery – Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

– PROPERTY BOUNDARY

– 1,000 FOOT RADIUS

1000 0 1000

SCALE FEET

FIGURE A–2
AERIAL MAP
SI GROUP
ORANGEBURG, SC 29116–1028

REQUESTED BY:	G.POPE
DRAWN BY:	BRONSON
DWG DATE:	05/12/20
DWG NO:	25569_B001

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SECTION B
FACILITY DESCRIPTION
[40 CFR 270.14(b)(1); SC R.61-79.270.14(b)(1)]

B.1 General Description

This Resource Conservation Recovery Act (RCRA) Permit Renewal Application (Application) was prepared in accordance with appropriate sections of Title 40 Code of Federal Regulations (CFR) 264 through 270, and South Carolina Hazardous Waste Management Regulations (SCHWMR) R.61-79, Sections 260-270.

B.1(a) Site Location

SI Group, Inc. (SI Group) is in central Orangeburg County, South Carolina, approximately 1 mile southwest of the city limits of Orangeburg. SI Group operates a manufacturing facility that produces industrial organic and specialty chemicals used in the pharmaceutical, chemical, and petroleum industries. The plant property occupies approximately 300 acres and employs approximately 350 persons. Manufacturing operations are conducted 24 hours a day, 7 days a week.

Boiler No. 4, four hazardous waste storage tanks, and ancillary equipment comprise Hazardous Waste Management Units (HWMUs) regulated under the facility's Resource Conservation and Recovery Act (RCRA) Permit. The Boiler No. 4 trailer pad is not part of the RCRA facility. Figure B-1 is a topographic map of SI Group facility and surrounding area. Figure B-2 is an aerial view of the facility and surrounding area. Figure B-3 shows the legal boundaries of the facility, the access gates, and security fencing on the property. Details of the RCRA facility are shown in Figure B-4. All figures for Section B are in Appendix B-1. The requirement in 40 CFR 270.14(b)(19) and SCHWMR R.61-79.270.14(b)(19) for the scale of the topographic map is 1-inch equal no more than 200 feet. Due to the size of the facility and the distance of 1,000 feet around the facility that is required to be shown on the topographic map, the map at the required scale was cutting off the property boundary and the 1,000-foot boundary. Additionally, the quality of the map at the required scale was not legible. Therefore, a scale of 1 inch to 1,000 feet is used on Figure B-1.

The site address, including the RCRA Facility is:	The mailing address is:
SI Group, Inc.	SI Group, Inc.
725 Cannon Bridge Road	PO Box 1028
Orangeburg, South Carolina 29115	Orangeburg, South Carolina 29116

B.1(b) Owner/Operator

SI Group is a global company headquartered in New York:

SI Group, Inc. Global Headquarters
2750 Balltown Road
Schenectady, New York 12301
Contact: Frank A. Bozich, President and Chief Executive Officer
Phone: 518-347-4200

The legal owner of the Orangeburg site is:

SI Group, Inc.
2750 Balltown Road
Schenectady, New York 12301
Contact: Jon Kimmel, Vice President Manufacturing — Americas
Phone: 304-284-2247

The contact person responsible for hazardous waste management activities at SI Group Orangeburg site is:

Lisa Luna
Manager — Environmental Compliance
SI Group, Inc.
725 Cannon Bridge Road
Orangeburg, South Carolina 29115
Phone: 803-539-5490

B.1(c) Current Operations

B.1(c)(1) Manufacturing Facility

SI Group produces industrial organic and specialty chemical used in the pharmaceutical, chemical, and petroleum industries.

B.1(c)(2) Resource Conservation and Recovery Act Hazardous Waste Management Units

Boiler No. 4 and the waste storage facility are designated HWMUs. The HWMUs consist of four aboveground waste storage tanks and ancillary equipment that are enclosed in a secondary

containment structure located directly east of Boiler No. 4. Additional waste handling facilities include a tank truck loading/unloading area, which is utilized to unload waste that is transferred across plant property via tank truck. Tank trucks are unloaded from six unloading stations located in a paved containment area immediately adjacent and east of the storage tank containment structure. Depending on the nature of the waste stream, waste delivered by the tank trucks may be deposited into the waste storage/blend tanks or may be fed directly to Boiler No. 4 for individual burning. Blending of waste is accomplished by circulating the wastes in a tank with the discharge pump. Mixing nozzles in two of the tanks are designed to disperse the wastes throughout the tank making the mixture more homogeneous. There are no agitators in any of the waste tanks.

Figure B-1 shows the layout of the SI Group property and the location of the HWMUs. Details of the RCRA facility are shown in Figure B-4. It should be noted that, in addition to (and as stated in) 40 CFR 266.111, the tank truck loading/unloading area is subject only to the closure requirements of 40 CFR Part 265.178, the containment requirements of 40 CFR Part 265.175, and 40 CFR 265 Subpart I requirements, with the exception of Part 265.170 and 265.174. However, for ease of review, the Boiler No. 4 truck trailer loading/unloading area is shown as part of the RCRA facility throughout this document.

Wastes that are managed and burned at the HWMUs consist of both hazardous and non-hazardous combustible liquid wastes. These wastes are generated within SI Group, primarily by production, pollution control, traffic, and maintenance activities, and include used cleaning and pump oils, scrubber liquor, still bottoms, reaction by-products, residues, organics separated from aqueous wastes, and heavy organics from production lines. The wastes are designated hazardous because they either contain RCRA F-listed hazardous constituents or they are characteristic ignitable hazardous wastes. Some are characteristic hazardous wastes that also contain hazardous constituents.

B.1(c)(3) RCRA Less Than 90-Day Storage Areas

In addition to the No. 4 Boiler and four associated storage tanks which are part of this Application, the site manages and accumulates hazardous waste in the manufacturing facility, in accordance with appropriate State and Federal regulations.

A summary of these RCRA less than 90-day (<90-day) storage areas are briefly described below. This listing includes those standard hazardous waste streams that are generated on some type of routine basis.

Important Notes:

- Non-routine hazardous waste from spill cleanup, plant turnarounds, and vessel cleanouts are not listed in the table.

- This table represents a snapshot at the time of the Application and is subject to change based on process changes as well as operational changes. Any changes made to the <90-day areas will be maintained at the facility and made available upon request.

Process	Area	Description Of Routine Hazardous Waste Activities	Management Method	Disposal Method
Maintenance	Site Wide	Maintenance type waste associated with plant repairs and servicing including: Solvent and oil contaminated rags, paint waste, aerosol can, and universal waste	Satellite Accumulation Areas (SAA) or < 90 day container	Offsite disposal at TSDF
Isobutylbenzene Production	Plant 5	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
		Distillation column bottoms	< 90 day container	Offsite disposal at TSDF or Boiler No. 4
		Distillation column lights	< 90 day tank	Offsite disposal at TSDF or Boiler No. 4
Traffic and Logistics	Site Wide	Drumming flushes and spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
		Trailer cleanouts	< 90 day container	Offsite disposal at TSDF
4716 Antioxidant Production	Plants 5 and 9	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
		Byproduct Methanol	< 90 day container	Offsite disposal at TSDF or Boiler No. 4
		Residual Process Organics	< 90 day container	Offsite disposal at TSDF or Boiler No. 4
330 Antioxidant Production	Plants 10 and 14	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
		Distillation Column Bottoms	< 90 day tank	Boiler No. 4
		Residual process organics and acid	< 90 day container	Offsite disposal at TSDF

Process	Area	Description Of Routine Hazardous Waste Activities	Management Method	Disposal Method
702 Antioxidant Production	Plant 12	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
		Distillation column bottoms	Point of generation is the last valve before being committed to Boiler No.4. This is when the material is no longer considered process material and now a waste	Boiler No. 4
		Off spec product with residual solvent	< 90 day container	Offsite disposal at TSDF
Aluminum Alkyl Production	Plants 4 and 7	Spent sample waste, off spec product	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
MMT Antiknock Production	Plant 5	Distillation column lights	< 90 day container	Offsite disposal at TSDF
Ibuprofen Production	Plants 9 and 15	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
		Distillation column bottoms	Point of generation is the last valve before being committed to Boiler No.4. This is when the material is no longer considered process material and now a waste.	Offsite disposal at TSDF or Boiler No. 4
		Column washouts	< 90 day container	Offsite disposal at TSDF or Boiler No. 4
Proposal Production	Plant 15	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
LCAP (Long chain alkyl phenol) Production	Plant 15	Spent sample waste	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF
Analytical and R&D Laboratories	AS Lab, PI Labs	Spent sample waste, out of date lab chemicals	Satellite Accumulation Areas (SAA)	Offsite disposal at TSDF

Note:
TSDF = Treatment, storage, and disposal facility

B.1(d) Site History

A summary of the RCRA facility history is included in Appendix B-2.

B.1(e) Wind Rose

Figure B-5 presents a wind rose for Columbia, South Carolina using 2010 through 2014 meteorological data from weather station 13883 at the Columbia, South Carolina Metro airport.

B.2 Topographic Map

B.2(a) Surface Waters

There are no permanent surface waters on the plant property. The North Fork Edisto River forms the eastern boundary of the plant property, as shown on Figure B-2.

B.2(b) Surrounding Land Use

Land use within 1,000 feet of the facility consists of wooded areas and industrial and residential landowners to the west and north of the plant. A copy of the Environmental Data Resources Inc. Offsite Receptor Report is in Appendix B-3.

B.2(c) Location of Solid Waste Management Units

A detailed description of the solid waste management units (SWMUs) and areas of concern (AOCs) is in Section J of this Application.

B.2(d) Access Controls

Figure B-3 shows the access gates and the security fencing on the property. Figure B-6 shows the security fencing, card access points and gates near the plant offices, maintenance facilities, and the main gate. The plant is operated 24 hours per day, 7 days per week. Guards are on duty at all times to control access to the site.

B.2(e) Injection and Withdrawal Wells

There are no injection wells on the property. Figure B-7 shows water supply wells within a 1,500-foot radius of the property boundary, as well as other wells in the vicinity. Figure B-8 depicts the location of the monitoring wells used to investigate the SWMU at the SI Group site. Recovery wells shown on Figure B-9 are used to extract water for treatment at the wastewater treatment system.

B.2(f) Buildings and Other Structures

Figure B-3 shows the location of buildings and process units at the SI Group facility.

B.2(g) Drainage and Flood Control Barriers

Figure B-10 depicts the storm water drainage at the SI Group facility.

Runoff Control System

Natural surface drainage at the facility is provided by the contour of the surrounding land. Precipitation runoff follows the land contours, discharging via ditches to the North Fork Edisto River. The storm water discharges for the facility are monitored pursuant to the South Carolina Storm Water Multi-Sector General Permit for Sector C, Permit ID SCR0000000.

The conditions of the General Permit require SI Group to visually observe on a quarterly basis the storm water to determine color, odor, clarity, floating solids, settled solids, suspended solids, foam, and oil sheen. SI Group continues to conduct these inspections and document conditions of the storm water.

Storm, Sanitary, and Process Sewers

Facility storm drains are routed to the storm water impoundment basin, located on the east side of the property. Trenches and sumps that pump to the onsite wastewater treatment facility are located at or within 1,000 feet of the HWMUs.

The industrial wastewater discharges to surface waters for the facility are monitored pursuant to the National Pollutant Discharge Elimination System Permit, Permit ID SCR0001180.

Loading and Unloading Areas

Waste is transferred across plant property via tank truck. Tank trucks are unloaded from six unloading stations located in a paved containment area immediately adjacent and east of the storage tank containment structure. Waste is also directly piped to the Boiler No. 4 storage tanks. Loading and unloading procedures are detailed in Section F of this permit Application.

Fire Control Facilities

The facility is equipped with proper fire control equipment, and the facility has trained employees in fire and spill control. Emergency response and fire-fighting equipment are detailed in Section F of this permit Application.

Flood Control

No flood control or drainage barriers are at the SI Group. The topography at the facility is relatively level, and gradually slopes from west to east toward the North Fork of the Edisto River. Elevations range from 190 feet above mean sea level (msl) along Cannon Bridge Road at the western edge of the plant property to 160 feet above msl at the North Fork of the Edisto River, which forms the eastern boundary of the plant property. The Federal Emergency Management Agency identified the boundary of the 100-year floodplain as an elevation of 162 feet in the vicinity of SI Group's Orangeburg property. The lowest elevation that occurs at the HWMUs is 181 feet; thus, the HWMUs are situated 19 feet higher than, and 800 feet west of, the 100-year floodplain surface. Figure B-11 shows the 100-year floodplain.

B.2(h) Additional Topographic Map Information

Figure B-1 shows the legal boundaries of the SI Group property. The plant consists of two parcels. The north parcel of approximately 200 acres is almost completely developed with plant structures. The 100-acre southern portion is largely undeveloped and is a certified wildlife habitat.

B.2(h)(1) Regional Geology

The Coastal Plain of South Carolina is underlain by sedimentary deposits ranging in age from Upper Cretaceous to Recent, which lie un-conformably on ancient crystalline rocks. There are three Upper Cretaceous formations — the Tuscaloosa formation, composed chiefly of light-colored sand and clay; the Black Creek formation, consisting in its lower part of dark-gray to black leaf-bearing laminated sand and clay and in its upper part of the sandy Snow Hill marl member, which contains marine fossils; and the Peedee formation, composed chiefly of gray sand and marl-stone.

The Eocene series is represented by the Black Mingo formation, of Wilcox age; the McBean formation, of Lisbon (Claiborne) age; and the Santee limestone, the Cooper marl, and the Barnwell sand, all of Jackson age, the last apparently equivalent to both Santee and Cooper. All the Eocene formations contain marine shells.

The Miocene series includes the phosphatic Hawthorn formation, whose typical occurrence is in Florida; the Raysor marl, a shell bed that is in part equivalent to the lower part of the Yorktown formation of Virginia and to the lower part of the Choctawhatchee formation of Florida; and remnants of the Duplin marl, whose type locality is in North Carolina.

The Pliocene series is represented by the Waccamaw formation, composed chiefly of marine shell beds, and by high-level terrace deposits. The seven Pleistocene formations have the same names as the Pleistocene terraces and are limited by the same shore lines. They consist chiefly of sand, but the younger ones contain clay and marine shells

The major regional formations present in the Orangeburg County area are the Waccamaw, Neogene Strata, and Duplin Formation.

The Waccamaw formation represents all known Pliocene beds in South Carolina and un-conformably underlies Pleistocene terrace deposits (so-called "Lafayette") and overlies the Miocene Duplin marl. The Waccamaw consists of soft limestones and loose gray to buff fine quartz sands in which occasional small quartz pebbles are present; in places it contains a small number of

black water-worn phosphatic pebbles that were evidently derived from the Cretaceous. Approximate thickness is 0-12 feet in South Carolina.

The Neogene Strata (undifferentiated) is made up of poorly sorted clayey sand and gravel deposited in a fluvial environment in South Carolina. The unit is characterized by insitu weathered feldspar and an abundance of quartzite gravel and cobbles.

In South Carolina, the Duplin formation consists chiefly of shell marl. It rests upon the eroded surface of formations that range in age from basal Upper Cretaceous to lower Miocene, and therefore it represents the deposits formed during a temporary invasion of the sea across a former land surface. Generally, it is less than 20 feet thick.

B.2(h)(2)(i) Soils

Orangeburg County includes a region formed by unconsolidated and consolidated sedimentary deposits. The beds consist of reddish and variegated argillaceous sands, a clay resembling fuller's earth, marl, and limestone, the clay strata outcrop in the northern or more rolling part of the county occurring at the foot of hills and in the few narrow ravines.

The marls underlie probably the greater part of the county, but are at considerable depth and outcrops are not at all common. In the eastern and southeastern parts of the county limestone is encountered at relatively shallow depths, as in wells, and lies near enough to the surface to produce a number of lime sinks and lime sink ponds. Outcrops appear in the bluffs along the Santee River, at Eutaw Spring, the Rocks Plantation, and in a few other localities. It is only from Eutaw Spring eastward that the limestone is near enough to the surface materially to influence the character of the soil) this influence being seen in the stiff or compact structure of the subsoil or substratum and indicated by a difference in the character of the native vegetation.

Three general groups of soils, taking as the distinguishing criterion the genesis or geologic process of accumulation, are represented in the count — sedimentary, alluvial, and colluvial. The soils of sedimentary origin greatly predominate. The alluvial soils are confined to strips of lowland adjacent to the present streams. Although much less extensive than the sedimentary soils, they occupy a considerable total area, all swamp and overflow land being included in the general class. The colluvial soils are almost negligible, occupying only very narrow strips on the lower parts of slopes to the stream valleys in the better drained section of the county.

Six predominant soils have been mapped at the SI Group property; the soil survey report is included as Appendix B-4. The six units include the Lumbee loamy sand, Blanton sand, Bonneau sand, Troup sand, Alpin sand, and Udorthents (loamy). Three of the six — the Smithdale-Lexington Complex, the Smithdale and Lucy soils, and the Smithdale-Providence Complex — soil units appear in the immediate area of Boiler No. 4. The six soil units are described in detail below.

The **Lumbee loamy sand** is developed along the North Fork Edisto River on the east side of the SI Group property, as well as in the north central wooded area of the property. This soil is moderately deep and poorly drained, with frequent flooding on floodplains. Slopes are 0-2 percent. This soil has a high infiltration rate (low runoff potential) and a high rate of water transmission.

The **Blanton sand** lies along the central portion of the property, running north to south. This soil is moderately deep and moderately well drained, on 0-6 percent slopes. This soil has a high infiltration rate (low runoff potential) and a high rate of water transmission.

The **Bonneau sand** is developed along the east and west sides of the SI Group property. This soil group is on 0-4 percent slopes, moderately deep, and well drained. It has a moderate infiltration rate and moderate rate of water transmission.

The **Troup sand** is developed on 0-6 percent slopes in the southwest corner of the property and throughout the central plant are. This soil is moderately deep and somewhat excessively drained, with a high infiltration rate (low runoff potential) and a high rate of water transmission.

The **Alpin sand** lies along the western property line, beneath the central plant buildings and parking lot, and in the northeast section of the property. This soil is developed on 0-6 percent slopes, is moderately deep, and is excessively drained. It has a high infiltration rate (low runoff potential) and a high rate of water transmission.

The **Udorthents (loamy)** makes up the central portion of the property around the wastewater ponds as well as the northeast corner of property. This soil is developed on 0-4 percent slopes, moderately deep, and moderately well drained. It has a moderate infiltration rate and moderate rate of water transmission.

Boiler No. 4 Soils

Soils directly beneath the HWMUs consist of Troup sand and Alpin sand. The area is covered in pavement, concrete, and gravel, with these well-drained sands and loamy sands found beneath. These sands have a high infiltration rate (low runoff potential) and a high rate of water transmission.

B.2(h)(3) Regional Hydrology

There are six hydrostratigraphic systems of the Southeastern Coastal Plain hydrogeologic province — three aquifer systems and three confining systems. In ascending order, the aquifer systems are the Midville, Dublin, and Floridan. The Midville and Dublin systems consist of a single aquifer each, the McQueen Branch and Crouch Branch, respectively. The Floridan system consists of the Gordon aquifer, the Gordon confining unit, and the Upper Three Runs aquifer. In ascending order, the confining systems are the Appleton, Allendale, and Meyers Branch. Each confining system consists of a single confining unit: the Gramling, McQueen Branch, and Crouch Branch. Several aquifers and confining units contain zones that have unique hydrogeologic properties.

Area Hydrology

In the Orangeburg area, a surficial aquifer zone occurs from approximately 0-22 feet. Sediments are thought to be of Quaternary age. The zone consists of poorly sorted, very fine to very coarse, clayey sand and gravel. Accessory minerals include opaque heavy minerals, mica, and feldspar. No hydraulic data are available for the zone and its degree of hydraulic connection to the underlying Upper Three Runs aquifer is unknown.

The Floridan aquifer system overlies the Meyers Branch confining system and is correlated with the Pearl River aquifer and Floridan aquifer system. The Floridan is transitional between the clastic and carbonate phases of the aquifer system. It includes all sediments from the top of the Meyers Branch confining system to the surficial aquifer zone. The system consists of the Gordon and Upper Three Runs aquifers and the Gordon confining unit.

The Upper Three Runs aquifer overlies the Gordon confining unit and underlies the surficial aquifer zone. In the Orangeburg area, the aquifer occurs from approximately 22-92 feet and is 70 feet thick. It consists of limestone and clayey quartz sand of Eocene and Oligocene age. A slightly sandy shelly limestone that overlies fine-grained calcareous, sandy clay (marl) marks the boundary with the underlying Gordon confining unit.

The Gordon aquifer is the lowermost aquifer of the Floridan aquifer system in updip areas. It overlies the Crouch Branch confining unit and is confined by the Gordon confining unit. The aquifer occurs from approximately 194-273 feet and is 79 feet thick. It consists of quartz sand beds of Eocene age. The lower boundary of the aquifer is marked by unconsolidated, fine to very coarse, clayey sand that overlies laminated silty clay and very fine sand of the Crouch Branch confining unit.

B.2(h)(4) Drinking Water

The raw water source for the City of Orangeburg is the North Fork Edisto River in the Edisto Memorial Gardens which is upstream of the site's wastewater discharge outfall. The Water Treatment Plant has three raw water intake structures located on the North Fork Edisto River. The river water is pumped to the plant into one of two mixing chambers. The plant's current capacity is nineteen million gallons per day. The water is pumped into the distribution system of eight tanks and to homes, schools, and businesses. The plant is staffed 24 hours a day, 7 days a week by highly trained and state certified personnel. Sampling and testing are performed hourly to ensure that all processes meet and exceed all state and federal drinking water regulations.

Additional wells shown on Figure B-9 are used for industrial and other non-potable purposes.

B.3 Description of Treatment Unit

B.3(a) Design

Boiler No. 4 is designated as one of the HWMUs at the RCRA facility. In addition to Boiler No. 4, the associated waste storage and handling facilities serving the boiler are included in the application. The waste storage facility consists of four aboveground waste storage tanks and ancillary equipment that are enclosed in a secondary containment structure located directly east of Boiler No. 4. Additional waste handling facilities include a tank truck loading/unloading area, which is utilized to unload waste that is transferred across plant property via tank truck. The Boiler No. 4 tank truck loading/unloading area is not part of the HWMUs; however, the tank truck loading/unloading area is a <90-day storage area and the tank trucks are subject to 40 CFR 265 for containers.

The HWMUs design is described in Section D of this Application.

B.3(b) Operation

Boiler No. 4 operates under a constant schedule. When the boiler is not burning hazardous waste, the boiler uses either natural gas or No. 2 fuel oil as a fuel source (up to 3 or 4 days at a time). Boiler No. 4 is monitored by properly trained personnel at all times.

The proposed and current quantities of hazardous waste burned in Boiler No. 4 and stored in the four hazardous waste storage tanks are listed in Part A of the Application.

B.3(c) Maintenance, Monitoring, Inspection

Boiler No. 4 burning operations are monitored and maintained as required by SI Group and applicable regulations. Currently, the boiler and 4 supporting hazardous waste tanks undergo integrity testing every 3 years. Sections D-10(h) and D-11(h) of this application provide additional information on inspections, monitoring, and maintenance of equipment at the HWMUs. Additionally, the boiler is inspected annually by the South Carolina Boiler Inspection Division.

B.3(d) Closure

In the event that the HWMUs/Boiler No. 4 is closed, SI Group will follow the Closure Plan, which is described in Section I.

B.4 Facility Location Information

The following are provided in accordance with 40 CFR 270.14(b)(11) relating to the requirements for facility location information.

B.4(a) Seismic Requirements

The facility is not listed in Appendix VI of 40 CFR Part 264; therefore, the requirements for the seismic standard do not apply to this Application.

B.4(b) Floodplain Standard/100-Year Flood Plain Area

Evaluation of the RCRA facility's location with respect to the 100-year floodplain is required by 40 CFR 264.18. The facility is not in the 100 year floodplain. Orangeburg County joined the Federal Emergency Management Agency in preparing flood insurance maps in 1980. Orangeburg County's Community Number for the Flood Insurance Rate Maps that intersect SI Group property are 450160 0115 B and 450160 0225 B.

B.5 Traffic Patterns

Boiler No. 4 processes hazardous waste from the production area. These wastes are transported on private internal plant streets within the secured perimeter of the facility. Figure B-3 illustrates the plant layout and identifies street locations on the plant property. Tank trucks typically use "A" street and "D" street to transfer hazardous wastes to the HWMUs, which is located on 10th Street. The other streets are used as required to gain access to the temporary (i.e., <90 day) waste storage tanks located throughout the facility.

B.5(a) Vehicle Information and Quantity of Waste Moved Per Shipment

The internal access roads ("A," "D," and 10th) are routinely used only by trained hazardous waste personnel and tank trucks authorized to be onsite. Traffic is variable depending on the operations of the plant and the amounts of hazardous waste generated. The average traffic flow for both internal and external vehicles is approximately 350 trucks over a 7 day period. Types of vehicles typically traveling the road include pickup trucks, tank trucks, scooters, and forklifts. No more than 7,500 gallons of waste are transported to the storage tanks or Boiler No. 4 in any single shipment.

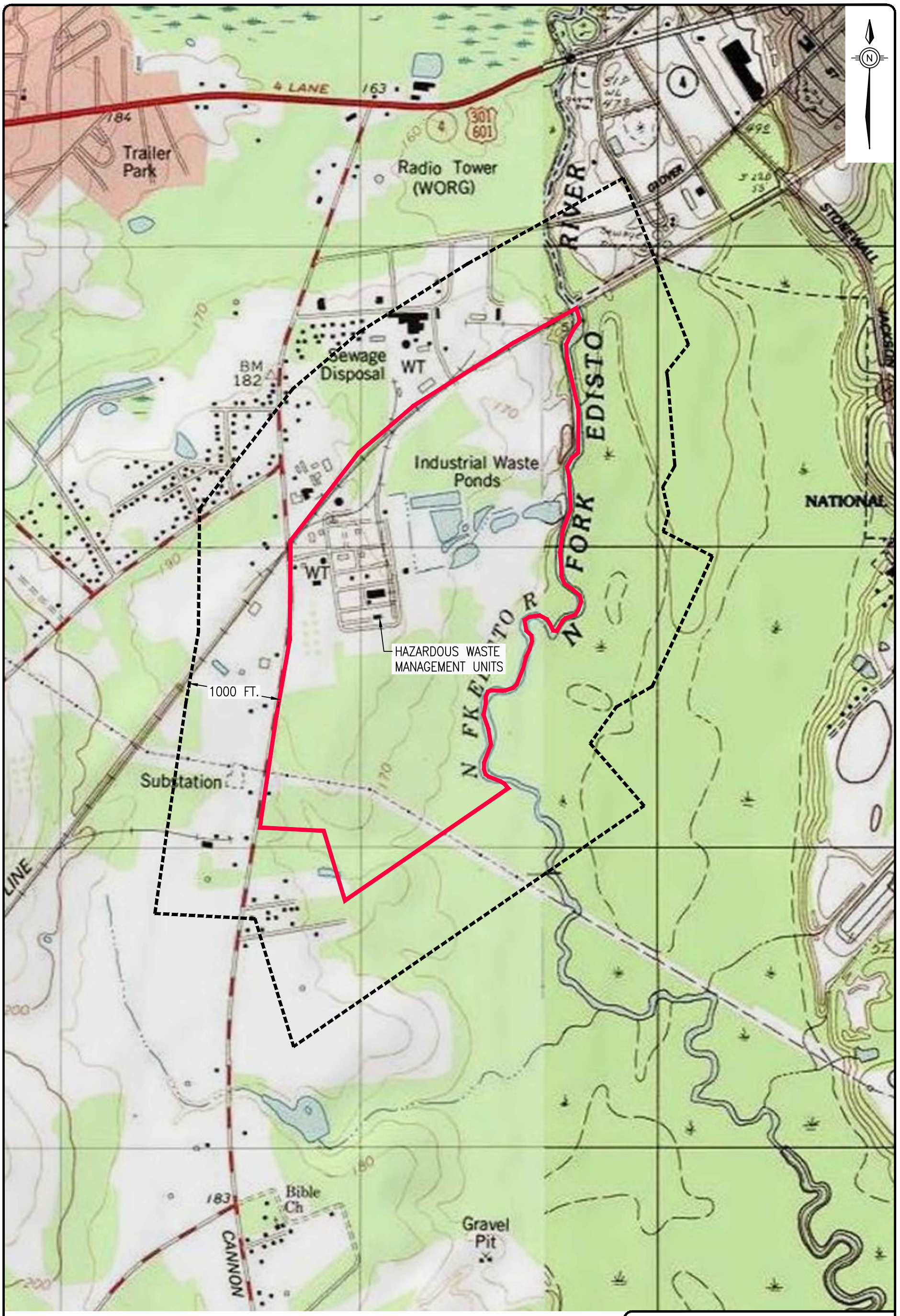
B.5(b) Traffic Control

Traffic is controlled by stop signs that are placed at all intersections within the plant; no electronic signals are used. There is a plant-wide 15 miles per hour speed limit that is in effect on plant property. Access to the plant is restricted to authorized SI Group or subcontractor vehicles and delivery trucks. Tenth Street is not a primary route and is typically used only for deliveries of waste.

B.5(c) Road Construction Composition and Load-Bearing Capacity

Most of the plant streets have been paved (see Figure B-3). "A" street and "D" street are paved. Tenth Street, the Street adjacent to and serving the HWMUs, is unpaved. The standard pavement design for all paved plant roadways is 5,000 pounds per square inch (psi) reinforced concrete paving, 10 inches thick at the center and 12 inches thick at the edge. The Portland Cement Association publication, Concrete Industrial Driveways (ISO 16.05P), 1969, shows that this pavement design is capable of sustaining an unlimited number of loads up to 34,500 pounds for a single axle and 53,000 pounds for tandem axles. The load-bearing capacity of the existing gravel drive serving the HWMUs has not been tested, however it has historically supported all trailers (73,000 pounds full), even during wet weather.

Appendix B-1
Figures



USA Topo Maps – Copyright:© 2013 National Geographic Society, i-cubed

LEGEND

– PROPERTY BOUNDARY

– 1,000 FOOT RADIUS

1000 0 1000

SCALE FEET

FIGURE B-1
TOPOGRAPHIC MAP
SI GROUP
ORANGEBURG, SC 29116-1028

REQUESTED BY:	G.POPE
DRAWN BY:	BRONSON
DWG DATE:	05/12/20
DWG NO:	25569_B002

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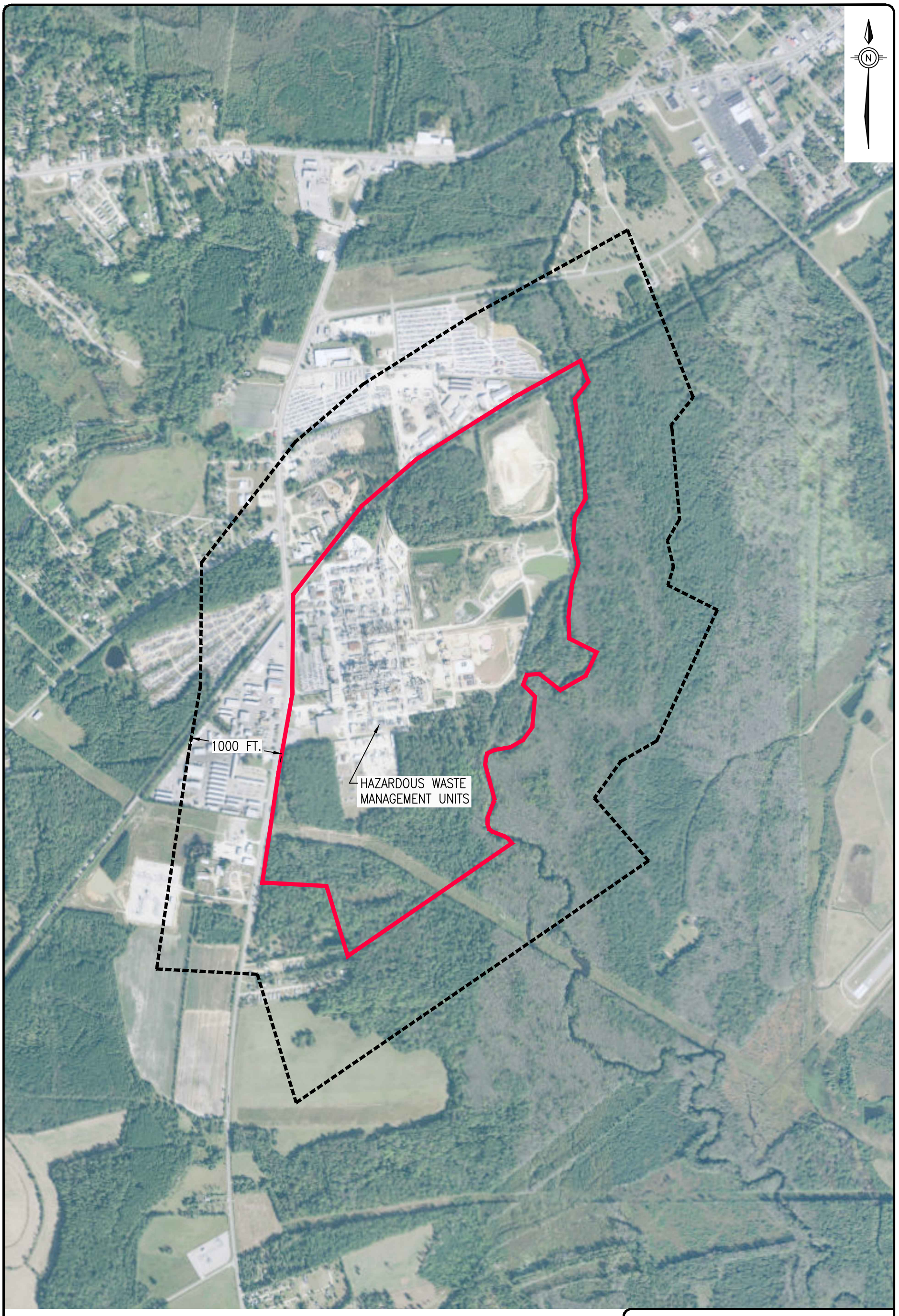

World_Imagery – Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

– PROPERTY BOUNDARY

– 1,000 FOOT RADIUS

1000 0 1000

SCALE FEET

FIGURE B-2
AERIAL MAP
SI GROUP
ORANGEBURG, SC 29116-1028

REQUESTED BY:	G.POPE
DRAWN BY:	BRONSON
DWG DATE:	05/12/20
DWG NO:	25569_B001

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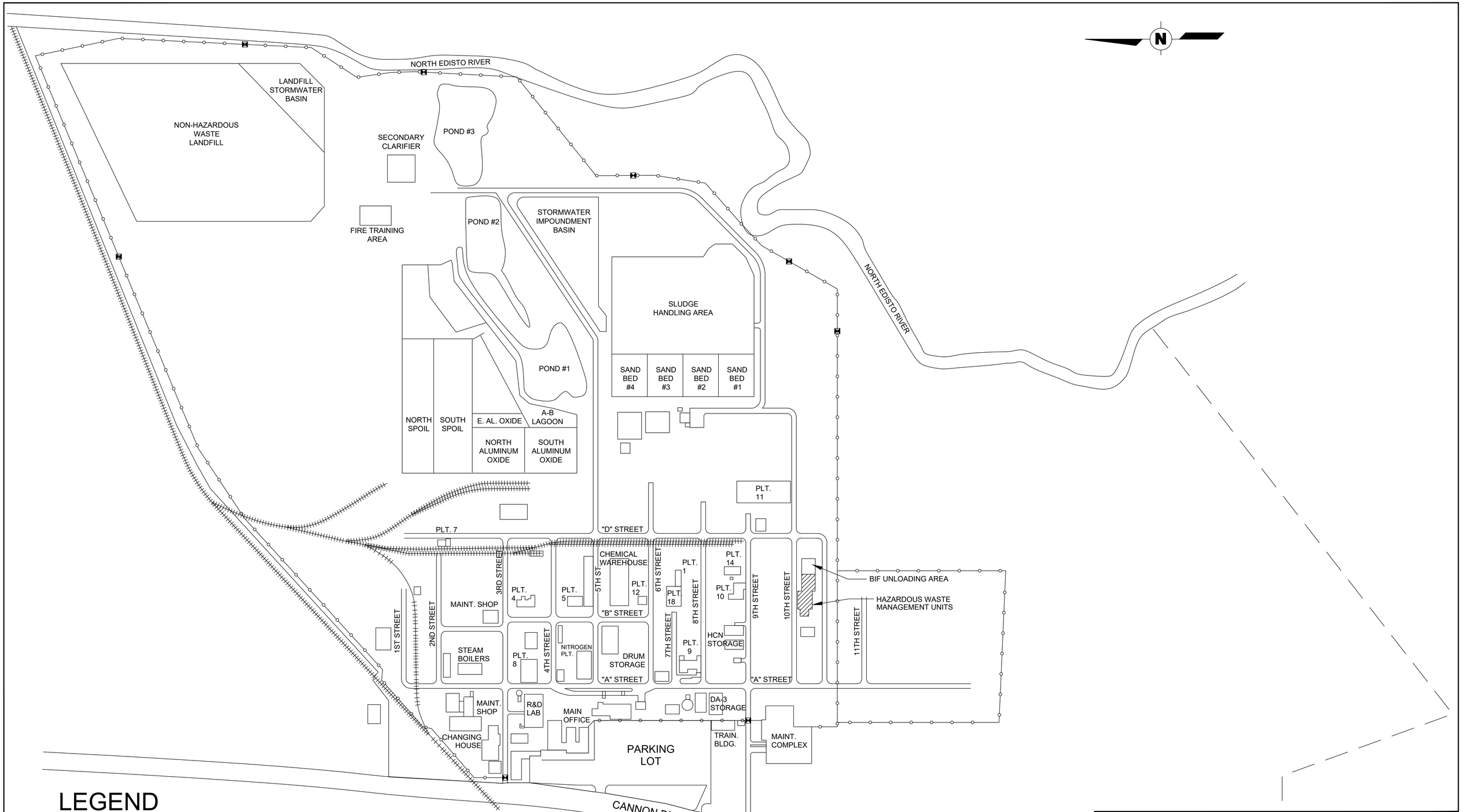

LEGEND

- PROPERTY BOUNDARY (NORTH FORK EDISTO RIVER FORMS EASTERN BOUNDARY)
- SECURITY FENCE
- RAILROAD
- GATE

I:\CAD PROJECTS\SI GROUP\25569 SI GROUP\PLANS\25569_B004_SECURITY_00A455_SI GROUP_SC.DWG

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ISSUED FOR REFERENCE FOR POLLUTION CONTROL	12/14/04 RDS					

S:\LIBRARY\SIG logo.png

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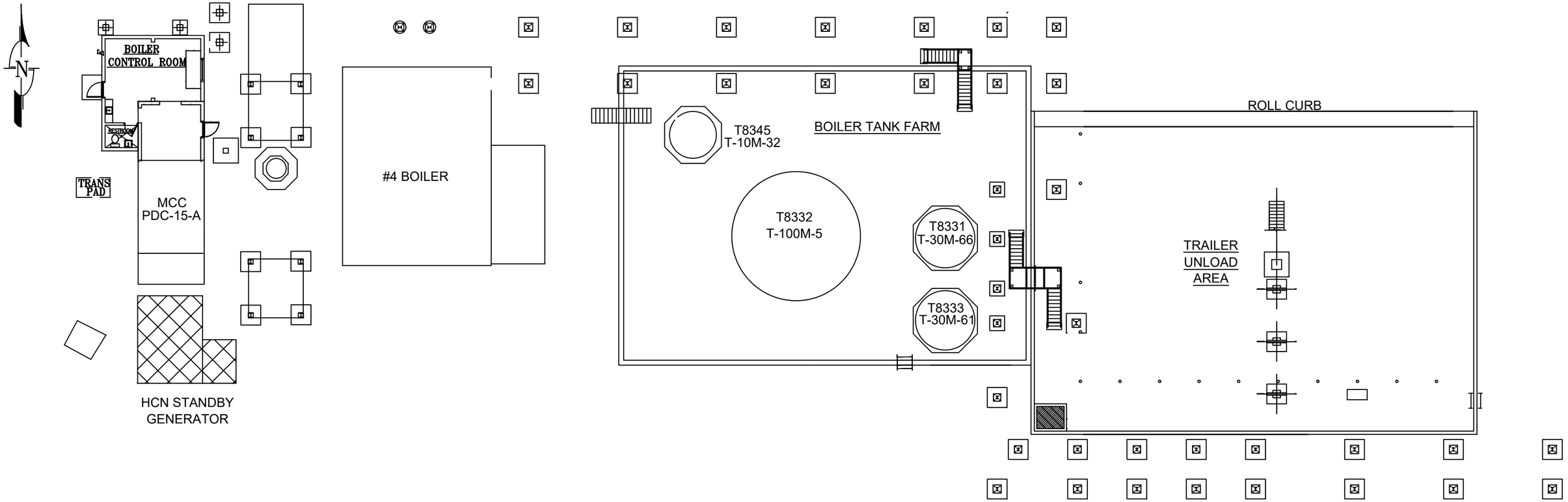
B-3

ORANGEBURG SITE PLANT SECURITY PROPERTY BOUNDARIES, FENCES, & GATES

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A455	0

SCALE: 1"=200' | OPERATING AREA: | BUILDING NO:

TENTH STREET



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NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE RCRA FACILITY LOCATION	8/6/04 RDS	8/9/04 RDS	8/9/04 MGC	8/9/04 JWR		8/10/04 RAT

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FIGURE B-4
ALBEMARLE ORANGEBURG
HAZARDOUS WASTE MANAGEMENT UNITS

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A410	0
SCALE: NONE	OPERATING AREA:	BUILDING NO: –

Station #13883 - COLUMBIA/METRO ARPT, SC

DISPLAY:
Wind Speed
Direction (blowing from)

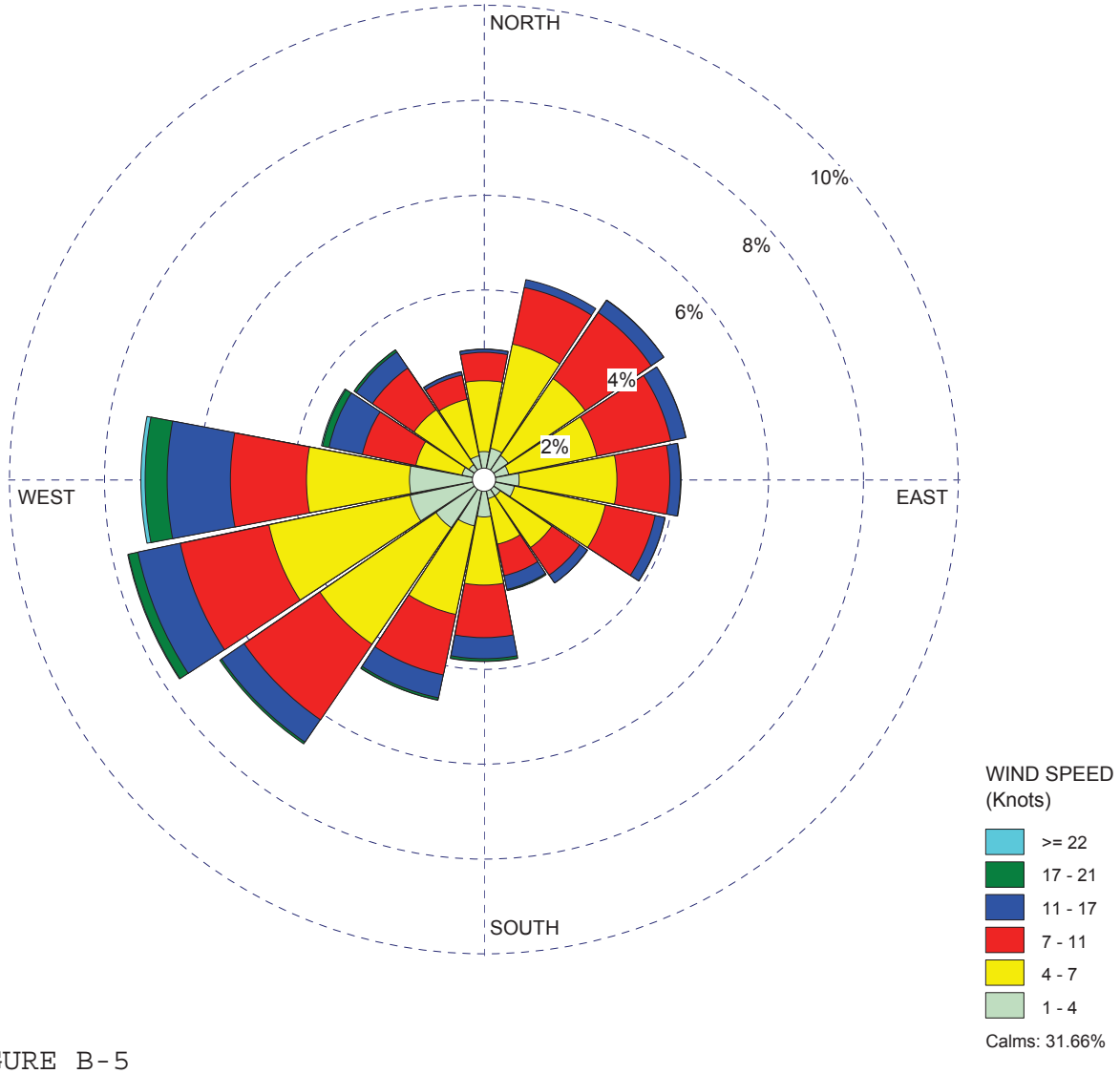

FIGURE B-5

	DATA PERIOD: **2010 2011 2012 2013 2014** **Jan 1 - Dec 31** **00:00 - 23:00**	**Integrated Surface Hourly (ISH) Meteorological Data**	
	CALM WINDS: **31.66%**	TOTAL COUNT: **43783 hrs.**	**Liesa R. Elliott** **Consulting Meteorologist**
	AVG. WIND SPEED: **4.44 Knots**	DATE: **8/26/2015**	

WRPLOT View - Lakes Environmental Software

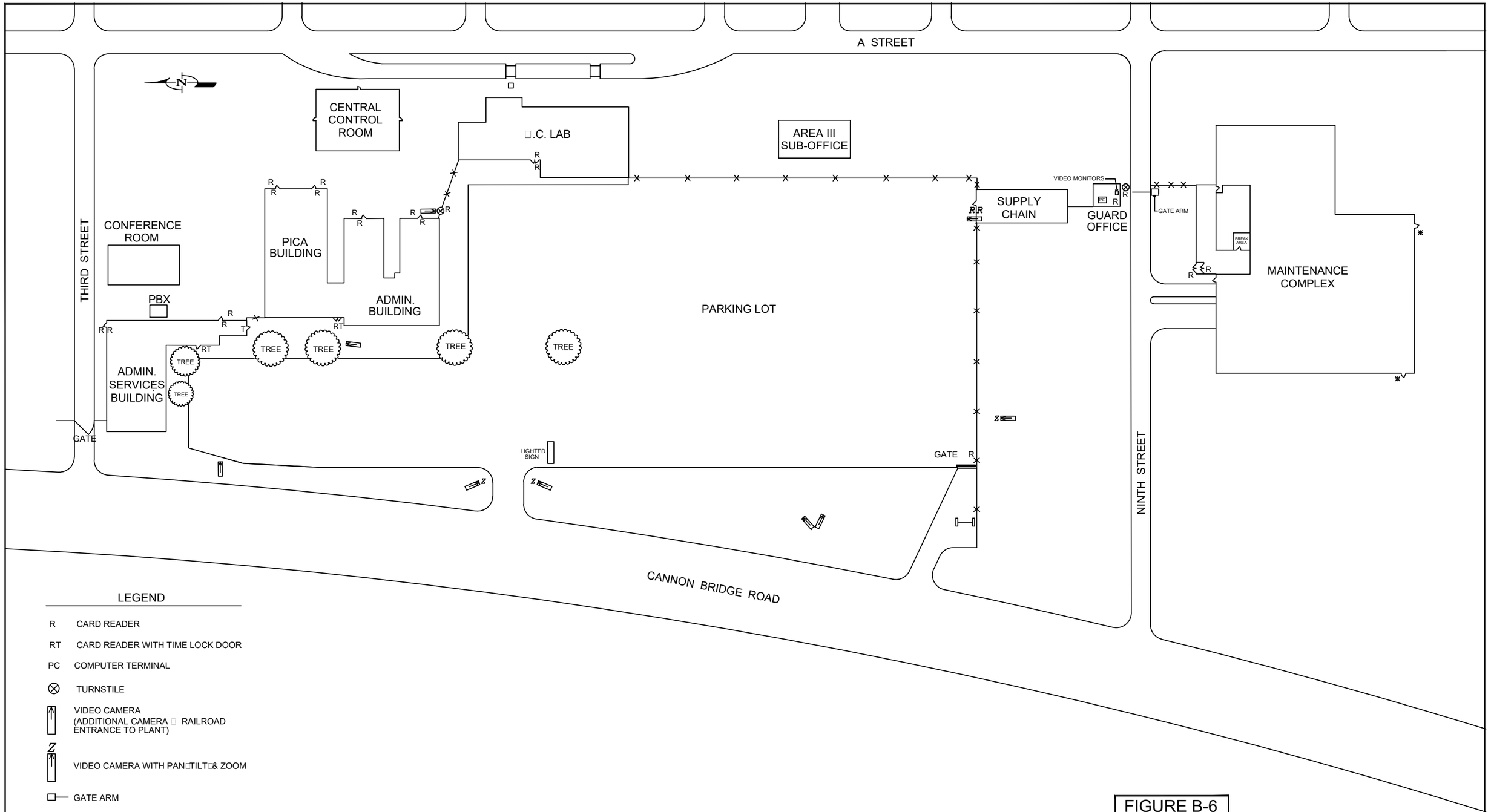

FIGURE B-6

S:\LIBRARY\SIG logo.png

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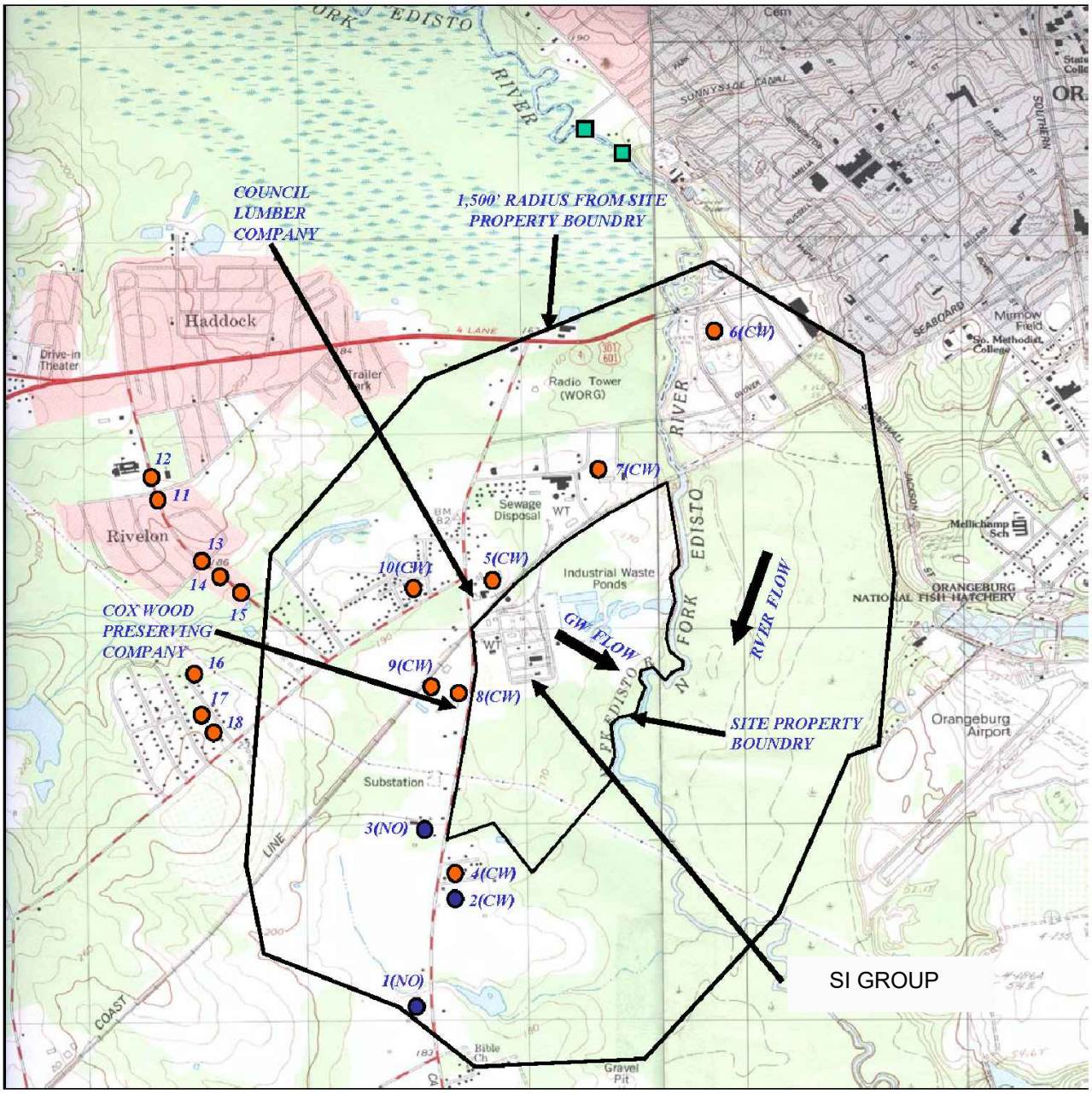
ORANGEBURG PLANT SECURITY PLAN OFFICE & LABORATORY

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ORIGINAL	10/17/91 GFW					
1	REVISED PER LOCAL REVIEW	10/31/91 GFW					
2	ADDED ADDITIONAL CARD READERS	11/07/91 GFW					
3	ADDED CARD READERS @ MAINT. BREAK AREA & ADMIN. SERV. BLDG. PER PROJ. #0395	4/6/92 DLG	4/8/92 GFW	4/8/92 GFW			
4	REVISED CARD READERS AT MAINT. COMPLEX PER PROJ.# 0395	8/12/92 DLG	8/12/92 GFW				

0395	0BH00I001	4
PROJECT NUMBER	DRAWING NUMBER	REV.
SCALE: NONE	OPERATING AREA: – BUILDING NO: –	



APPROXIMATE

0 1300 2600

SCALE IN FEET

- *SURFACE WATER INTAKE (CITY OF ORANGEBURG)*
- *WELL SAMPLED IN 1979*
- *RESIDENTIAL WATER SUPPLY WELL*
- *(NO) WELL NOT OBSERVED IN RECENT FIELD RECONNAISSANCE*
- *(CW) USE CITY WATER FOR POTABLE USE*

NOTE: AREA SERVED BY PUBLIC WATER WELLS 5, 8, AND 9 ARE USED FOR INDUSTRIAL WATER

FIGURE B-7

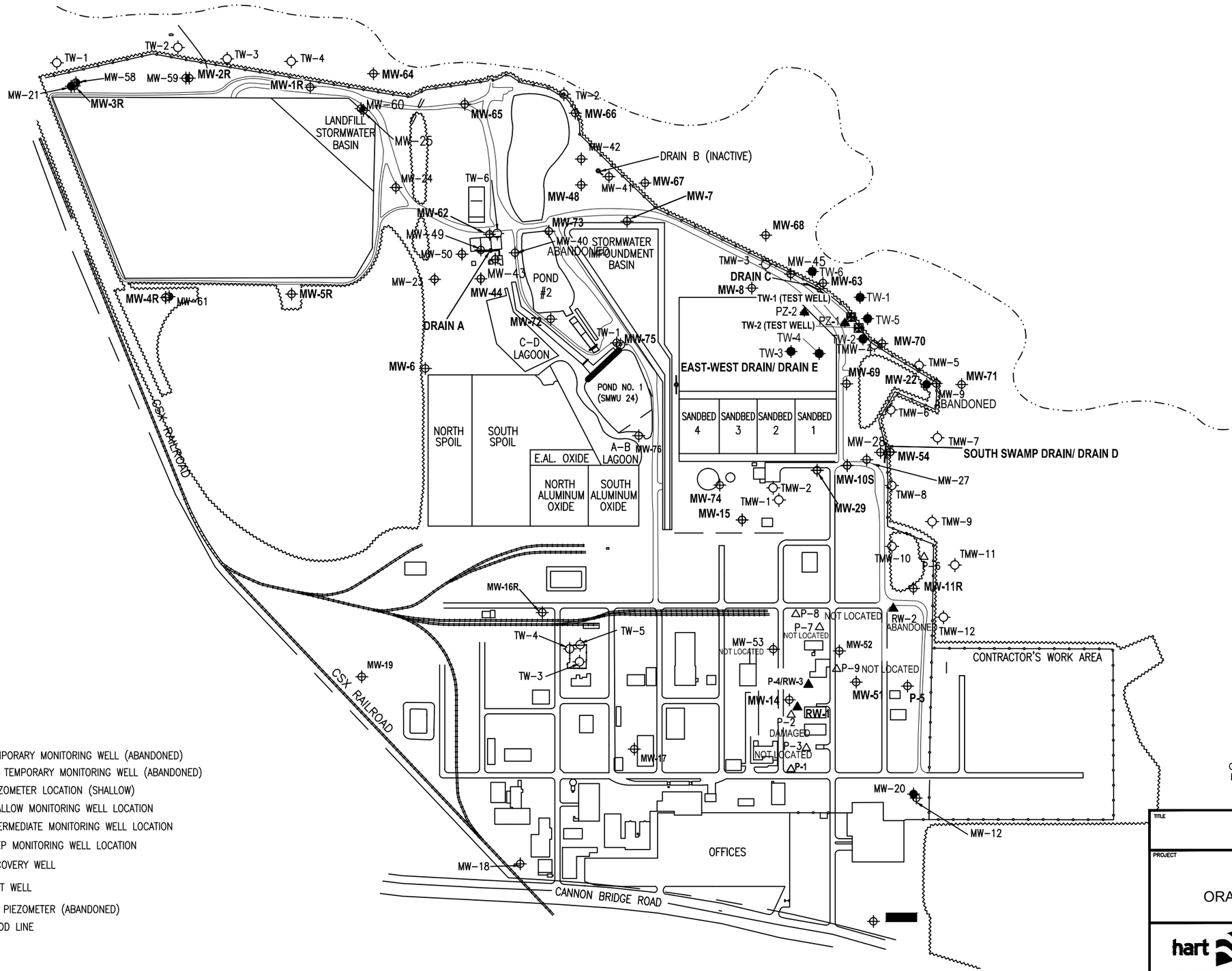
TITLE
1999 WATER SUPPLY WELL SURVEY

PROJECT
SI GROUP
ORANGEBURG, SOUTH CAROLINA

Hart & Hickman
A Professional Corporation
501 Minuet Lane-Suite 101
Charlotte, North Carolina 28217
(704) 586-0007 (704)586-0373 fax

DATE: 10-7-02 REVISION NO: 0

JOB NO: ALB-13 FIGURE NO: B-7



LEGEND

- TEMPORARY MONITORING WELL (ABANDONED)
- RFI TEMPORARY MONITORING WELL (ABANDONED)
- PIEZOMETER LOCATION (SHALLOW)
- SHALLOW MONITORING WELL LOCATION
- INTERMEDIATE MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- RECOVERY WELL
- TEST WELL
- RFI PIEZOMETER (ABANDONED)
- WOOD LINE

FIGURE B-8

TITLE

MONITORING WELLS

PROJECT

SI GROUP INC.
ORANGEBURG□SOUTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 09-17-15	REVISION NO. 0
JOB NO: SGI-001	FIGURE: B-8

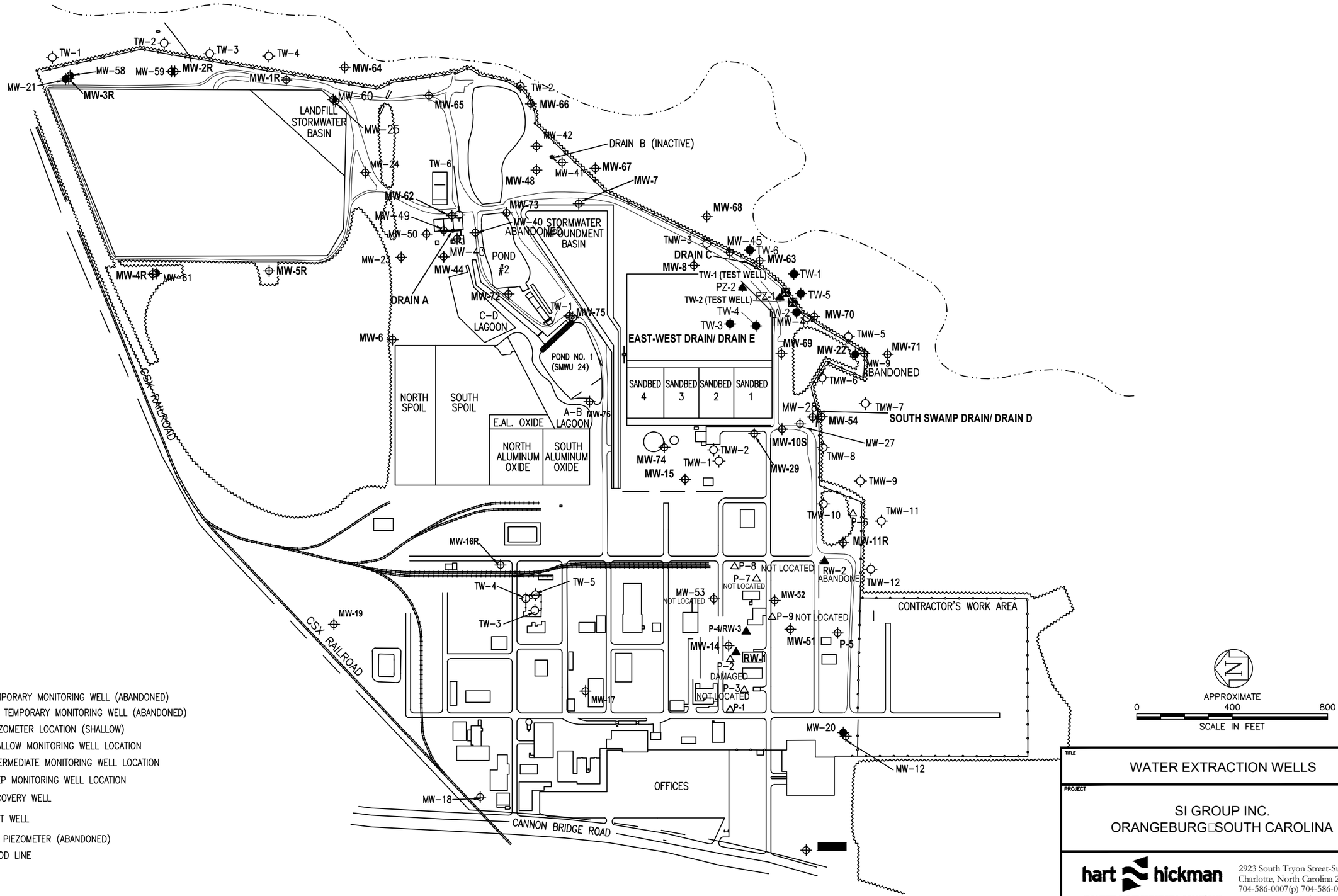


FIGURE B-9

TITLE

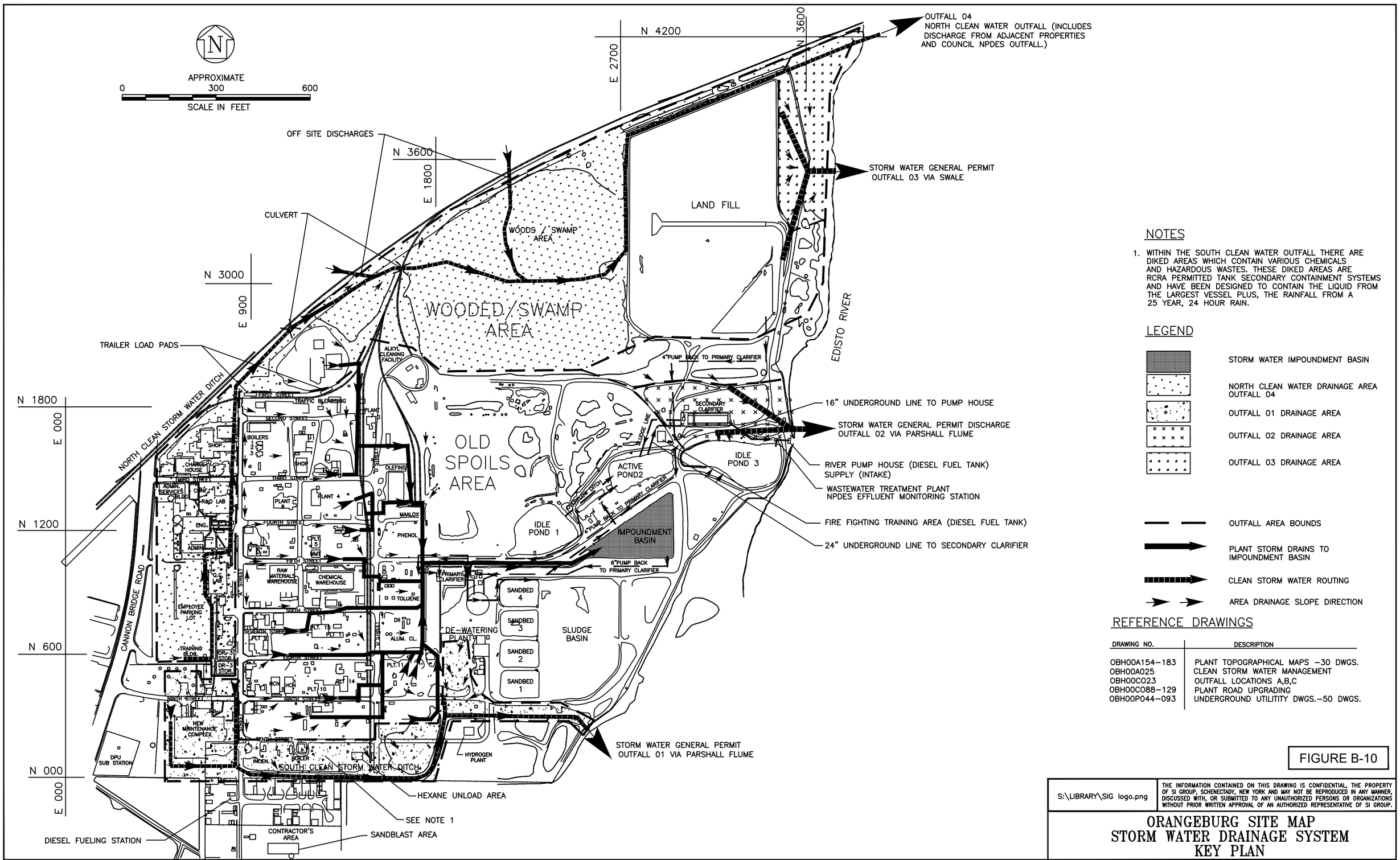
WATER EXTRACTION WELLS

PROJECT

SI GROUP INC.
ORANGEBURG□SOUTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 09-17-15	REVISION NO. 0
JOB NO: SGI-001	FIGURE: B-9



NOTES

1. WITHIN THE SOUTH CLEAN WATER OUTFALL THERE ARE DIKED AREAS WHICH CONTAIN VARIOUS CHEMICALS AND HAZARDOUS WASTES. THESE DIKED AREAS ARE RCRA PERMITTED TANK SECONDARY CONTAINMENT SYSTEMS AND HAVE BEEN DESIGNED TO CONTAIN THE LIQUID FROM THE LARGEST VESSEL PLUS, THE RAINFALL FROM A 25 YEAR, 24 HOUR RAIN.

LEGEND

- STORM WATER IMPOUNDMENT BASIN
- NORTH CLEAN WATER DRAINAGE AREA OUTFALL 04
- OUTFALL 01 DRAINAGE AREA
- OUTFALL 02 DRAINAGE AREA
- OUTFALL 03 DRAINAGE AREA
- OUTFALL AREA BOUNDS
- PLANT STORM DRAINS TO IMPOUNDMENT BASIN
- CLEAN STORM WATER ROUTING
- AREA DRAINAGE SLOPE DIRECTION

REFERENCE DRAWINGS

DRAWING NO.	DESCRIPTION
0BH00A154-183	PLANT TOPOGRAPHICAL MAPS -30 DWGS.
0BH00A025	CLEAN STORM WATER MANAGEMENT
0BH00C023	OUTFALL LOCATIONS A,B,C
0BH00C088-129	PLANT ROAD UPGRADING
0BH00P044-093	UNDERGROUND UTILITIY DWGS.-50 DWGS.

FIGURE B-10

S:\LIBRARY\SIG logo.png

THE INFORMATION CONTAINED ON THIS DRAWING IS CONFIDENTIAL, THE PROPERTY OF SI GROUP, SCHENECTADY, NEW YORK AND MAY NOT BE REPRODUCED IN ANY MANNER, DISCUSSED WITH, OR SUBMITTED TO ANY UNAUTHORIZED PERSONS OR ORGANIZATIONS WITHOUT PRIOR WRITTEN APPROVAL OF AN AUTHORIZED REPRESENTATIVE OF SI GROUP.

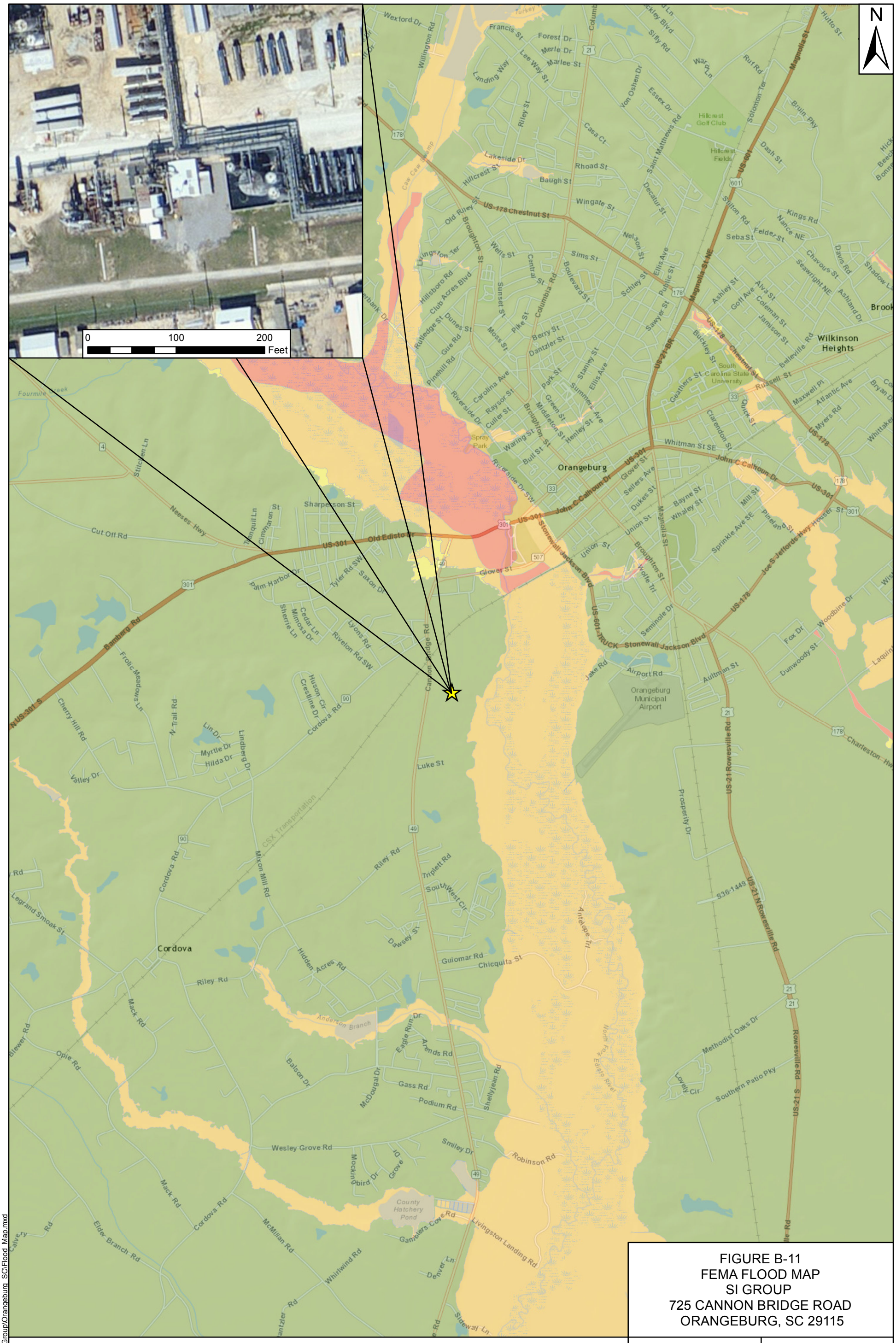
ORANGEBURG SITE MAP
STORM WATER DRAINAGE SYSTEM
KEY PLAN

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE FOR EPA	3/25/93					
	PROJECT 04580	JWT					
3	REVISED PER ENVIRONMENTAL PROTECTION AGENCY MANDATE.	09/20/07 CKW	09/20/07 MGC	09/20/07 CKW	09/20/07 MGC	09/20/07 MGC	09/20/07 RLT

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
4	ADDED OUTFALL 05 PER GTK'S MARK-UP 12/16/09	12/16/09 JWR					
5	TSR-12099, AS-BUILT REVISIONS TO STORM WATER DRAWINGS PER JAMES MELTON	4/25/12 JWR	5/24/12 JHM	5/24/12 JHM	4/25/12 JWR	4/25/12 JWR	5/24/12 RLT

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D

PROJECT NUMBER	DRAWING NUMBER	REV.
SCALE: 1"=200'	0BH00C151	5
	OPERATING AREA: 00 BUILDING NO:	



Legend

- SITE LOCATION
- AREA OF MINIMAL FLOOD HAZARD
- 0.2% ANNUAL CHANCE FLOOD HAZARD
- 1% ANNUAL CHANCE FLOOD HAZARD
- FLOODWAY

0 3,500 7,000 Feet

National Flood Hazard Layer is from the Federal Emergency Management Agency.

FIGURE B-11
FEMA FLOOD MAP
SI GROUP
725 CANNON BRIDGE ROAD
ORANGEBURG, SC 29115

REQUESTED BY: K. SASS	
DRAWN BY: B. LIPSCOMB	
DATE: 9/21/2015	
PROJECT NO: 0888817298	

ENSAFE
1-800-588-7962
WWW.ENSAFE.COM

Document Path: X:\SI Group\Orangeburg_SC\Flood_Map.mxd

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community; Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Appendix B-2
RCRA Facility History

SI GROUP FACILITY RCRA PERMITTING HISTORY

Albemarle (then as Ethyl) submitted a Part A permit application on November 14, 1980 to gain interim status under RCRA. On February 3, 1982, EPA formally requested Albemarle's Part B permit application. This was submitted to EPA on July 30, 1982; a revised Part B permit application was submitted to the South Carolina Department of Health and Environmental Control (DHEC) on January 28, 1983. It was subsequently determined that a Part B permit was not required as long as RCRA wastes were managed for less than 90 days.

Albemarle's Orangeburg, SC plant became subject to RCRA requirements upon promulgation of the Boiler and Industrial Furnace (BIF) regulations of 40 CFR Part 266, Subpart H. Ethyl had incinerated hazardous waste-derived on-site fuel in Boiler No. 4 since approximately 1979. A Part A permit application and Certification of Pre-compliance were submitted on August 21, 1991, thus gaining interim status for Boiler No. 4. On January 19, 1993, EPA formally requested a Part B permit application from Albemarle. A document was prepared in accordance with this request.

In June 1992, Albemarle ceased burning hazardous waste-derived fuel in the No. 4 Boiler while air emissions upgrades were performed. On July 21, 1992, Albemarle notified EPA of their intent to take the automatic 12-month extension in submitting its Compliance Certification. Additional Certifications of Pre-compliance were submitted to EPA on January 16, 1992, March 3, 1992, and April 10, 1992, based on different emission limits which were expected due to control device additions and modifications. On March 24, 1993, Albemarle personnel met with EPA Region IV to request that the Compliance Test and Trial Burn be combined into a single testing event. A Trial Burn Plan and a revised Certificate of Pre-compliance was submitted. Testing occurred in late July 1993; the results were submitted to EPA during September 1993. Albemarle's initial Part A application, submitted on August 21, 1991, designated Boiler No. 4 as the RCRA facility. A revised Part A application is included with the Part B permit application (see Section A, Statement of Certification and Part A Permit Application). In addition to Boiler No. 4, the associated waste storage and handling facilities serving the boiler are included in the revised application as part of the designated RCRA facility, in order to allow waste storage at the facility to exceed 90 days. The waste storage facility consists of four aboveground waste storage tanks and ancillary equipment that are enclosed in a secondary containment structure located directly east of Boiler No. 4.

The RCRA Part B Permits were issued in 2006.

TABLE OF PERMIT MODIFICATIONS
SI GROUP, INC.
EPA I.D. NUMBER SCD 043 384 072

Effective Date	Permit Conditions	Description
10/20/06	Conditions III.D.4.g. and Appendix B	Class 1 modification to revise the combustion chamber pressure monitoring approach from absolute pressure to gauge pressure as described in the February 15, 2006 modification request from the Permittee.
10/20/06	Conditions II.B., III.F.1., III.F.2.c., III.F.3., and Appendix A	EPA initiated modification to reference the revised Waste Analysis Plan submitted July 24, 2006.
10/20/06	Conditions III.G.5.a., III.G.5.b. and Appendix A	EPA initiated modification to reference the revised Automatic Waste Feed Cutoff System Test Procedure submitted August 24, 2006.
10/20/06	Condition III.A.	EPA initiated modification to remove reference to the second redundant Aeropulse fabric filtration system, which will be removed to make room for the boiler feed water preheater.
1/24/08	Condition I.H.1.	Class 1 modification to reference all updates to the RCRA permit application submitted subsequent to the permit issuance date.
1/24/08	Condition III.A. and Appendix A	EPA initiated modification to reflect installation of the boiler economizer and to reference corresponding revisions to Section D.9 of the permit application as submitted on March 15, 2007 and September 21, 2007. Class 1 modification to reflect revisions to Section D.9 of the permit application as submitted December 18, 2007.
1/24/08	Condition III.D.4.h. and Appendix A and B	EPA initiated modification to reflect submission of a bag leak detection monitoring plan on September 21, 2007 and November 5, 2007 and approval of that plan on January 24, 2008.
1/24/08	Conditions III.G.5.a., III.G.5.b. and Appendix A	EPA initiated modification to reference the revised Automatic Waste Feed Cutoff System Test Procedure submitted September 21, 2007.
1/24/08	Appendix B	Class 1 modification to reflect revised continuous monitor specifications and figures submitted on March 15, 2007.
10/29/14	Cover Page	Class 1 modification to reflect the transfer of ownership of the facility from Albemarle Corporation to SI Group, Inc. that occurred on September 1, 2014. No change in activities is permitted.

Appendix B-3
Offsite Receptor Report

SI Group Formerly Albermarle Corporation
725 Cannon Bridge Road
Orangeburg, SC 29115

Inquiry Number: 4364010.1s
July 24, 2015

EDR Offsite Receptor Report

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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Thank you for your business
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available records was conducted by Environmental Data Resources, Inc. (EDR). The EDR Offsite Receptor Report provides information which may be used to comply with the Clean Air Act Risk Management Program 112-R. *"The rule requires that you estimate in the RMP residential populations within the circle defined by the endpoint for your worst-case and alternative release scenarios (i.e., the center of the circle is the point of release and the radius is the distance to the endpoint). In addition, you must report in the RMP whether certain types of public receptors and environmental receptors are within the circles."*

The address of the subject property, for which the search was intended, is:

SI GROUP FORMERLY ALBERMARLE CORPORATION
725 CANNON BRIDGE ROAD
ORANGEBURG, SC 29115

Distance Searched: 1.000 miles from subject property

RECEPTOR SUMMARY
An X indicates the presence of the receptor within the search radius.

Residential Population
Estimated population within search radius: 665 persons.

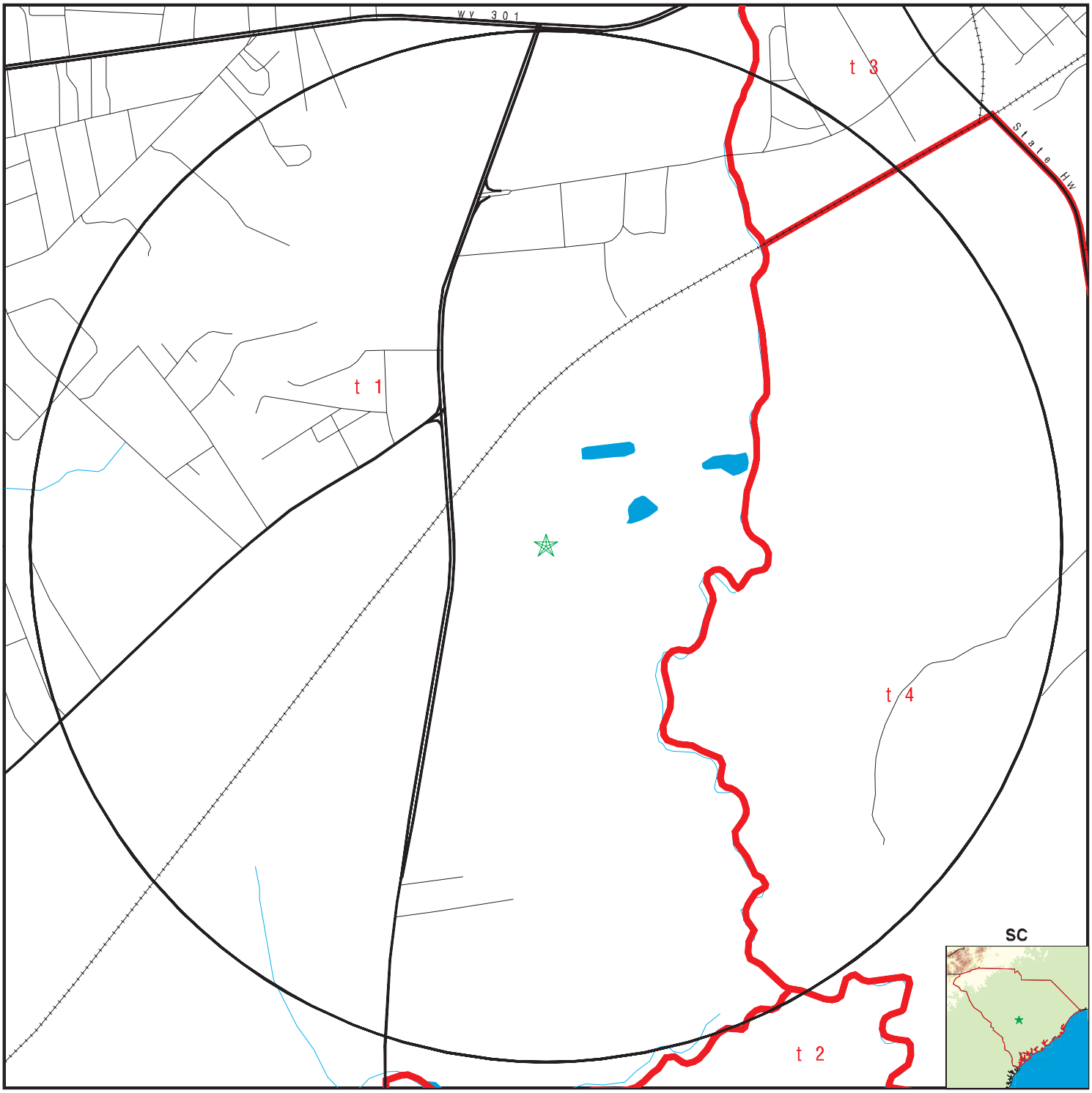
Other Public Receptors

Type	Within Search Radius	Sites Total
Day Care Centers:	☐	
Medical Centers:	☐	
Nursing Homes:	☐	
Schools:	☐	
Hospitals:	☐	
Colleges:	☐	
Arena:	☐	
Prison:	☐	

Environmental Receptors

Type	Within Search Radius	Sites Total
Federal Land:	☐	

CENSUS MAP - 4364010.1s



Target Property
Roads
Waterways
Census Tracts

TARGET PROPERTY:	SI Group Formerly Albermarle Corporation	CUSTOMER:	ENSAFE
ADDRESS:	725 Cannon Bridge Road	CONTACT:	Kim Sass
CITY/STATE/ZIP:	Orangeburg SC 29115	INQUIRY #:	4364010.1s
LAT/LONG:	33.4669 / 80.8809	DATE:	July 24, 2015 12:07 pm

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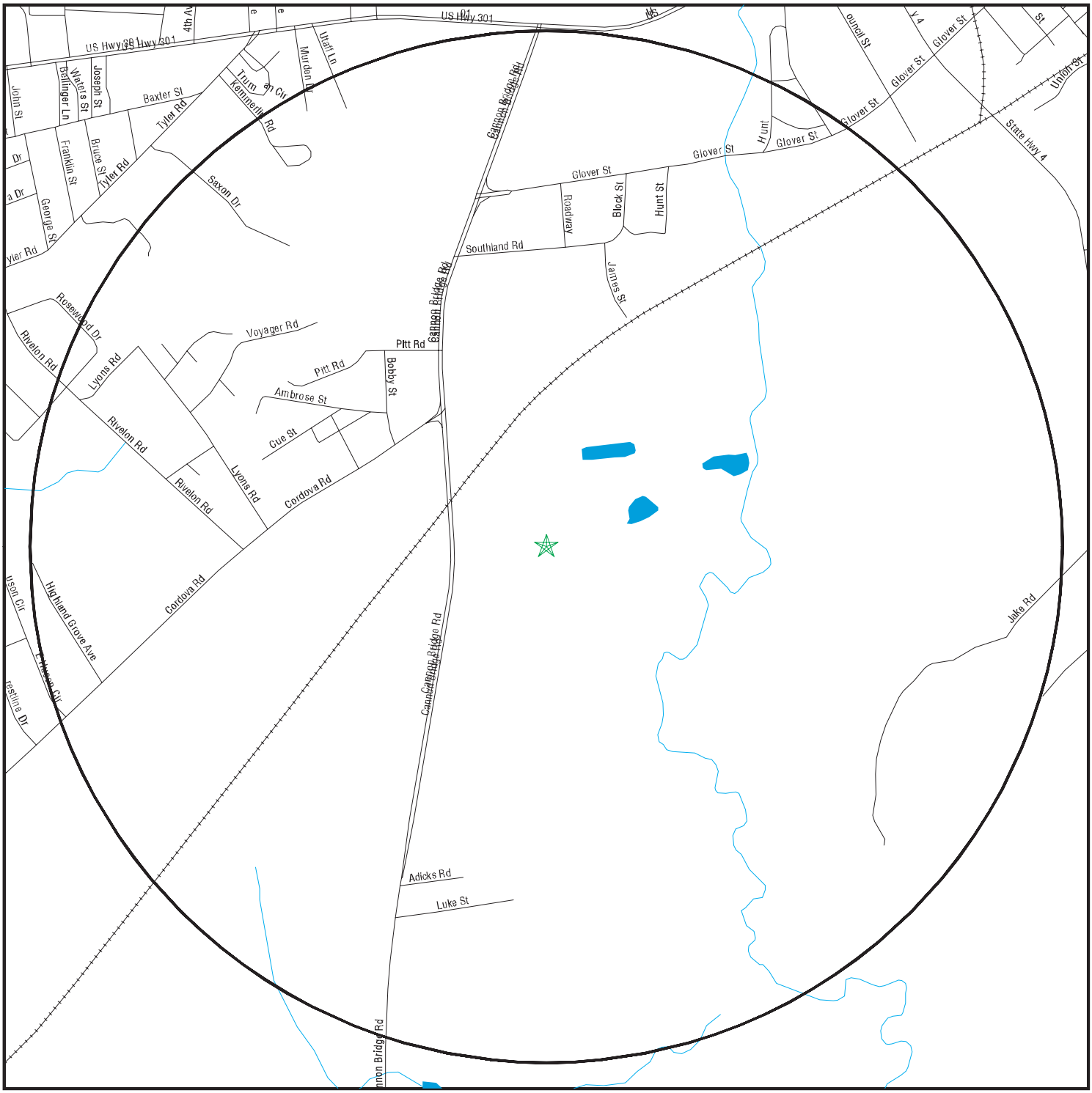
CENSUS FINDINGS

Map ID	Tract Number	Total Population	Population in Radius	Total Area(sq.mi.)	Area in Radius(sq.mi.)
T1	0115.00	3821	486.0	18.01	2.29
T2	0116.00	6655	0.2	31.94	0.00
T3	0113.00	3151	125.6	1.46	0.06
T4	0106.00	4998	52.9	73.33	0.78

RECEPTOR MAP - 4364010.1s



0 1/4 1/2 1 Miles

- Target Property
- Roads
- Waterways
- Environmental or Public Receptor
- Federal Lands Linear Features
- Federal Lands Area

TARGET PROPERTY:	SI Group Formerly Albermarle Corporation	CUSTOMER:	ENSAFE
ADDRESS:	725 Cannon Bridge Road	CONTACT:	Kim Sass
CITY/STATE/ZIP:	Orangeburg SC 29115	INQUIRY #:	4364010.1s
LAT/LONG:	33.4669 / 80.8809	DATE:	July 24, 2015 12:08 pm

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MAP FINDINGS

Map ID Direction Distance Distance (ft.) Elevation	Site	EDR ID Database

No Sites Reported.

RECORDS SEARCHED/DATA CURRENCY TRACKING

Census

Source: U.S. Census Bureau
Telephone: 301-763-4636
2010 U.S. Census data was used to estimate residential population following these EPA guidelines:
"Census data are presented by Census tract. If your circle covers only a portion of the tract, you should develop an estimate for that portion...Determine the population density per square mile (total population of the Census tract divided by the number of square miles in the tract) and apply that density figure to the number of square miles within your circle."

FED_LAND: Federal Lands

Source: USGS
Telephone: 888-275-8747
Federal lands data. Includes data from several Federal land management agencies, including Fish and Wildlife Service, Bureau of Land Management, National Park Service, and Forest Service. Includes National Parks, Forests, Monuments; . Wildlife Sanctuaries, Preserves, Refuges; Federal Wilderness Areas.

AHA Hospitals:

Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing

Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes

Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools

Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools

Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Colleges - Integrated Postsecondary Education Data

Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on integrated postsecondary education in the United States.

Arenas

Source: Dunhill International
EDR indicates the location of buildings and facilities - arenas - where individuals who are public receptors are likely to be located.

Prisons: Bureau of Prisons Facilities

Source: Federal Bureau of Prisons
Telephone: 202-307-3198
List of facilities operated by the Federal Bureau of Prisons.

Daycare Centers: Child Day Care List

Source: Department of Social Services
Telephone: 803-898-7345

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Appendix B-4
Soil Survey Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Orangeburg County, South Carolina

July 31, 2018

0070

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

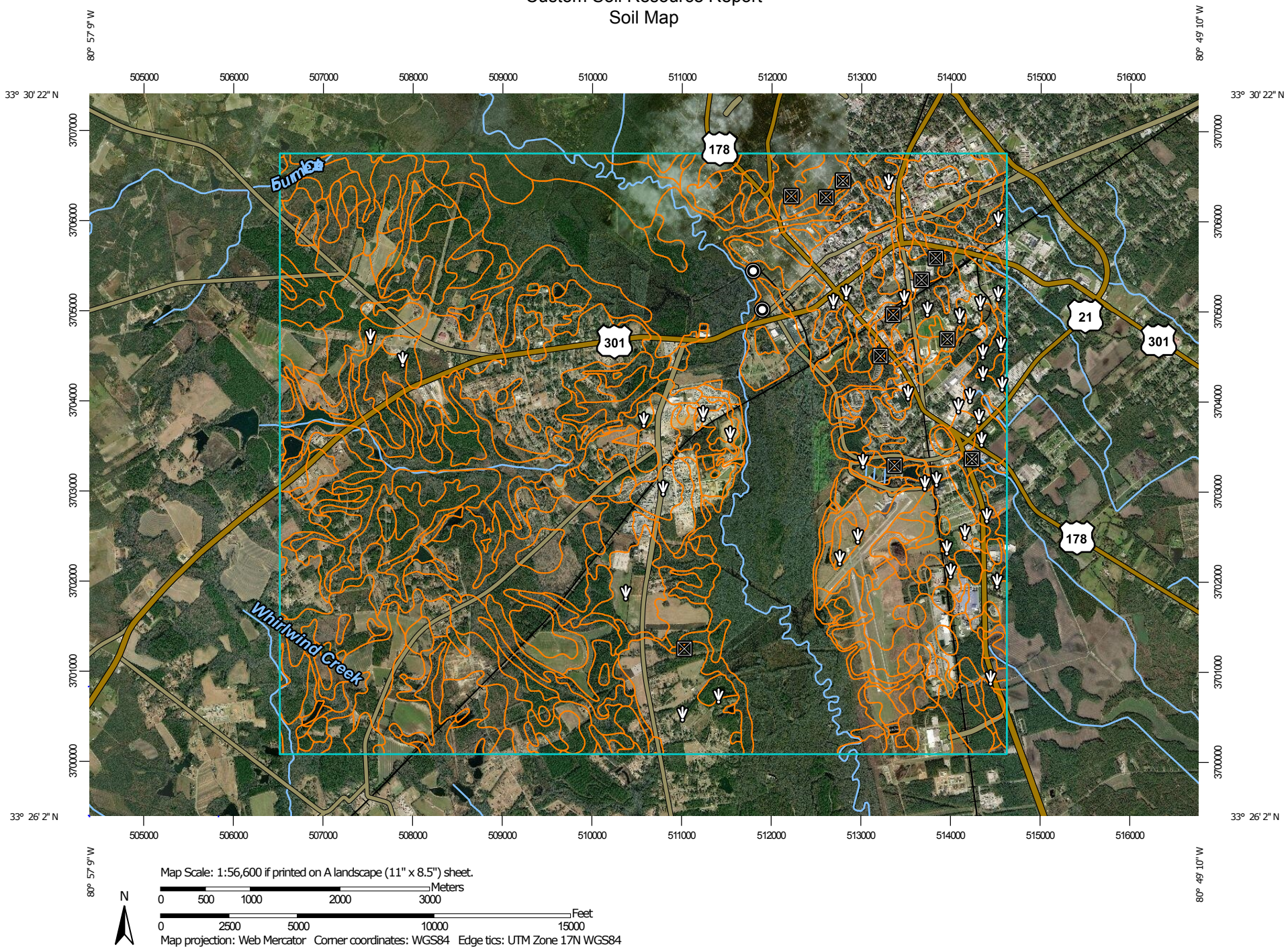
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orangeburg County, South Carolina
Survey Area Data: Version 14, Oct 5, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 26, 2011—Dec 15, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AeB	Ailey sand, 2 to 6 percent slopes	139.0	1.0%
AeC	Ailey sand, 6 to 10 percent slopes	430.2	3.2%
ApB	Alpin sand, 0 to 6 percent slopes, Southern Coastal Plain	622.6	4.6%
Bb	Bibb sandy loam	65.0	0.5%
BlB	Blanton sand, 0 to 6 percent slopes	170.2	1.3%
BlC	Blanton sand, 6 to 10 percent slopes	9.7	0.1%
BoB	Bonneau sand, 0 to 4 percent slopes	759.2	5.7%
By	Byars loam	78.3	0.6%
CdA	Clarendon loamy sand, 0 to 2 percent slopes	3.4	0.0%
Cx	Coxville sandy loam	302.6	2.3%
DaA	Dothan loamy sand, 0 to 2 percent slopes	470.1	3.5%
DaB	Dothan loamy sand, 2 to 6 percent slopes	512.1	3.8%
Dn	Dunbar sandy loam	46.6	0.3%
DpA	Duplin loamy sand, 0 to 2 percent slopes	61.7	0.5%
FaA	Faceville loamy sand, 0 to 2 percent slopes	206.4	1.5%
FaB	Faceville loamy sand, 2 to 6 percent slopes	434.0	3.2%
FuB	Fuquay sand, 0 to 6 percent slopes	245.2	1.8%
GoA	Goldsboro sandy loam, 0 to 2 percent slopes	145.5	1.1%
Jo	Johns loamy sand	110.7	0.8%
Js	Johnston sandy loam	888.0	6.6%
LcB	Lucy loamy sand, 0 to 6 percent slopes	328.3	2.4%
LcC	Lucy loamy sand, 6 to 10 percent slopes	76.7	0.6%
Lm	Lumbee loamy sand	36.5	0.3%
Lu	Lumbee loamy sand, frequently flooded	2,077.8	15.5%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ly	Lynchburg fine sandy loam, 0 to 2 percent slopes	77.3	0.6%
Mo	Mouzon fine sandy loam	35.8	0.3%
NeB	Neeses loamy sand, 2 to 6 percent slopes	647.7	4.8%
NeC	Neeses loamy sand, 6 to 10 percent slopes	856.3	6.4%
NeD	Neeses loamy sand, 10 to 15 percent slopes	9.6	0.1%
NoA	Noboco loamy sand, 0 to 2 percent slopes	329.3	2.5%
NoB	Noboco loamy sand, 2 to 6 percent slopes	875.6	6.5%
OcA	Ocilla loamy sand, 0 to 2 percent slopes	241.7	1.8%
OrA	Orangeburg loamy sand, 0 to 2 percent slopes	415.8	3.1%
OrB	Orangeburg loamy sand, 2 to 6 percent slopes	210.3	1.6%
OrC	Orangeburg loamy sand, 6 to 10 percent slopes	45.0	0.3%
Pa	Pantego fine sandy loam	21.3	0.2%
Ph	Pelham loamy sand, 0 to 2 percent slopes	139.7	1.0%
Ra	Rains sandy loam	263.2	2.0%
Sa	Stallings loamy sand	9.0	0.1%
TpB	Troup sand, 0 to 6 percent slopes, Southern Coastal Plain	309.6	2.3%
TpC	Troup sand, 6 to 10 percent slopes, Southern Coastal Plain	109.6	0.8%
Ud	Udorthents, loamy	470.5	3.5%
W	Water	125.2	0.9%
Totals for Area of Interest		**13,412.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the

characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered

practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Orangeburg County, South Carolina

AeB—Ailey sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d5k
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Ailey and similar soils: 90 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ailey

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 6 inches: sand
E - 6 to 25 inches: sand
Bt - 25 to 31 inches: sandy clay loam
Btx - 31 to 64 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Blanton

Percent of map unit: 2 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread

Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

AeC—Ailey sand, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 4d5l
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Ailey and similar soils: 96 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ailey

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 6 inches: sand
E - 6 to 25 inches: sand
Bt - 25 to 31 inches: sandy clay loam
Btx - 31 to 64 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Johnston

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

ApB—Alpin sand, 0 to 6 percent slopes, Southern Coastal Plain

Map Unit Setting

National map unit symbol: 2wdwp
Elevation: 70 to 430 feet
Mean annual precipitation: 43 to 48 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 230 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Alpin and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alpin

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 4 inches: sand
E - 4 to 46 inches: sand
E and Bt - 46 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: Dry Sandy Upland Woodland (F137XY001GA)
Hydric soil rating: No

Minor Components

Troup

Percent of map unit: 4 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Ailey

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Blanton

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Bb—Bibb sandy loam

Map Unit Setting

National map unit symbol: 4d5q
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Bibb and similar soils: 90 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bibb

Setting

Landform: Flood plains, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy alluvium

Typical profile

A - 0 to 15 inches: sandy loam
Cg1 - 15 to 40 inches: sandy loam
Cg2 - 40 to 62 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Johnston

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

BIB—Blanton sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d5r
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days

Farmland classification: Not prime farmland

Map Unit Composition

Blanton and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blanton

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and/or loamy marine deposits

Typical profile

A - 0 to 5 inches: sand
Bw - 5 to 61 inches: sand
Bt1 - 61 to 64 inches: sandy loam
Bt2 - 64 to 82 inches: sandy clay loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

BIC—Blanton sand, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 4d5s
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Blanton and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blanton

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

A - 0 to 5 inches: sand
Bw - 5 to 61 inches: sand
Bt1 - 61 to 64 inches: sandy loam
Bt2 - 64 to 82 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Hydric soil rating: No

BoB—Bonneau sand, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 4d5t
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Bonneau and similar soils: 90 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bonneau

Setting

Landform: Marine terraces

Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

A - 0 to 8 inches: sand
E - 8 to 35 inches: loamy sand
Bt1 - 35 to 69 inches: sandy clay loam
Bt2 - 69 to 80 inches: sandy clay

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Blanton

Percent of map unit: 2 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

By—Byars loam

Map Unit Setting

National map unit symbol: 4d5v

Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Byars and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Byars

Setting

Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey marine deposits

Typical profile

A - 0 to 9 inches: loam
Btg - 9 to 45 inches: clay
Btg - 45 to 63 inches: clay loam
BCg - 63 to 70 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

CdA—Clarendon loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4d5w
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Clarendon and similar soils: 90 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Clarendon

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand
E - 8 to 15 inches: loamy sand
Bt - 15 to 40 inches: sandy clay loam
Btgv - 40 to 88 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: Loamy Rise, Moderately Wet (R153AY001GA)
Hydric soil rating: No

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Cx—Coxville sandy loam

Map Unit Setting

National map unit symbol: 4d5x
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Coxville and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Coxville

Setting

Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey marine deposits

Typical profile

A - 0 to 5 inches: sandy loam
Btg - 5 to 60 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Rains

Percent of map unit: 2 percent
Landform: Depressions, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: Yes

DaA—Dothan loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2wb8x
Elevation: 50 to 660 feet
Mean annual precipitation: 40 to 69 inches
Mean annual air temperature: 55 to 70 degrees F
Frost-free period: 190 to 310 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Dothan and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dothan

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 7 inches: loamy sand
E - 7 to 13 inches: loamy sand
Bt - 13 to 40 inches: sandy clay loam
Btv - 40 to 79 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 36 to 59 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Forage suitability group: Loamy and clayey soils on rises and knolls of mesic uplands (G133AA321FL)
Hydric soil rating: No

Minor Components

Norfolk
Percent of map unit: 7 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Fuquay
Percent of map unit: 4 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Goldsboro
Percent of map unit: 4 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

DaB—Dothan loamy sand, 2 to 6 percent slopes

Map Unit Setting
National map unit symbol: 2wb94

Elevation: 50 to 660 feet
Mean annual precipitation: 40 to 69 inches
Mean annual air temperature: 55 to 70 degrees F
Frost-free period: 190 to 310 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Dothan and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dothan

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 7 inches: loamy sand
E - 7 to 13 inches: loamy sand
Bt - 13 to 40 inches: sandy clay loam
Btv - 40 to 79 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 36 to 59 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Forage suitability group: Loamy and clayey soils on rises and knolls of mesic uplands (G133AA321FL)
Hydric soil rating: No

Minor Components

Norfolk

Percent of map unit: 8 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear

Hydric soil rating: No

Fuquay

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Orangeburg

Percent of map unit: 5 percent
Landform: Marine terraces
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Dn—Dunbar sandy loam

Map Unit Setting

National map unit symbol: 4d60
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dunbar and similar soils: 96 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dunbar

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 26 inches: clay loam
Btg - 26 to 70 inches: clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

DpA—Duplin loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4d61
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duplin and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duplin

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

Ap - 0 to 6 inches: loamy sand

E - 6 to 13 inches: loamy sand
Bt - 13 to 38 inches: sandy clay
Btg - 38 to 62 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

FaA—Faceville loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4d63
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Faceville and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Faceville

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 6 inches: loamy sand
Bt - 6 to 62 inches: sandy clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

FaB—Faceville loamy sand, 2 to 6 percent slopes

Map Unit Setting
National map unit symbol: 4d64
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Faceville and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Faceville

Setting
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile
Ap - 0 to 6 inches: loamy sand
Bt - 6 to 62 inches: sandy clay

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

FuB—Fuquay sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d65
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Fuquay and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fuquay

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

A - 0 to 2 inches: sand
E - 2 to 24 inches: sand
Bt - 24 to 45 inches: sandy clay loam
Btv - 45 to 74 inches: sandy clay loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Hydric soil rating: No

GoA—Goldsboro sandy loam, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 4d66
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Goldsboro and similar soils: 96 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Goldsboro

Setting
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile
Ap - 0 to 8 inches: sandy loam
E - 8 to 16 inches: sandy loam
Bt - 16 to 45 inches: sandy clay loam
Btg - 45 to 68 inches: sandy clay loam

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 24 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: Loamy Rise, Moderately Wet (R153AY001GA)
Hydric soil rating: No

Minor Components

Rains

Percent of map unit: 2 percent
Landform: Depressions, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: Yes

Jo—Johns loamy sand

Map Unit Setting

National map unit symbol: 4d67
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Johns and similar soils: 96 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Johns

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy fluviomarine deposits

Typical profile

A - 0 to 4 inches: loamy sand
E - 4 to 14 inches: loamy sand
Bt - 14 to 28 inches: sandy clay loam
Cg - 28 to 62 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Johnston

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Js—Johnston sandy loam

Map Unit Setting

National map unit symbol: 4d68
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Johnston and similar soils: 90 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Johnston

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Loamy fluviomarine deposits

Typical profile

A - 0 to 26 inches: sandy loam
Cg - 26 to 72 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Occasional
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Johns

Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lumbee

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

LcB—Lucy loamy sand, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d69
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lucy and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lucy

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand
E - 8 to 29 inches: loamy sand
Bt - 29 to 62 inches: sandy clay loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Hydric soil rating: No

LcC—Lucy loamy sand, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 4d6b
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Lucy and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lucy

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand
E - 8 to 29 inches: loamy sand
Bt - 29 to 62 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Hydric soil rating: No

Lm—Lumbee loamy sand

Map Unit Setting

National map unit symbol: 4d6c
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lumbee and similar soils: 90 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lumbee

Setting

Landform: Depressions
Landform position (three-dimensional): Tread

Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy marine deposits

Typical profile

A - 0 to 8 inches: loamy sand
Btg - 8 to 23 inches: sandy clay loam
Cg - 23 to 61 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Johnston

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Lu—Lumbee loamy sand, frequently flooded

Map Unit Setting

National map unit symbol: 4d6d
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Lumbee and similar soils: 90 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lumbee

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

A - 0 to 8 inches: loamy sand
Btg - 8 to 23 inches: sandy clay loam
Cg - 23 to 61 inches: loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Johnston

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Ly—Lynchburg fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2tzkm
Elevation: 0 to 280 feet
Mean annual precipitation: 45 to 52 inches
Mean annual air temperature: 64 to 65 degrees F
Frost-free period: 250 to 310 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Lynchburg and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lynchburg

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bt - 7 to 13 inches: sandy clay loam
Btg - 13 to 62 inches: sandy clay loam
BCg - 62 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Goldsboro

Percent of map unit: 3 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Coxville, drained

Percent of map unit: 3 percent
Landform: Depressions on marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Ocilla

Percent of map unit: 2 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Rise, Moderately Wet (R153AY001GA)
Hydric soil rating: No

Mo—Mouzon fine sandy loam

Map Unit Setting

National map unit symbol: 4d6g
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Mouzon and similar soils: 90 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mouzon

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey fluviomarine deposits

Typical profile

A - 0 to 4 inches: fine sandy loam
Eg - 4 to 11 inches: loamy sand
Btg - 11 to 50 inches: sandy clay loam
Cg - 50 to 74 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Lumbee

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Johns

Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

NeB—Neeses loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d6h
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Neeses and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Neeses

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

A - 0 to 5 inches: loamy sand
E - 5 to 8 inches: loamy sand

Bt - 8 to 28 inches: sandy clay
BC - 28 to 54 inches: sandy clay
C - 54 to 85 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

NeC—Neeses loamy sand, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 4d6j
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Neeses and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Neeses

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

A - 0 to 5 inches: loamy sand
E - 5 to 8 inches: loamy sand
Bt - 8 to 28 inches: sandy clay
BC - 28 to 54 inches: sandy clay
C - 54 to 85 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

NeD—Neeses loamy sand, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 4d6k
Elevation: 50 to 400 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 59 to 70 degrees F
Frost-free period: 240 to 285 days
Farmland classification: Not prime farmland

Map Unit Composition

Neeses and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Neeses

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey marine deposits

Typical profile

A - 0 to 3 inches: loamy sand
E - 3 to 8 inches: loamy sand
Bt - 8 to 28 inches: sandy clay
BC - 28 to 54 inches: sandy clay
C - 54 to 85 inches: sandy clay loam

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

NoA—Noboco loamy sand, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 4d6l
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Noboco and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Noboco

Setting
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy marine deposits

Typical profile
Ap - 0 to 7 inches: loamy sand
E - 7 to 13 inches: loamy sand
Bt - 13 to 72 inches: sandy clay loam

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

NoB—Noboco loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d6m
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Noboco and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Noboco

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 7 inches: loamy sand
E - 7 to 13 inches: loamy sand
Bt - 13 to 72 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Coxville

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

OcA—Ocilla loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4d6n
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ocilla and similar soils: 97 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ocilla

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

A - 0 to 3 inches: loamy sand

E - 3 to 24 inches: loamy sand
Bt - 24 to 37 inches: sandy clay loam
Btg - 37 to 70 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: Loamy Rise, Moderately Wet (R153AY001GA)
Hydric soil rating: No

Minor Components

Pelham

Percent of map unit: 2 percent
Landform: Depressions, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: Yes

OrA—Orangeburg loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 4d6p
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Orangeburg and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Orangeburg

Setting

Landform: Marine terraces

Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand
E - 8 to 11 inches: loamy sand
Bt - 11 to 60 inches: sandy clay loam
Bt - 60 to 72 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

OrB—Orangeburg loamy sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 4d6q
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Orangeburg and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Orangeburg

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand
E - 8 to 11 inches: loamy sand
Bt - 11 to 60 inches: sandy clay loam
Bt - 60 to 72 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

OrC—Orangeburg loamy sand, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 4d6r
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Orangeburg and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Orangeburg

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

Ap - 0 to 8 inches: loamy sand
E - 8 to 11 inches: loamy sand
Bt - 11 to 60 inches: sandy clay loam
Bt - 60 to 72 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Pa—Pantego fine sandy loam

Map Unit Setting

National map unit symbol: 4d6s
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Pantego and similar soils: 96 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pantego

Setting

Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy marine deposits

Typical profile

A - 0 to 12 inches: fine sandy loam
Btg1 - 12 to 59 inches: sandy clay loam
Btg2 - 59 to 67 inches: sandy clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Rains

Percent of map unit: 2 percent
Landform: Depressions, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: Yes

Ph—Pelham loamy sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2tzk8
Elevation: 0 to 180 feet
Mean annual precipitation: 40 to 62 inches
Mean annual air temperature: 51 to 78 degrees F
Frost-free period: 189 to 272 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Pelham and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pelham

Setting

Landform: Flatwoods
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and loamy marine deposits

Typical profile

A - 0 to 6 inches: loamy sand
Eg - 6 to 33 inches: loamy sand
Btg1 - 33 to 41 inches: sandy loam

Btg2 - 41 to 66 inches: sandy clay loam
Cg - 66 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Surrency

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: North Florida Flatwoods (R153AY004FL)
Hydric soil rating: Yes

Pickney

Percent of map unit: 1 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Ocilla

Percent of map unit: 1 percent
Landform: Flatwoods
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf, rise
Microfeatures of landform position: Rises
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Rains

Percent of map unit: 1 percent
Landform: Flatwoods
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear

Across-slope shape: Linear
Hydric soil rating: Yes

Ra—Rains sandy loam

Map Unit Setting

National map unit symbol: 4d6v
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rains and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rains

Setting

Landform: Depressions, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

A - 0 to 5 inches: sandy loam
Eg - 5 to 12 inches: sandy loam
Btg - 12 to 70 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Sa—Stallings loamy sand

Map Unit Setting

National map unit symbol: 4d6x
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Stallings and similar soils: 96 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stallings

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy marine deposits

Typical profile

A - 0 to 5 inches: loamy sand
E - 5 to 11 inches: loamy sand
Bt - 11 to 52 inches: sandy loam
Btg - 52 to 68 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A/D
Hydric soil rating: No

Minor Components

Rains

Percent of map unit: 2 percent
Landform: Depressions, marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: Yes

TpB—Troup sand, 0 to 6 percent slopes, Southern Coastal Plain

Map Unit Setting

National map unit symbol: 2tzkp
Elevation: 80 to 630 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 220 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

Troup and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Troup

Setting

Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 6 inches: sand
E - 6 to 63 inches: sand
Bt - 63 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Blanton

Percent of map unit: 5 percent
Landform: Marine terraces
Landform position (two-dimensional): Footslope, summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Fuquay

Percent of map unit: 3 percent
Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Lakeland

Percent of map unit: 3 percent
Landform: Dunes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wagram

Percent of map unit: 2 percent
Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lucy

Percent of map unit: 2 percent
Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

TpC—Troup sand, 6 to 10 percent slopes, Southern Coastal Plain

Map Unit Setting

National map unit symbol: 2tzkr
Elevation: 80 to 630 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 220 to 280 days
Farmland classification: Not prime farmland

Map Unit Composition

Troup and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Troup

Setting

Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loamy fluviomarine deposits

Typical profile

Ap - 0 to 6 inches: sand
E - 6 to 63 inches: sand
Bt - 63 to 80 inches: sandy clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Blanton

Percent of map unit: 8 percent
Landform: Marine terraces
Landform position (two-dimensional): Footslope, summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Wagram

Percent of map unit: 7 percent
Landform: Marine terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ud—Udorthents, loamy

Map Unit Setting

National map unit symbol: 4d70
Elevation: 50 to 400 feet
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and/or loamy marine deposits

Typical profile

C - 0 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

W—Water

Map Unit Setting
National map unit symbol: 4d71
Mean annual precipitation: 44 to 55 inches
Mean annual air temperature: 61 to 70 degrees F
Frost-free period: 225 to 265 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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SECTION C
WASTE CHARACTERISTICS AND WASTE ANALYSIS PLAN

The purpose of the waste characteristics section is to provide a general description of the waste types treated at the boiler and the waste characterization procedures prior to disposal. This section is provided to fulfill the requirements of 40 CFR 264.13, 40 CFR 270.14, and equivalent South Carolina hazardous waste management regulations.

As noted in revised Section E-1 and E-2 of this Permit Application, wastes currently burned in the boiler are consistent with the wastes burned to support the original trial burn, risk assessment, and permit application. Although the designations used to describe some waste stream have changed, the chemistry of the wastes have remained the same. This is further discussed in Section E.

A comparison of the waste codes from the 2003/2004 Permit Application with those in the 2014/2015 Permit Application indicates that there has been only one waste code added since 2003 — F002.

C.1 Physical and Chemical Characteristics of Waste and Residues

SI Group's manufacturing processes at its main production plant include the production of various industrial organics and chemical intermediates used in the agricultural, pharmaceutical, and petroleum industries. Hazardous waste generated at the main production plant includes various organic and chlorinated organic compounds identified in RCRA Appendix VIII and listed in detail in Table C-1. (Note that Table C-1 is provided for reference only. Some constituents and waste numbers may change from time to time as processes are modified.) The hazardous waste is accumulated in four Hazardous Waste Storage Tanks, which is then transferred to Boiler No. 4 for burning as a fuel. Laboratory analysis has been, and will continue to be, performed on the combined waste solutions in the burn tanks before treatment at the boiler to quantify trace metals and chlorine content pursuant to the stack emission limits listed in Section IV.C of the Part B permit and the Hazardous Waste Combustion MACT, as appropriate. However, generator knowledge and ongoing analytical characterization of the various individual waste streams that can be received at the boiler allows for the qualitative identification and classification of each waste stream into three main categories shown below to ensure compliance with the RCRA Hazardous Waste permit and to provide for flexibility in implantation of the permit and operation of the boiler.

- D001/D018 hazardous wastes — containing no compounds listed as an Appendix VIII Hazardous Constituent

- D001/D018/F003/F005 hazardous wastes — containing one or more compounds listed as an Appendix VIII Hazardous Constituent at varying proportions

- F002 hazardous wastes containing methylene chloride in addition to one or more compounds listed as an Appendix VIII and may also include ignitable and/or corrosive waste as defined below.

Note that these wastes are limited to the Appendix VIII constituents noted in the original application.

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
2	330/330 C Still Bottoms	D001	330 Antioxidant Process: Distillation column bottoms	methylene chloride	10 ppm	Yes
				Fuel oil	0-50 %	No
				alklyated phenols	0-50 %	No
				normal and isobutyl benzene	0-50 %	No
				solids	0-50 %	No
4	Isobutylbenzene (IBB) Still Bottoms	D001	Isobutyl benzene Process: Distillation column bottoms	isobutyl benzene	0-100 %	No
				normal butyl benzene	0-100 %	No
5	Wastewater Organics	N/A	Wastewater Treatment Plant Primary Clarifier skimmer tank(s)	Process oil	80-95%	No
				Isooctyl alcohol	0-2%	No
				2,6 di tert butyl phenol	0-5%	No
				Methyl 2, 4 isobutyl phenyl propionate	0-1%	No
				Tri tert butyl phenol	0-1%	No
				Orth tert butyl phenol	0-1%	No
				Isobutyl acetophenone (IBAP)	0-1%	No
				Water	0-0.5	No
6	Hexane from Ibuprofen process	D001, F003	Ibuprofen production: equipment washouts	hexane	25-100 %	No
				methanol	0-50 %	No
				ibuprofen or other heavies	0-25 %	No
7	Distillation lights from Isobutybenzene production	D001	Isobutylbenzene production: Distillation lights	toluene	0-10 %	Yes
				4 methyl 1 pentene	30-65 %	No
				4 methyl 2 pentene	25-40 %	No
				Hexane	0-10%	Yes
8	Kerosene from vessel and tank cleaning*	D001, F005	Traffic area — Rinseate from decontamination of tanks	toluene	< 1%	Yes
				phenol	< 1%	Yes
				kerosene	90-100 %	No
				other organics	0-10 %	No
16	Used lubricating, hydraulic and cutting oil	D001	Maintenance activities around facility	various oils	90-100 %	No

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
18	Unlisted ignitable organic compounds*	D001	Misc.	aniline	waste could contain in various amounts	Yes
				toluene	waste could contain in various amounts	Yes
				toluenediamine	waste could contain in various amounts	Yes
				O-toluidine	waste could contain in various amounts	Yes
				phenol	waste could contain in various amounts	Yes
				methylene chloride	waste could contain in various amounts	Yes
				benzene	waste could contain in various amounts	Yes
				methyl ethyl ketone	waste could contain in various amounts	Yes
23	Methanol/hexane washout	D001, F003	Ibuprofen production area: Tank washouts using Methanol/Hexane mixture	methanol	0-80 %	No
				hexane	0-80 %	No
				Isobutyl acetophenone (IBAP)	0-10 %	No
				Methyl -2-hydroxy-2-4(isobutylphenyl) proprionate solution (HME)	0-10 %	No
				misc. compounds	0-10%	No
37	fuel oil from vessel and tank cleaning*	D001	Traffic	Toluene	< 10%	Yes
				fuel oil	90%	No
76	lab waste*	D001	Laboratory	Toluene	< 100%	Yes
				phenol	< 100%	Yes
				methylene chloride	< 100%	Yes
				n-hexane	< 100%	Yes
				triethylamine	< 100%	Yes
				methanol	< 100%	Yes
				ethylene glycol	< 100%	Yes
77	330 organic*	D001	South Production	methylene chloride	20-80%	Yes
				heptane	0-10 %	No
				fuel oil	0-50 %	No
				alkylated phenols	0-50 %	No

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
85	702/703 still bottoms with super high flash naphtha	D001	702 Antioxidant process: Distillation column bottoms	naphtha	0-25 %	No
				702	0-50	No
				703	0-50 %	No
				cumene	0-75 %	No
				total xylenes	0-75 %	No
90	Diisopropylaniline (DIPA) Columns Bottoms	Non hazardous	Diisopropylaniline production: Distillation column bottoms	aniline	< 10%	Yes
				diisopropylaniline	< 85 %	No
				heavy compounds	< 75 %	No
				toluene	< 10%	Yes
99	Process Oil from Alkyl Aluminum Cylinder Cleaning	Non hazardous	Aluminum Alkyl Production: Process oil from flushing empty cylinders	process oil	90-100 %	No
				water	0-10 %	No
				alkyl organics	0-5 %	No
104	Ibuprofen Heel	D001	Ibuprofen Production: Hexane distillation column bottoms	ibuprofen	0-10%	No
				hexane	0-20 %	No
				para DR3 (ibuprofen)	20-40%	No
				meta DR3 (ibuprofen)	20-40%	No
108	Alkyl Aluminum Vacuum Pump Oil	Non hazardous	Aluminum Alkyl production: spent pump oil that has been contaminated with alkyls	Process oil	90-100%	No
				Water	0-10%	No
				Alkyl organics	0-5%	No
123	Organic from Ibuprofen Aqueous Waste	D001, F003	Ibuprofen production: Dryer or trailer cleanouts	isobutylbenzene	0-50%	No
				Isobutyl acetophenone (IBAP)	50-90%	No
				Methyl 2, 4 isobutyl phenyl propionate (PME)	0-50%	No
				Hexane	0-50%	Yes
				Methyl -2-hydroxy-2-4(isobutylphenyl) proprionate solution (HME)	0-20%	No

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
125	Diisopropylphenol (DIP) Miscellaneous Organics	Non haz	Diisopropylphenol production: Distillation column lights	2,6 diisopropylphenol	0-60 %	No
				2,4,6 triisopropylphenol	0-40 %	No
				2, diisopropylphenol	0-30 %	No
				phenol	< 4300 ppm	Yes
				methanol	0-5%	Yes
				ethyl benzene	< 500 ppm	Yes
				ethylene glycol	< 500 ppm	Yes
				2,6 ditertiarybutyl phenol	0-5% %	No
				4716 (3,5 di tert butyl 4 hydroxyhyrdocinnaminic acid, C - 9 branched alkyl esters	0-5%	No
				methyl acrylate	0-20 %	No
				process oil	10-90 %	No
				Isooctyl alcohol	10-90%	No
128	Vessel/Column Cleanout Waste*	D001, F003, F005	Plant wide	aniline	< 96 ppm	Yes
				formaldehyde	< 2.5 ppm	Yes
				toluene	10-90 %	Yes
				O-toluidine	< 96 ppm	Yes
				phenol	< 96 ppm	Yes
				methylene chloride	50%	Yes
				benzene	< 25%	Yes
				xylene	< 25%	Yes
				n-Hexane	< 25%	Yes
				methanol	< 2700 ppm	Yes
				ethyl benzene	< 25%	Yes
				ethylene glycol	< 500 ppm	Yes
				hexane	0-70 %	No
				butyl phenols and heavies	0-30 %	No
				naphtha	0-90 %	No
				isopropyl alcohol	0-10 %	No
				methanol	0-10 %	No
				oil	0-50 %	No

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
130	MMT Lights*	D001, F003	North Production	toluene	< 50 ppm	Yes
				methylene chloride	< 50 ppm	Yes
				benzene	< 50 ppm	Yes
				methyl ethyl ketone	< 50 ppm	Yes
				xylene	276 ppm	Yes
				ethyl benzene	158 ppm	Yes
				dimers	0-60 %	No
				MMT	0-45 %	No
				dimethyl carbitol	0-40 %	No
				water	0-5 %	No
				xylene	0-25 %	No
				methyl 1 H pyyrole	0-2 %	No
135	Naproxen Waste Solvents *	D001, F005	South Production	aniline	< 18 ppm	Yes
				formaldehyde	21.5 ppm	Yes
				toluene	< 3800 ppm	Yes
				O-toluidine	< 48 ppm	Yes
				phenol	< 48 ppm	Yes
				methylene chloride	< 470 ppm	Yes
				benzene	< 470 ppm	Yes
				methyl ethyl ketone	< 940 ppm	Yes
				xylene	< 470 ppm	Yes
				n-Hexane	< 470 ppm	Yes
				triethylamine	10%	Yes
				methanol	< 50 ppm	Yes
				ethyl benzene	< 470 ppm	Yes
				ethylene glycol	< 110 ppm	Yes
				toluene	5-60 %	Yes
				triethylamine	0-25 %	No
				tetrahydrofuran	0-25 %	No
				diethyl ketone	0-50 %	No
				DIP	0-40 %	No

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
145	Toluene Still Bottoms *	D001, F003, F005	South Production	n hexane	< 5000 ppm	Yes
				triethylamine	< 5000 ppm	Yes
				methanol	<1 ppm	Yes
				ethyl benzene	< 5000 ppm	Yes
				ethylene glycol	50 ppm	Yes
				toluene	50-100 %	Yes
				naproxen	0-10 %	No
				methanol	0-30 %	No
				heavies	0-20 %	No
146	NMDPP Waste Solvents *	D001, F003	North Production	aniline	< 1000 ppm	Yes
				toluene	< 5 ppm	Yes
				toluenediamine	<1000 ppm	Yes
				O-toluidine	<1000 ppm	Yes
				phenol	<1000 ppm	Yes
				methylene chloride	< 5 ppm	Yes
				benzene	2220 ppm	Yes
				methyl ethyl ketone	< 5 ppm	Yes
				xylene	45 ppm	Yes
				n-hexane	< 5 ppm	Yes
				triethylamine	1050 ppm	Yes
				methanol	58.80%	Yes
				ethylbenzene	< 5 ppm	Yes
				methanol	0-80 %	No
				tetrahydrofuran	0-20 %	No
				misc. organics	0-5 %	No
148	Recovered Process Oil-NcendX *	D001, F005	North Production	hydrolyzed oil	90-100 %	No
149	2,6 di,tert butyl phenol Lights	Non hazardous	2,6 Di tert butyl phenol (2,6 DTBP) production: Distillation column lights	phenol	5-10%	Yes
				ortho tert butyl phenol	10-20%	No
				di terty butyl phenol	40-65%	No
169	MBA & Hexane/Toluene Solution *	D001	South Production	n — Hexane	86%	Yes
				methylbenzlyamine	10-30 %	No
				hexane	70-90 %	No
				misc. organic compounds	2-10 %	No
				toluene	50-90 %	Yes

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
170	Methylcyclohexane (Commercial Grade) *	D001	PT Lab	Benzene	5 ppm	Yes
				methylcyclohexane	80%	No
				heptanes	20%	No
175	Waste Methanol *	D001	North Production	water	0-10 %	No
				ammonia	100-500 ppm	No
				hexane	0-100 ppm	No
				methanol	90-99 %	No
162	Di-isopropyl aniline (DIPA) waste solvents	D001	Di-isopropyl aniline production: Distillation bottoms	anilne	15%	Yes
				OIPA	7%	No
				PIPA	1%	No
				DIPA	17%	No
				super high flash naphtha	60%	No
				cumene	3%	No
193	IBAP lights *	D001	Ibuprofen	water	< 1 %	No
				ortho isobutylacetophenone	2-40 %	No
				isobutylbenzene	2-20 %	No
				diisobutylbenzene	4-65 %	No
				hexane	2-90 %	No
264	ETHANOL FROM PURIFICATION OF MeCl2 from EEC-15 *	D001	South Production	ethanol	95-99 %	No
				methylene chloride	0.05-1 %	Yes
324	RB-79 VACUUM PUMP SEAL OIL FROM V0122 *	D001	RB-79 Production	1,4 dioxane	1-70 %	No
				vacuum pump oil	30-100 %	No
				toluene	0-1 %	Yes
				diethylbenzene	0.1-3 %	No
				acetone	0.1-1 %	No
				propylene oxide	0-6 %	No
389	Methanol Byproduct	D001	4716 Antioxidant production; Methanol byproduct	2,6 di tert butyl phenol Isooctyl alcohol	0-15% 0-10%	No No
415	ID415 LAO flush *	D001	South Production	LAO C14	50-99 %	No
				LAO C16	50-99 %	No
				IPA	0-15 %	No
				water	<5 %	No
525	Isohexane *	D001	North Production	isohexane	100%	No

Table C-1
Waste Streams

Waste ID (SI Group Internal Use Only)	Waste Description	RCRA Waste Code(s)	Generating Process	Constituent	Concentration (% by weight or ppm)	Appendix VIII Hazardous Constituent?
576	TnAg (Tennessee Silver solvent)	Non-hazardous	Tennessee facility: Solvent distillation bottoms	PTBP	6.15%	No
				2 4 DTBP	9.19%	No
				2 4 6 TTBP	0.45%	No
				XYLENE	1.83%	No
				BUTYL XYLENE	5.65%	No
				PHENOL	0.06%	Yes
				DIISOBUTYLENE	0.23%	No
				BUTYLATED BIPHENOL	14.60%	No
				BIPHENOL	0.24%	No
				C-12	1%	No
				2 6 DTBP	5.77%	No
				METHANOL	<0.05 %	No
460	330 Organic Layer	D002, F002	330 Antioxidant production: Organic layer from production	330 organics	0-30 %	No
				dimethyl ether	0-01 %	No
				heptane	0-05 %	No
				methanol	0-20 %	No
				methylene chloride	40-75 %	Yes
687	Recycle Toluene	D001/F005		Toluene	75-98 %	Yes
				Hexane	0-5%	No
				Isobutylbenzene	< 1%	No
				n-butyl benzene	< 1%	No
				Methyl acrylate	<1%	No

Notes:
* = Waste Steams marked with an asterisk are not currently being generated.
RCRA = Resource Conservation and Recovery Act
ppm = parts per million
NA = Not applicable

Identification of unique waste streams into one of these three general categories provides operational flexibility, allowing for continuity of waste handling and disposal regardless of potential modifications to the plant processes. Waste streams that do not fall into one of the aforementioned categories will not be accumulated in the same storage tanks or incinerated in Boiler No. 4.

Each hazardous waste category treated at the boiler is discussed below.

C.1(a) Definition of Ignitable Hazardous Waste

Waste solutions treated at the boiler may be hazardous because they exhibit the characteristic of ignitability and are classified with United States Environmental Protection Agency (U.S. EPA) Hazardous Waste Code D001. These wastes can readily catch fire and sustain combustion as determined by flash point testing and defined in 40 CFR 261.21 and SCHWMR 261.21.

C.1(b) Waste Characterization

SI Group's manufacturing processes involve a range of chemical mixing procedures and formulas that generate waste streams with varying chemical composition and properties. Characterization of each unique waste stream will be generated either via process knowledge, or periodic analytical testing as needed to determine the waste type if/when any changes to the process are made. Because multiple waste streams are mixed in the Hazardous Waste Storage Tanks, the accumulated contents of each storage tank will be analyzed in accordance with this waste analysis plan prior to incineration in accordance with U.S. EPA Test Methods for Evaluating Solid Waste, Publication SW-846, or equivalent, prior to incineration. Waste analysis procedures are discussed below in Section C.3.

C.1(c) Ignitable Only Waste Compositions

Ignitable waste streams, that do not contain any Appendix VIII constituents, originate from a range of source processes and are comprised of a variety of organic and aqueous components, including but not limited to; alkylated benzenes, hexane, methanol, ibuprofen, hydraulic fluid, lubricating oils, naphtha, and xylenes. Handling and combustion of these streams do not require any special precautions, other than those applied to ignitable materials as classified by Hazardous Waste Code D001, F003, and F005.

C.1(d) Hazardous Constituent Waste Compositions (Non-Chlorine)

This group includes hazardous waste streams containing one or more of the listed Appendix VIII Hazardous Constituents at varying quantities Handling and combustion of these streams require appropriate precautions, including those applied to ignitable materials as classified by Hazardous Waste Codes D001 (ignitability) and defined by spent solvent streams F003 and F005, and

toxicity as appropriate for D018 and other constituents. These waste streams require similar handling and disposal practices, regardless of the specific waste profile.

C.1(e) Chlorine-Containing Hazardous Constituent Waste Compositions

Chlorine-containing waste streams contain methylene chloride in addition to one or more Appendix VII Hazardous Constituents. In addition to ignitability concerns, these waste streams may contain benzene (D018), and be generated by processes described as F002, F003, and/or F005, and toxicity as appropriate for D018 and other constituents These waste streams require similar handling and disposal practices, regardless of the specific waste profile.

C.2 Chemical Analysis of Residuals and Stack Emissions Generated from Boiler Operations

Table C-1 lists the wastes generated at the main production plant proposed in this renewal application for treatment at the boiler.

The facility runs a batch manufacturing process. Therefore, additional or different waste streams (or IDs) may be present in the future. Any new waste stream will be assessed based on generator knowledge or analyzed[1] for inclusion in the appropriate waste type as needed. Note that Type B and C streams are limited to the Appendix VIII constituents noted in the original application.

C.3 Waste Analysis Plan

The Waste Analysis Plan (WAP) was developed in accordance with *Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes*, (U.S. EPA 530-R-12-001, April 2015) to ensure that SI Group has sufficient information to identify the waste for proper handling, transport, and treatment, and to confirm the effectiveness of treatment. Compliance with stack emission limitations are addressed under the Clean Air Act (CAA) Hazardous Waste Combustor (HWC) National Emission Standards for Hazardous Air Pollutants (NESHAP) Title V Permit Program and are not further discussed here.

The WAP is designed to describe the procedures used to obtain chemical and physical information and data on wastes to ensure proper transportation, treatment, and disposal. The WAP details parameters for analysis and supporting rationale, test methods, sampling methods, and frequency of analysis, along with other documentation for additional requirements pertinent to the boiler operations. Modifications to sampling, quality assurance (QA)/quality control (QC), or

[1] Because U.S. EPA and ATSM methods do not apply to pharmaceuticals, analytical procedures may include one or more of the following SI Group Methods: OAM 4070, 4081, 4090, 4092, 4095, 4097, 4136, 4162, 4252, 4345.

waste analytical methods, and additions to the types of hazardous waste treated at the boiler shall result in the modification of the WAP. Modifications shall be submitted to the South Carolina Department of Health and Environmental Control (SCDHEC) and the EPA if they meet criteria of Appendix 1 to 40 CFR 270.42.

All persons at SI Group responsible for characterizing, handling, treating, and managing hazardous waste shall be familiar with this WAP. Any deviation in the methods needed to characterize a solid or hazardous waste shall be reviewed and accepted by SI Group and incorporated into this plan.

There are generally two types of analytical information developed by SI Group to support its permitted hazardous waste storage and boiler process. The first type is development of the chemical information as described in Table C-2 to ensure that wastes are handled safely, in accordance with regulations, and in accordance with the permit as an individual waste stream. Therefore, individual waste streams are assessed as described in Table C-2 using generator knowledge which includes Safety Data Sheets process recipes, and chemical purchasing records. In the event that laboratory analysis is required to assess Appendix VIII constituents, that analysis is performed in accordance with U.S. EPA SW-846 Methods, most recent version.

The second type of analytical information consists of analysis of tank batches prior to a burn to ensure that the permit burn conditions can be met. The parameter, frequency, etc., are described below.

C.3(a) Parameters and Rationale

Table C-2 lists the parameters to be assessed, the rationale for parameters to be analyzed, and methods used to test the accumulated contents of each storage tank prior to incineration. Note that generator knowledge of the process (from ingredient lists and SDSs may be used in lieu of analytical analysis). Appendix C-1 contains the actual procedures used by the contract laboratory for the tests that are not from SW-846 and references quality assurance and reporting procedures. SW-846 tests follow the quality assurance requirements of the procedure as specified.

C.3(b) Test Methods

Table C-2 describes the test methods used for parameters proposed in this WAP. Any information used to define or characterize a hazardous waste (i.e., generator knowledge, reference documentation, or analytical results) is maintained on file onsite for at least 5 years from the last day the specific hazardous waste was treated at the boiler.

Table C-2 Parameters, Rationale, and Test Methods for Sampling		
Parameters to be Analyzed	**Rationale**	**Test Method(s)**
All Liquid Waste Streams		
Metals	Required to establish metal concentration in feed solution to inform stack emission considerations per RCRA Part B Permit regulations	SW-846 6010D/7470A
Total Chlorine/Chloride	Required to establish total chlorine in feed solution to inform stack emission considerations per RCRA Part B Permit regulations	SW-846 9056A
Heating Value	Required per RCRA Part B Permit regulations	ASTM D 240-14
Viscosity	Required per RCRA Part B Permit regulations	ASTM D-446-12
Water Content	Required per RCRA Part B Permit regulations	ASTM D-1744-13
Ash	Required per RCRA Part B Permit regulations	ASTM D-482-13

Notes:
RCRA = Resource Conservation and Recovery Act
ASTM = American Society for Testing and Materials

C.3(c) Sampling Methods

As previously stated, all wastes treated at the boiler are sampled and analyzed prior to treatment, due to the variable nature of each waste stream and the limitations on stack emissions. Information provided in Section C.1 and Table C-1 provides general information on the three classes of waste streams. Once a burn tank is full of waste, the tank is isolated. The tanks are circulated on average for four hours (some tanks are circulated continuously) to ensure that a homogeneous sample is obtained. The sample line is purged prior to sample collection, and the combined waste is sampled and submitted for laboratory analysis per the appropriate U.S. EPA-approved test methods as listed in Table C-2 prior to treatment in the boiler.

Individual waste streams are sampled by qualified personnel at the operating area generating the waste before transfer to the RCRA facility. Storage tanks are equipped with circulating pumps and adjacent sample pots or sample valves. Purged material is returned to the waste storage tank for disposal.

Each waste tank is equipped with a sample port. All samples are collected in clean, 8-ounce glass bottles for analysis. Waste samples are collected with a minimum amount of agitation, to minimize the amount of surface area exposed to the ambient air and subsequent loss of volatile organics from the sample. Sample bottles are filled to 3/4 full. Sample bottles are labeled with the lot number; tank, trailer, or waste ID number; description of contents; and date and time of sample collection. Special instructions or remarks concerning the waste sample are indicated on the sample bottle label. Samples are maintained at ambient temperature and sent under proper chain of custody to a contract laboratory

Sampling areas are outside in the open air and are thus well ventilated. All operating personnel are required to wear safety glasses (goggles) and a hard hat while performing their jobs. A face shield, impervious gloves, and chemical resistant suit are required for additional protection during sampling activities. In addition, operators are familiarized with the hazards associated with sampling through training and routine safety meetings. Operators also have access to Material Safety Data Sheets and receive annual RCRA hazardous waste training, as described in Section H. Safety and RCRA training records for operating personnel are maintained on file in SI Group's Safety and Training Department.

C.3(d) Frequency of Analysis

All waste streams are generated and transferred to the boiler in batches, each of which are analyzed by a licensed commercial laboratory prior to incineration per the method-specific sampling and handling procedures, as summarized in Table C-2. Each batch of hazardous waste is analyzed before it is burned in Boiler No. 4 to ensure that process limits are met.

C.4 Recordkeeping

All inspection logs, records, laboratory analysis, and other documentation used to establish physical and chemical characteristics of waste are maintained in SI Group's Environmental Manager's or designee's office for at least 5 years from the last day the waste was treated. Hazardous waste manifests are maintained by SI Group's Environmental Manager at the main production plant for at least 5 years from the last day the waste was treated.

The burn process is managed through the use of a Hazardous Waste Burn Slip which records the analytical results for each batch and the burn timing and conditions and a Waste Receipt Slip which details the waste placed in each tank for batch burning. Examples of both may be found in Appendix C-2. The completed Waste Receipt Slip and the Hazardous Waste Burn Slips are kept in the Environmental File room.

Appendix C-1
Analytical Procedures for Batch Waste Analysis

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE

FOR

HEATING VALUE DETERMINATION

BY BOMB CALORIMETER

(GL-GC-E-048 REVISION 10)

APPLICABLE TO METHODS:
ASTM D 240-14
ASTM 4809-13
ASTM E 711-87, Modified (Re-approved 1996)

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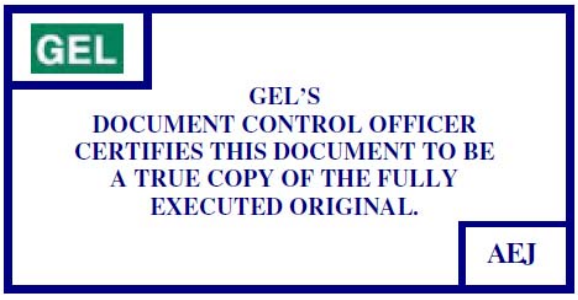

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1.0 STANDARD OPERATING PROCEDURE FOR HEATING VALUE DETERMINATION BY BOMB CALORIMETER

2.0 METHOD CODE

2.1 ASTM D 240-14, Modified

2.2 ASTM 4809-13, Modified

2.3 ASTM E 711-87, Modified

3.0 METHOD OBJECTIVE/PURPOSE

This Standard Operating Procedure (SOP) describes the procedure used to determine the heating values for samples of various liquid and solid matrices.

4.0 METHOD SUMMARY

Heating value determinations are made by burning a weighed sample under controlled conditions. The heating value (BTU) is computed from the temperature changes before, during, and after sample combustion with proper allowances for thermochemical and heat transfer corrections.

5.0 APPLICABLE MATRICES

5.1 Oil

5.2 Miscellaneous liquid and solid samples

6.0 HOLDING TIME

A specific holding time is not addressed by the method. The stability of the heating value is dependent upon the characteristics of the sample. The heating value of some samples is stable for a period of one year while samples with volatile components are analyzed as soon as possible after collection.

7.0 SAMPLE CONTAINER, PRESERVATION, COLLECTION, AND STORAGE REQUIREMENTS

7.1 Samples are collected in plastic or glass containers.

7.2 Samples are unpreserved.

7.3 Samples are stored at 0° $\leq$ 6° C in accordance with GL-SR-E-001 for Sample Receipt, Login, and Storage.

8.0 INTERFERENCES/LIMITATIONS

8.1 Samples that are highly explosive may be difficult to test because the violence of the ignition may expel sample from the test capsule before its contents have completely burned.

8.2 Samples containing high amounts of iron and/or aluminum generate such high temperatures that sample and/or test capsule might melt and cause damage to the bomb apparatus.

8.3 Samples with significant water content may not burn completely causing low analytical results.

8.4 The precision and accuracy of heating value determination is extremely matrix dependent, particularly on the degree of homogeneity of the sample.

8.5 This SOP does not include sample preparation procedures outlined in the applicable ASTM methods for miscellaneous and refuse derived fuels.

9.0 PERFORMANCE CHARACTERISTICS

9.1 Method precision: Refer to current control limits.

10.0 DEFINITIONS

10.1 AlphaLIMS: The Laboratory Information Management System used at GEL Laboratories, LLC.

10.2 BTU: British Thermal Unit

10.3 Laboratory Control Standard (LCS): An aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.

10.4 Laboratory Duplicate (DUP, LCSD, MSD, or PSD): Aliquots of a sample taken from the same container and processed in the same manner under identical laboratory conditions. The aliquot is analyzed independently from the parent sample, and the results are compared to measure precision and accuracy.

10.5 Statistical Process Control (SPC) Limits: Statistically derived limits that establish acceptable ranges for recoveries of analytes of interest including LCS, MS, MSD, PS, PSD, and internal standards.

11.0 ANALYST VERIFICATION

Technicians and analysts are not allowed to analyze client samples without supervision until trained by qualified personnel and upon successful analysis of a proficiency sample. Training records are maintained as quality records.

12.0 DOCUMENTATION OF DATA

As data is obtained, it is recorded in the Heating Value electronic logbook in the AlphaLIMS database and in a hard-copy notebook.

13.0 SAFETY PRECAUTIONS AND HAZARD WARNINGS

13.1 Wear safety glasses while in the laboratory.

13.2 All chemicals and samples should be treated as a potential health hazard and exposure to these chemicals must be reduced to the lowest level possible. GEL maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals in the laboratory as well as a reference file of Material Safety Data Sheets (MSDS). These documents are maintained in the laboratory. Individual sample MSDS forms provided by the clients are kept in login.

14.0 SAMPLE RECEIPT FOR ANALYSIS

14.1 The analyst/technician gives the list of samples needed to the sample custodian. The list is typically in the form of a computer-generated batch sheet and is placed on the clipboard outside of the main cooler. The sample custodian removes the appropriate samples from the cooler and scans them to AlphaLIMS using a barcode scanner. The analyst then takes custody of the samples and scans the batch to the code for the area where the samples are to be prepped or analyzed.

14.2 Analysts and technicians are responsible for retrieving their own samples when the sample custodian is not available.

15.0 INSTRUMENTATION, EQUIPMENT, AND GLASSWARE

15.1 Analytical balance capable of measuring 1 ±0.0001g, calibrated according to GL-LB-E-002.

15.1 Parr 6200 calorimeter

15.2 Parr 845DD2 Ignition Thread

15.3 Parr model 1108 oxygen combustion bombs

15.4 Parr A391 DD oval bucket

15.5 Stainless steel sample holder (Parr part number 43A0)

15.6 Parr 6510 Water Handling System

16.0 REAGENTS

16.1 ASTM Type I deionized (DI) reagent water (see GL-LB-E-016)

16.2 Commercial oxygen

16.3 Parr 3415 benzoic pellets or equivalent

16.4 Parr 3601 gelatin capsules or equivalent

17.0 PREPARATION OF SAMPLES

Samples may be reduced by grinding with a mortar and pestle, pulverized, cut, or blended at the discretion of the analyst. Reasonable efforts are made to obtain a homogeneous and representative sample aliquot. Typical sample weights range from 0.4 to 0.7 g.

18.0 PREPARATION OF STANDARDS

18.1 Commercially prepared benzoic acid pellets of approximately 1 gram are used to standardize the calorimeter as described in section 22.1. These are ready to use and require no preparation.

18.2 Standards associated with this procedure maintained in the AlphaLIMS database.

18.3 Laboratory control sample (LCS): Benzoic acid serves as the laboratory control sample and has a heating value = 11373 BTU/lb.

19.0 INSTRUMENT/EQUIPMENT START-UP PROCEDURE

19.1 Press the rocker switch on the back of the calorimeter to turn it on.

19.2 Once the calorimeter is on, go to “Calorimeter Operations” and switch the heater and pump option to “on”.

19.3 Allow the jacket/bucket temperature to warm up for approximately 20 minutes. The calorimeter is ready to run once the start button is lit up.

20.0 QUALITY CONTROL (QC) REQUIREMENTS

20.1 Frequency of QC:

20.1.1. A matrix duplicate is analyzed for every batch of ≤ 10 samples and for each set of ten samples in batches with > 10 samples.

20.1.2. A laboratory control sample (LCS) is analyzed for each set of 20 samples in a batch or once for batches that contain ≤ 20 samples.

NOTE: LCS duplicates are analyzed if required by contract.

20.2 Acceptance limits:

20.2.1. Matrix relative percent difference (RPD): Refer to current control limits.

20.2.2. LCS: The heating value determined for the LCS should be 11373 ± 1137.3 BTU/lb (90-110%)

20.2.3. LCSD RPD: Refer to the current SPC limits.

21.0 SUGGESTED RUN SEQUENCE

21.1 LCS

21.2 Sample 1

21.3 Sample 1 duplicate

21.4 Sample 2 through x where x ≤ 10

21.5 Repeat steps 21.1 through 21.4 for each set of 10 sample in the batch.

22.0 PROCEDURE

22.1 Standardization of Bomb and Bucket Combination

22.1.1 The calorimeter is standardized using benzoic acid pellets, which have a known heating value of 11373 BTU/lb. This is within the mid-operating range of the unit. A factor called the energy equivalent (EE) value is generated from the standardization series and is used to calculate subsequent heating values. Using the standard, reliable determinations of heating values in any range can be made.

22.1.2 The EE value is determined from a series of ten individual standardization runs using benzoic acid, with a known heating value of 11373 BTU/lb. These runs are performed in accordance with the analysis procedure outlined in Section 22.2.

22.1.2.1 These runs must be performed over a period of three to five days.

22.1.2.2 To be acceptable, the standard deviation must not exceed 6.5 BTU/° C. For this purpose, any individual test may be discarded only if there is evidence of incomplete combustion. If this limitation is not met, investigate for the source of the

problem, correct it, and repeat the entire series to obtain a standard deviation within acceptable limits.

22.2 Analysis:

22.2.1 In a stainless steel combustion capsule, weigh 0.4 to 0.7 g. of sample on an analytical balance and record the weight in AlphaLIMS to the nearest 0.0001 g.

22.2.1.1 Benzoic acid pellets weigh approximately one gram. Record the exact weight to the nearest 0.0001 g for LCS and standardization runs.

22.2.1.2 If a stable weight cannot be obtained after measuring out a quantity of sample on the analytical balance, the sample may contain volatile components. Gelatin capsules are used to contain these volatile components. Refer to sections 22.2.23.4 through 22.2.23.7 for further instructions.

22.2.2 Rinse the bomb and invert to drain.

22.2.3 Add 1 mL of water to the bomb prior to assembly for a determination.

22.2.4 Use the ignition thread and loop it around the permanent fuse so that both ends are in contact with the sample, but it does not touch the sides of the combustion capsule.

22.2.5 Assemble the bomb and charge it to a pressure of 30 atm by going to "Calorimeter Options" then pressing "O2 Fill".

NOTE: Pushing the O2 Fill key will stop the flow of oxygen at any time.

22.2.6 To fill the bomb, connect the hose to the bomb inlet valve and push the O_2 button on the calorimeter control panel. The calorimeter will fill the bomb to the preset pressure (30 atm) and release the residual pressure in the connecting hose at the end of the filling cycle. The main display will read O_2 fill while the bomb is being charged. It will take approximately 60 seconds to fill the bomb.

22.2.7 Once the display returns to its reading, the operator can disconnect the coupling and proceed with the combustion test.

22.2.8 Fill the calorimeter bucket by twisting the knob on the water handling system. It will dispense approximately 200 grams of DI water at about 30 °C.

22.2.9 Set the bucket in the calorimeter. Attach the lifting handle to the two holes in the side of the screw cap.

22.2.10 Lower the bomb in the water with its feet spanning the circular boss in the bottom of the bucket. The bomb must not be touching the sides of the water-filled bucket.

22.2.11 Push the two ignition lead wires into the terminal sockets on the bomb head.

22.2.12 Remove the handle and shake any drops of water back into the bucker, being careful not to remove any water from the bucket with the fingers. Orient the wires away from the stirrer shaft so they do not become entangled in the stirring mechanism.

22.2.13 Close the calorimeter cover. This lowers the stirrer and thermistor probe into the bucket.

22.2.14 Press the "Start" button. This will prompt for the ID#. Enter the ID # for the bomb and bucket combination to be used. The calorimeter bomb and bucket is calibrated as a unit. Once calibrated, do not interchange buckets or bomb parts. The calorimeter will next prompt for sample ID #.

22.2.15 Enter sample ID#. For standardization, entries of 1 to 10 are acceptable. The calorimeter will next prompt for SAMPLE WT.

22.2.16 Enter the sample weight in standardization mode.

22.2.17 After the weight is entered, the calorimeter will take over and conduct the test.

22.2.17.1 During the time it is established the initial equilibrium, the calorimeter PRE-PERIOD light will illuminate.

22.2.17.2 Just before it fires the bomb, it sounds a series of short beeps to warn the operator to move away from the calorimeter.

22.2.17.3 Once the bomb has been fired, the POST light comes on.

22.2.17.4 If it fails to meet either the initial or the final equilibrium condition, or if it fails to detect a temperature rise in the allotted time, the calorimeter terminates the test and advised the operator of the error.

22.2.17.5 At the conclusion of the test, the calorimeter signals the operator with a final beep. To see the results, go to "report", select from list, find the sample ID number, and then press "display". Gross heat is displayed at the bottom right.

22.2.18 Open the bomb door and remove the bucket.

22.2.19 Remove the bomb and the bucker and open the knurled valve knkow on the bomb head to release the residual gas pressure before attempting to remove the cap.

NOTE: This step should be performed in a fume hood.

22.2.20 After all pressure has been released, unscrew the cap.

22.2.21 Lift the head out of the cylinder and place it in the support stand.

22.2.22 Examine the interior of the bomb for evidence of incomplete combustion. If such evidence is found, the test is discarded.

22.2.23 Additional information and recommendations:

22.2.23.1 During the series of ten standardization runs, to make sure the statistical values (mean and standard) deviation values) are within the limits required by ASTM (3.6 cal/g).

22.2.23.2 After standardization, the calorimeter is ready to make heating value determinations of known samples.

22.2.23.3 It is recommended that bone dry sample not be burned. If moisture is to be added drop a small amount of water directly into a loose sample or into a pellet after it has been weighed. Let the sample stand a while to obtain uniform distribution.

22.2.23.4 Volatile samples must be weighed in a Parr 3601 gelatin capsule to prevent loss of sample due to evaporation.

22.2.23.5 These two-piece capsules are stored in a sealed container and handled with due regard for the hygroscopic nature.

22.2.23.6 When used for calorific purposed, blank tests are run in the empty capsules to determine the proper corrections for heat of combustion.

22.2.23.7 Such tests are repeated with each batch of samples where gelatin capsules are required, since value determined on a weight basis will vary with changes in the moisture content of the gelatin.

22.3 Calculation/reporting of results:

22.3.1 The calorimeter automatically reports test results in BTU/lb. A factor of 1.8 automatically converts values from Cal/g to BTU/lb.

22.4 Instrument/Equipment Shut-Down Procedure

22.4.1 To turn off the calorimeter, go to the “Calorimeter Operations” and press the heater and pump to the “off” position.

23.0 DATA REVIEW, VALIDATION, AND APPROVAL PROCEDURE

Refer to GL-GC-E-092 for General Chemistry Data Review and Packaging and GL-LB-E-005 for Data Review and Validation.

24.0 DATA TRANSMITTAL

When a batch is issued "DONE" status, data are made available to reporting personnel.

25.0 RECORDS MANAGEMENT

All data associated with the performance of this procedure, including relevant logbooks, are maintained as quality records in accordance with GL-QS-E-008 for Quality Records Management and Disposition.

26.0 ROUTINE INSTRUMENT/EQUIPMENT MAINTENANCE

26.1 Turn off the Parr 6200 calorimeter by depressing the rocker switch in the back of the instrument.

26.2 Close the valve on the oxygen cylinder.

26.3 Clean and dry the interior of the calorimeter and bomb parts. Store in designated place.

26.4 Refer to the Parr calorimeter manual for routine maintenance and trouble shooting information.

26.5 It is recommended that bombs be retested after each 500 firings by shipment to the factory.

27.0 LABORATORY WASTE HANDLING AND DISPOSAL

For the proper disposal of sample and reagent wastes from this procedure, refer to the Laboratory Waste Management Plan, GL-LB-G-001.

28.0 METHOD VARIATIONS

28.1 This SOP is an adaptation based on the methods cited in Section 30.

28.2 These methods give instructions for measuring cotton thread, nitric acid, and sulfur thermochemical corrections, whereas, this SOP allows estimated factors that are suggested as default values by the calorimeter controller.

28.3 This method does not address sample preparation procedures, specified by all of the referenced methods except for ASTM E 711-87.

29.0 REFERENCES

29.1 ASTM D 240-14: Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter.

29.2 ASTM 4809-13: Standard Test Method for Heat of Combustion of Hydrocarbon Fuels by Bomb Calorimeter (High Precision Method).

29.3 ASTM E 711-87 (Re-approved 1996): Gross Calorific Value of Refuse-derived Fuels by Bomb Calorimeter.

30.0 HISTORY

Revision 8: Added definitions and procedural notes.
Revision 9: Various procedural changes for Instrument. Updated date in reference section.
Revision 10: Removed use of Mineral Oil as combustion aid.

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE

FOR

MERCURY ANALYSIS USING THE PERKIN ELMER

AUTOMATED MERCURY ANALYZER

(GL-MA-E-010 REVISION 29)

APPLICABLE TO METHODS:

EPA SW-846 Methods: 7470A, 7471A, and 7471B
EPA Methods: 245.1, 245.2 and 245.5
EPA Methods 245.1 CLP-M, 245.2 CLP-M and 245.5 CLP-M

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1.0 STANDARD OPERATING PROCEDURE FOR MERCURY ANALYSIS USING THE PERKIN ELMER AUTOMATED MERCURY ANALYZER

2.0 METHOD OBJECTIVE AND SUMMARY

This standard operating procedure (SOP) describes the digestion and analysis procedures for the determination of mercury (Hg) in surface and saline waters, wastewaters, industrial effluents, sanitary sewage, soils, sediments, bottom deposits, sludges, oils, and TCLP extracts. This is a cold-vapor atomic absorption technique based on the absorption of radiation at 253.7 nm by mercury vapor. Samples are treated with nitric acid and sulfuric acid or hydrochloric acid in the presence of potassium permanganate and potassium persulfate to oxidize all mercury to the mercuric (Hg^{++}) form. The mercury is then reduced to its elemental state and evacuated from the sample. The mercury vapor passes through an optical cell positioned in the light source of an atomic absorption spectrophotometer. Absorbance is measured as a function of mercury concentration. This SOP is applicable for the following methods:

2.1 EPA SW-846 Methods 7470A, 7471A, and 7471B

2.2 EPA Methods 245.1, 245.2 and 245.5

2.3 EPA Methods 245.1 CLP-M, 245.2 CLP-M and 245.5 CLP-M

3.0 METHOD APPLICABILITY

3.1 Calibration Range: The typical calibration range used for analysis of mercury is 0.2 µg/L to 10.0 µg/L. Other calibration ranges (e.g., 0.1 µg/L to 5.0 µg/L) may be used per client/contract request.

3.2 Tested Concentration Range: The range for the method is limited by calibration and can be extended by diluting the sample.

3.3 Method Detection Limit (MDL): The MDL is calculated using the procedure described in GL-LB-E-001 for The Determination of Method Detection Limits. The MDL is verified quarterly, or whenever there is a significant change in the instrument response.

3.4 Instrument Detection Limits (IDLs): IDLs are determined by calculating the average of the standard deviations of three analytical runs performed on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day. IDLs are performed quarterly.

3.5 Method Precision: Analytical precision can be determined by calculating the Relative Percent Difference (RPD) between a Laboratory Control Sample (LCS) and a Laboratory Control Sample Duplicate (LCSD) or a Matrix Spike (MS) and a Matrix Spike Duplicate (MSD).

3.6 Method Bias (Accuracy): Accuracy can be determined by calculating recoveries of a LCS and LCSD or an MS and MSD of a similar matrix.

4.0 DEFINITIONS

4.1 AlphaLIMS: The Laboratory Information Management System used at GEL.

4.2 Continuing Calibration Blank (CCB): An aliquot of reagent water or other blank matrix that is analyzed after each CCV. The CCB is used to determine whether the analytical sequence is in control during sample analysis.

4.3 Continuing Calibration Verification (CCV): A solution of the method analytes used to evaluate the performance of the instrument with respect to a defined set of criteria. The CCV concentration is varied throughout the calibration range.

4.4 Initial Calibration Blank (ICB): An aliquot of reagent water or other blank matrix that is analyzed after each ICV. The ICB is used to determine whether there is carryover contamination after injection of the mid-level ICV.

4.5 Initial Calibration Verification (ICV): A solution of method analytes of known concentrations that is used to fortify an aliquot of Blank or sample matrix. The ICV is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check laboratory performance with externally prepared test materials.

4.6 Laboratory Control Sample (LCS): A certified reference material that has been taken through the digestion process. The LCS is used to determine digestion accuracy and to determine if the digestion is in control.

4.7 Laboratory Control Sample Duplicate (LCSD): A duplicate of the LCS. The LCSD is used to determine reproducibility and to indicate precision.

4.8 Method Blank (MB): Type I water that has been taken through the digestion process. The method blank is used to determine the amount of background contamination resulting from the digestion process.

4.9 Method Detection Limit (MDL): The minimum concentration of an analyte that can be measured and reported with 99% confidence that the concentration is greater than zero. The MDL is determined from analysis of a sample in a given matrix type containing the analyte.

4.10 Matrix Spike (MS): A sample that has added to it a known amount of solution containing known concentrations of analytes. The MS is used to determine the presence or absence of interferences and matrix effects in the digested sample.

4.11 Matrix Spike Duplicate (MSD): A duplicate of the MS. The MSD indicates reproducibility.

4.12 National Institute of Standards and Technology (NIST): For the purpose of this method, the national scientific body responsible for the standardization and acceptability of analyte solutions.

4.13 Sample Duplicate (DUP): A duplicate of a sample. The DUP indicates reproducibility.

4.14 Tumble Blank (TB): TCLP extraction fluid Type 1 or 2 that has been taken through the TCLP tumbling process. The tumble blank is used to determine the amount of background contamination resulting from the tumbling process.

4.15 Contract Required Detection Limit (CRDL): The lowest level in the calibration curve.

4.16 Serial Dilution (SDILT): A 1 to 5 sample dilution used to assess matrix suppression.

5.0 METHOD VARIATIONS

This SOP varies from the referenced methods by utilizing a smaller sample aliquot. Reagent amounts are adjusted accordingly.

6.0 SAFETY PRECAUTIONS AND WARNINGS

WARNING

HYDROXYLAMINE HYDROCHLORIDE MAY EXPLODE WHEN HEATED TO 140º C.

MERCURY COMPOUNDS ARE TOXIC IF INHALED OR ABSORBED THROUGH THE SKIN.

ADDITION OF HYDROCHLORIC ACID AND NITRIC ACID IN THE PROPORTIONS 3 TO 1 FORMS AQUA REGIA.

ADDITION OF HYDROXYLAMINE HYDROCHLORIDE /SODIUM CHLORIDE TO AQUA REGIA CAN CAUSE THE SPONTANEOUS RELEASE OF CHLORINE GAS. PERFORM DIGESTIONS USING AQUA REGIA UNDER A HOOD.

NITRIC ACID AND SULFURIC ACID ARE HIGHLY CORROSIVE.

CONTACT WITH OXIDIZERS MAY GENERATE EXPLOSIVE MIXTURES.

NITRIC ACID IS CORROSIVE AND A POISON.

MERCURY VAPORS ARE TOXIC. DIGEST SAMPLES AND STANDARDS UNDER A FUME HOOD.

WHEN DIGESTING SOIL, OIL, AND SEDIMENT, BE CAREFUL TO AVOID INHALING TOXIC NITRATES.

WARNING

PREVENT SKIN AND EYE CONTACT BY USING SPECIFIED PERSONAL PROTECTIVE EQUIPMENT WHEN MAKING STOCK REAGENTS.

WORK UNDER A HOOD TO PREVENT INHALATION WHEN MAKING STOCK REAGENTS.

6.1 Wear eye protection with side shields while performing procedures in the lab.

6.2 Treat all chemicals as potential health hazards, and limit exposure to these chemicals to the lowest level possible. GEL maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals in the laboratory as well as a reference file of Material Safety Data Sheets (MSDS). These documents and individual sample MSDS forms are maintained in the laboratory.

6.3 Personal protective equipment

6.3.1 Gloves are required when handling the chemicals in this procedure.

6.3.2 Work under a hood when using concentrated acids and bases.

6.4 Prior to handling radioactive samples analysts must have had radiation safety training and understand their full responsibilities in radioactive sample handling. Some general guidelines follow:

6.4.1 Protect counter tops with counter paper or work from radioactive sample handling trays.

6.4.2 Prohibit admittance to immediate work area.

6.4.3 Post signs indicating radioactive samples are in the area.

6.4.4 Take swipes of the counter tops upon completion of work. Deliver those swipes to the appropriate swipe count box.

6.4.5 Segregate radioactive wastes. Radioactive waste containers are obtained from Waste Management.

6.5 All samples, chemicals, extracts, and extraction residues must be transferred, delivered, and disposed of safely according to all related SOPs.

6.6 Never leave gas cylinders unchained or untied, including when they are on the moving carts.

6.7 In the event of an accident or medical emergency, call for help immediately. When time and safety permit, an accident report form should be completed and turned in to the safety committee.

6.8 Fire escape routes are posted in the lab and all personnel should be familiar with them. In addition, fire safety equipment such as fire extinguishers is located in the lab. Training is available on the proper operation of this equipment.

7.0 INTERFERENCES TO THE METHOD

7.1 Potassium permanganate is added to eliminate possible interference from sulfide. Concentrations as high as 20 mg/L of sulfide as sodium sulfide do not interfere with the recovery of added inorganic mercury from reagent water.

7.2 Copper has also been reported to interfere; however, copper concentrations as high as 10 mg/L had no effect on recovery of mercury from spiked samples.

7.3 Seawaters, brines, and industrial effluents high in chlorides may require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs at 253.7 nm.

7.4 Certain volatile organic materials that absorb at 253.7 nm may also cause interference.

8.0 APPARATUS AND MATERIALS

8.1 50 mL digestion tubes

8.2 Flask, Volumetric, (100 mL and 250 mL)

8.3 Variable and single volume pipette and micropipettes

8.4 Hot Block (Temperature controlled at 95° ± 3° for solids and 90°- 95° for liquids)

8.5 Non-mercury thermometers

8.6 Culture tubes

9.0 REAGENTS

9.1 Type I deionized water

9.2 Nitric Acid (HNO_3), Concentrated, ACS grade certified for AA use.

9.3 Sulfuric Acid (H_2SO_4), Concentrated, ACS grade certified for AA use.

9.4 Hydrochloric Acid (HCl), Concentrated, ACS grade certified for AA use.

9.5 3% HCl: Dissolve 30 mL concentrated HCl in Type I water and dilute to 1000 mL. Volume may be scaled proportionately.

9.6 Potassium Permanganate Solution ($KMnO_4$), 5%: Dissolve 5 g potassium permanganate in Type I water and dilute to 100 mL. Volume and weight may be scaled up proportionally.

9.7 Potassium Persulfate Solution ($K_2S_2O_8$), 5%: Dissolve 5 g potassium persulfate in Type I water and dilute to 100 mL. Volume and weight may be scaled up proportionally.

9.8 Sodium Chloride-Hydroxylamine Hydrochloride Solution (NaCl-NH_2OH•HCl): Dissolve 12 g of sodium chloride and 12 g of hydroxylamine hydrochloride in Type I water and dilute to 100 mL. (Hydroxylamine sulfate may be used in place of hydroxylamine hydrochloride.) Volume and weight may be scaled up proportionally.

9.9 Stannous Chloride Solution ($SnCl_2$), 1.1%: Dissolve 11 g stannous chloride in 3% hydrochloric acid and dilute to1 L. Volume and weight may be scaled proportionately.

9.10 Aqua Regia: Combine 3 parts of concentrated HCl and 1 part concentrated HNO_3. Prepare fresh before use.

NOTE: Due to the inherent dangers of working with full strength aqua regia, a 1+1 solution is prepared for use with the sample preparation.

9.11 Mercury Source Standard (Hg), 1000 ppm, from an Approved Vendor. Standards are received, labeled, prepared and stored according to GL-LB-E-007 for Laboratory Standards Documentation.

9.12 Liquid Nitrogen or Compressed Nitrogen at pressures 75 to 100 psi.

10.0 INSTRUMENTATION

10.1 Perkin Elmer FIMS400 and FIMS100 Automated Mercury Analyzers

10.2 Balance

11.0 SAMPLE HANDLING AND PRESERVATION REQUIREMENTS

11.1 Aqueous samples must be acidified to a pH < 2 with nitric acid. The samples are tested using pH strips to verify the correct pH values of < 2 before preparation. If samples do not have the correct pH, samples are acidified to a pH of < 2 with nitric acid. The acidified aliquots are held at least 16 hours before preparation. The suggested maximum holding time for these samples is 28 days. When performing CLP analyses, the holding time is 26 days from verified time of sample receipt.

11.2 Non-aqueous samples shall be refrigerated and analyzed as soon as possible. The preservation required for soil/sediment samples is maintenance at 0° ≤ 6°C until

analysis. Water samples that require lab filtration are filtered from non-preserved fractions and acidified to a pH < 2 with nitric acid. A method blank is filtered with the samples for contamination QC purposes. The acidified aliquots are held at least 16 hours before preparation.

11.3 TCLP extracts have a maximum holding time of 28 days before extraction and 28 days after extraction for a total of 56 days.

12.0 SAMPLE PREPARATION TECHNIQUES

12.1 Prior to determining the concentration of mercury, all samples, calibration standards, check standards, laboratory control samples, and blanks must be digested using the following procedures:

12.1.1 For standards preparation, see the mercury recipe section of the AlphaLIMS Standards Logbook.

12.1.2 Label each digestion tube with a sample number or lab Quality Control (QC) number. Establish a one to one relationship between client samples, QC samples, and digestion tubes.

12.2 Aqueous Sample Preparation by Methods EPA SW-846 7470A, EPA 245.1 and EPA 245.2.

12.2.1 Transfer 20 mL of Type I water, 20 mL of a well mixed representative sample, or an aliquot of sample diluted to 20 mL with Type I water, to a labeled digestion tube. Record the volume of sample dispensed into the digestion tube in the Mercury Prep logbook.

12.2.2 For TCLP and MISC-L matrices, transfer 18 mL of Type I water, 2 mL of a well-mixed representative sample, or an aliquot of sample diluted to 20 mL final volume, to a labeled digestion tube. Record the volume of sample dispensed into the digestion tube in the Mercury Prep logbook.

12.2.3 The following calibration standards are required: 0.2, 0.5, 2.0, 5.0, 10.0 µg/L, ICV/CCV, ICB/CCB, and CRDL (Contract Required Detection Limit). Other calibration standards may be prepared per client request.

12.2.4 Add 0.5 mL concentrated nitric acid. Add the appropriate amount of spiking solution to each appropriate QC sample tube. Then add 1.0 mL concentrated sulfuric acid to each digestion tube and mix.

12.2.5 Add 3 mL of 5% potassium permanganate solution to each digestion tube and mix. Let sample stand for 15 minutes after addition of potassium permanganate. If sample does not maintain its brown/purple color, add an additional 3 mL aliquot of the 5% potassium permanganate to the sample and all associated QC. Record this additional aliquot on the comment section of the Mercury Prep logbook. If after the second aliquot is added, the sample is still not able to maintain its purple/brown color throughout the digestion process, then redigest the sample using an appropriate dilution.

12.2.6 Add 1.5 mL of 5% potassium persulfate solution to each digestion tube and mix. Cap each digestion tube and place in a hot block for two hours at 90° - 95°C.

12.2.7 After two hours, remove digestion tubes from the hot block and allow to cool. Cooling can be facilitated by moving samples to the walk-in cooler for no greater than 90 minutes. When the samples have been cooled to room temperature, add 1 mL of sodium chloride-hydroxylamine hydrochloride solution to each digestion tube to reduce any excess potassium permanganate. Cap tubes and shake until the samples are fully reduced. The samples are now ready for analysis.

12.3 Sediment, Oil and Soil Sample preparation by Methods EPA SW-846 7471A, 7471B, and EPA 245.5

12.3.1 For method 7471A, weigh triplicate 0.2 g aliquots of a representative sample and place the aliquot into a digestion tube. For method 7471B, weigh 0.5 to 0.6 g of a representative sample and place the aliquot into a digestion tube. Record the weight in the Mercury Prep logbook. LCS water is used for oil or any other samples that are not a soil or in soil form. Refer to GL-LB-E-029 for specifics on subsampling.

12.3.2 The following calibration standards are required: 0.2, 0.5, 2.0, 5.0, 10.0 µg/L, ICV/CCV, ICB/CCB, and CRDL. Other calibration standards may be prepared per client specification.

12.3.3 Add 5 mL of Type I water to each tube. Add 3 mL of 1+1 aqua regia to each sample and associated QC and mix. Add the appropriate amount of spiking solution to each appropriate QC sample tube.

12.3.4 Place each digestion tube in a hot block at 95° ± 3° C for two minutes.

12.3.5 Remove digestion tubes from the hot block. Cool for at least 15 minutes. Then add 25 mL of DI water and 7.5 mL of 5% potassium permanganate solution and mix thoroughly.

12.3.6 Cap each digestion tube and again place each digestion tube in a hot block 95° ± 3° C for 30 minutes.

12.3.7 Remove tubes from the hot block and allow to cool to room temperature for at least 60 minutes.

CAUTION: This next step can cause chlorine gas to be generated. Perform the following step under a hood.

12.3.8 Uncap the digestion tubes under a hood. Add 2 mL of sodium chloride-hydroxylamine hydrochloride solution to each tube. Cap and shake until samples are fully reduced. Uncap and allow time for chlorine gas to evolve and vent from the digestates. The samples and standards are now ready for analysis.

13.0 PREPARATION OF STANDARD SOLUTIONS AND QUALITY CONTROL SAMPLES

13.1 Source standard solutions

Source standard solutions are purchased from a certified vendor. These standards are traceable to National Institute of Standards and Technology (NIST) standards. The source standards are received from Purchasing.

13.2 Intermediate and working standards must be PREPARED FRESH DAILY.

13.3 For guidance on standard documentation, refer to GL-LB-E-007 for Laboratory Standards Documentation.

13.4 For Kerr-McGee Samples, reprep and reanalyze the samples if MB or CCB is greater than the reporting limit (RL) and samples are between IDL and RL. If samples are less than IDL or greater than 10 times the RL they can be reported.

14.0 INSTRUMENT CALIBRATION AND PERFORMANCE

14.1 Instrument calibration is performed using the following prepared mercury standards: 0.0, 0.2, 0.5, 2.0, 5.0 and 10.0 µg/L.

14.2 An example of a data calculation based on fictitious information follows. Other concentrations may be employed for the calibration curve and ICV.

CONCENTRATION	%RSD	INSTRUMENT RESPONSE
0.0 µg/L	8.2760	0.0007
0.2 µg/L	0.7089	0.0023
0.5 µg/L	1.3778	0.0059
2.0 µg/L	1.6793	0.0243
5.0 µg/L	0.5449	0.0600
10.0 µg/L	1.6070	0.1160

14.3 Performing a linear regression on these data, using the instrument response as the independent variable and the concentration as the dependent variable results in a slope = 86.103, intercept = -0.0521, and a correlation "r" = 0.9998. Thus the concentration of a sample will be calculated by solving the equation:

Concentration (µg/L) = 86.103 (instrument response) – 0.05214

TRUE VALUE	SAMPLE NAME	INSTRUMENT RESPONSE	CALCULATED LINEAR (µg /L)
0.5 µg	ICV	0.00580	0.4447
0.0 µg	ICB	0.0002	0.02
0.2 µg	0.2 CRDL	0.0026	0.17

14.4 Report data to the appropriate number of significant figures.

14.5 Data are reported in µg/L, mg/L, µg/kg or mg/kg Hg depending on client preference. Sample units are defined before data are input into AlphaLIMS by the analyst.

14.6 Any sample concentration less than 100% of the highest recorded calibration standard is acceptable. If sample concentrations are over 100% of the high standard, then these samples must be re-analyzed at a dilution that will bring the sample concentration within the range. Dilutions are made with digested blanks.

14.7 A CRDL standard for CVAA is required to be run following calibration. The result of CRDL should be within 50%-150% of the accepted value. This is used for guidance only. For DOD QSM, the CRDL should fall within 80%-120% of the accepted value or per client request. When performing CLP analyses, the acceptance criteria for the CDRL standard have not yet been established by EPA.

14.8 The acceptable performance requirements for the mercury instrument are a verification of stability by showing that there is no drift, correlation coefficient of 0.995 or better, and ICV and CCV within the acceptance range prescribed in Section 18.2.

14.9 Proof of instrument performance during actual sample analysis is provided by records of the calibration curve, ICV, CCV, and CCB.

15.0 ANALYSIS AND INSTRUMENT OPERATION

15.1 Before actual operation, all samples, including standards and QC samples, are prepared and digested as described in Section 12. Instrument operation includes a calibration phase and a sample analysis phase. The two phases are usually run as one continuous procedure, but the instrument may be calibrated prior to loading and running samples. Also note that the analyst needs to monitor the process to ensure that the calibration is satisfactory prior to analyzing samples. If the calibration process is unsatisfactory it will need to be terminated, problems corrected, and the calibration rerun.

15.2 Turn on computer.

15.3 Input computer passwords.

15.4 Turn on Hg FIMS instrument and note that the autosampler initializes. Let it warm up for at least 30 minutes.

15.5 Prepare daily 1.1% stannous chloride reducing solution in 3% hydrochloric acid in amber bottle. Shake well and put in the appropriately labeled reductant reservoir bottle that feeds the instrument.

15.6 Fill other instrument reservoir bottle with 3% hydrochloric acid for instrument rinse and carrier acid.

15.7 Double-click AA WinLab Analysis icon.

15.8 For Hg_2 Click on the middle button [automated analysis] or for Hg_3 Click on Workspace “Jason”.

15.9 Click [Sample Info] button.

15.10 The standards will be in positions 1 through 11, and they are already entered into the system, but don't show up here (1-BC, 2-0.2 ppb, 3-0.5 ppb, 4-2.0 ppb, 5-5.0 ppb, 6-10 ppb, 7-CCV, 8-CCB, 9-ICV, 10-ICB, 11-CRDL). Go to Autosampler location 12 to type in information from batch sheet.

15.11 At location 12, enter sample IDs from Batch Sheet following the naming convention outlined in the instrument user manual.

15.12 File: save as sample file info (name it with the "mmddyy," followed by W# for waters or S# for soils). (The # indicates the FIMS model used.)

15.13 For $Hg_{2:}$ Click [Auto] button or For $Hg_{3:}$

Make sure "Pumps off at end of analysis" and "Print log during analysis" are turned on Automated analysis control panel.

15.14 Double click on #1 cell, select the soil or water method as appropriate from the list [OK]. They are Water1 or Soil1 depending on matrices.

15.15 For Hg_2 Sample info file: browse, select your "mmddyy" [OK] or for Hg_3 perform the following:

15.15.1 In sample information editor, right click in the shaded box.

15.15.2 Go to parameter list

15.15.3 Highlight and remove "Analyze QC's Before"

15.15.4 Click "OK"

15.15.5 Save sample info file

15.16 Result data set name: browse, enter "mmddyy" [OK].

15.17 Double click on the line under "method" and click on the box under "use entire sample info file." An "x" will appear in the box.

15.18 Check the [Cont] icon button by clicking on the icon. Remove the FIMS cell, and then click on Autozero. Re-install the FIMS cell.

15.19 Load standards. Put standards in the autosampler rack.

15.20 Load samples beginning in position #12. Note that samples go in the 15 mL digestion tubes. A CCV and CCB must separate each group of 10 samples. All samples must be bracketed by a satisfactory CCV and CCB.

15.21 Install dry membrane filter, rough side up (in final assembly position). Screw cap on tightly.

15.22 Hook up and clamp pump tubing. Check all pump tubing daily.

15.23 Click [FIAS] button icon.

15.24 For $Hg_{2,}$ to flush things out: Click [pump 1] (adjust to 100 rpm) and [pump 2] (adjust to 120 rpm for FIMS 400 only) icons or for Hg_3 perform the following:

15.24.1 Clamp, in a downward position, rinse pump to fill rinse line.

15.24.2 Pump turns on when analysis begins. However, raise and lower probe to begin pump for rinsing prior to analysis.

15.25 Adjust gas flow to 40 to 70 cm^3/min.

15.26 Verify flow rates of reductant (5 to 7 mL/min, red/red tubing) and carrier (9 to 11 mL/min, blue/yellow tubing) with DI water using graduated cylinders.

15.27 Cycle [valve fill/inject] to further flush things out. Give it a minute or so in each position. Unclick all three buttons and close the window.

15.28 In the "Automated Analysis" window click on "Analyze Tab" then click on [Analyze All].

16.0 EQUIPMENT AND INSTRUMENTATION MAINTENANCE

16.1 If there are problems: During the analysis the foreground window is usually the "Results" text window that is also automatically printed, and the background window is the "Automated Analysis" window. If you need to abort a run, you must wait for the hourglass mouse cursor to change to an arrow, then click on the "Automated Analysis" window to bring it to the foreground. Then unclick the [Analyze All] button. A dialog box will come up giving you a couple of options.

16.2 For non-routine maintenance procedures, refer to Perkin Elmer manual for troubleshooting.

16.3 Whenever instrument is serviced or adjusted, an entry needs to be made in the maintenance log. The entry includes the analyst's initials, date, nature of the problem, and actions taken to correct it.

17.0 DATA RECORDING, CALCULATIONS AND DATA REDUCTION

17.1 The concentration of mercury can be determined by comparing the response obtained from analyzing the sample digestate to the calibration curve. The sample concentration of mercury is matrix specific and is calculated as follows:

Aqueous Sample

17.1.1 Concentration (µg/L) = $\frac{(C)(D)(V_t)}{V_i}$

Where:

C = Concentration (µg/L) digestate

D = Dilution Factor

V_t = Total Volume of sample digestate

V_i = Initial Volume of sample in L

17.1.2 Non-aqueous Samples

Concentration (µg/kg) = $\frac{(C)(D)(V_t)}{W(\%S)}$

Where:

C = Concentration (µg/mL) digestate

D = Dilution Factor

V_t = Total Volume of the sample digestate

W = Weight of the sample digested

%S = Percent Solids

18.0 QUALITY CONTROL REQUIREMENTS

18.1 Frequency of Quality Control Activities

18.1.1 ICV is performed immediately following each calibration and CCV is performed after every 10 analysis.

18.1.2 ICB is performed immediately following the ICV and CCB must follow each CCV.

18.1.3 A method blank is analyzed for each batch of 20 or less samples.

18.1.4 A matrix spike and matrix spike duplicate or matrix spike and a sample duplicate are analyzed for every 20 or less samples in a batch, or per client requirements. When performing CLP analyses, the requirement for matrix spike analysis is one per every sample delivery group (SDG) of 20 samples or less.

18.1.5 A LCS is analyzed with each batch of 20 or less samples. Additionally, a LCS duplicate also may be analyzed due to client specific requirements.

18.1.6 A SDILT is required with each batch of 20 or less samples, preferably the QC designated sample.

18.1.7 Linear Calibration Range (LCR) checks are performed on a 6 month basis. The high standard of the curve is read back against the calibration and must recover ± 10%. If this procedure fails, the problem must be investigated and rectified.

18.1.8 A post spike is required if the percent recovery of an MS or MSD is outside the acceptance limits or the MSD %RPD is greater than 20% RPD for all SW-846 Methods.

18.2 Acceptance Limits

18.2.1 Acceptance limits for the following methods are outlined below:

Method/ Acceptance Criteria	SW-846 7471A SW-846 7471B	SW-846 7470A SM 3112B	EPA 245.1 EPA 245.5 EPA 245.2	245.1 CLP-M 245.5 CLP-M 245.2 CLP-M	DOD QSM
ICV	90% - 110%	90% - 110%	95% - 105%	90% - 110%	90-110%
ICB	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	<LOD
CRDL	70% - 130%	70% - 130%	70% - 130% advisory limits only	70% - 130% advisory limits only	80% - 120% to investigate and recalibrate

CCV	80% - 120%	80% - 120%	90% - 110%	80% - 120%	80% - 120%
CCB	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	<LOD
Method Blank	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	-0.2 µg/L to 0.2 µg/L	± ½ x RL
LCS	80% - 120% (for non-SRM sources) certified SPC limits for SRM	80% - 120%	85% - 115%	80% - 120% Certified SPC limits from ERA	80% - 120%
Matrix Spikes	80% - 120%	75% - 125%	75% - 125%	75% - 125%	80% - 120%
Sample Duplicates	0 - 20%, when > 5 x RL, ± RL when < 5 x RL	0 - 20%, when > 5 x RL, ± RL when < 5 x RL	0 - 20%, when > 5 x RL, ± RL when < 5 x RL	0 - 20%, when > 5 x RL, ± RL < 5 x RL	0 - 20%, when > 5 x RL, ± RL < 5 x RL
Serial Dilution	<10% if > 25x IDL	<10% if > 25x IDL	< 10% if > 25x IDL	< 10% if > 25x IDL	< 10% if > 50x LOQ
Matrix Spike Dup	0 - 20%, when > 5 x RL, ± RL when < 5 x RL	0 - 20%, when > 5 x RL, ± RL when < 5 x RL	0 - 20%, when > 5 x RL, ± RL when < 5 x RL	0 - 20%, when > 5 x RL, ± RL < 5 x RL	0 - 20%, when > 5 x RL, ± RL < 5 x RL
Post Spikes	80% - 120%	80% - 120%	75% - 125%	75% - 125%	80% - 120%
Linear Calibration Range	90% - 110%	90% - 110%	90% - 110%	90% - 110%	90% - 110%

18.2.2 All reported sample concentrations must be less than the highest calibration standard. Samples greater than the highest calibration standard must be diluted to bring the concentration within range.

18.2.3 The ICV is prepared from a second standard source other than the source employed for initial calibration. Generally, the concentration of the ICV is 5.0 µg/L.

18.2.4 The method blank must have an absolute value below the CRDL for CLP analyses and have an absolute value below ½ RL for DOD QSM analyses.

18.2.5 All LCS recoveries must fall within the stated acceptance limits. Statistical process control limits are established for LCS soils.

18.2.6 Matrix spikes, matrix spike duplicates, sample duplicates, and post spikes are indicators of method performance for a specific sample matrix. Acceptance limits are based on guidelines outlined in the specific methods and are listed in the table above.

18.2.7 The serial dilution must be < 10% difference for sample concentrations that are > 25x the IDL or the MDL, depending on client specifications.

19.0 CORRECTIVE ACTION FOR OUT OF CONTROL OR UNACCEPTABLE DATA

19.1 ICV and/or CCV failure requires recalibration of the instrument and/or preparation of new standard solutions. Samples analyzed between calibration verification that fail must be reanalyzed. An ICV or CCV that has failed may be rerun provided there is an attributable cause known to have affected the check standard only and not the previous samples. Examples of an acceptable cause may be a sample tip out of solution during analysis, no solution in the sample cup or obvious carryover in the CCV from a very high sample immediately prior to the CCV. If the CCV is reanalyzed, the data must be lined through, initialed and dated, and the reason for the rerun must be documented on the raw data. In addition, corrective action should be taken to eliminate the cause of the initial CCV failure to prevent future occurrence.

19.2 ICB or CCB failure requires recalibration of the instrument and/or repreparation of the calibration blank. When analyzing under SW-846, a CCB may be accepted above the RDL level under two conditions: 1) the CCB is acceptable if the sample value is below the RDL and 2) the CCB is acceptable if the level of analyte in the CCB is less than 1/10 the analyte value in the lowest reported sample. For DOD QSM, acceptance criteria must be the absolute value less than the LOD or less than 10 x the lowest value of the samples bracketed by the blank.

19.3 Method blank results higher than the RDL and greater than 10% of any sample value in that batch which has concentrations above the RDL requires that batch be redigested, reanalyzed, and/or reported with the appropriate qualifier. If the method blank results are less than -1x RDL, there may be significant interference, calibration or contamination problems with the sample, or instrument or calibration standards that must be resolved before the batch can be reported. When performing CLP analyses, method blank results that have absolute values higher than the CRDL and greater than 10% of any sample in the batch require that the samples be redigested and reanalyzed.

19.4 LCS results outside of the upper and lower control limits can be reanalyzed for verification. If reanalysis is still outside the limits, the batch representing the failing LCS must be reprepped for reanalysis.

20.0 DATA REVIEW, APPROVAL, AND TRANSMITTAL

20.1 The printout from the instrument is attached to the Laboratory Information Management System (AlphaLIMS) data report, original batch sheet, and the Mercury Prep Logbook.

20.2 The metals department analyst reviews mercury data by verifying that the values from the printout agree with values entered into the mercury data run logbook, and with the values that appear on computer printed data report sheets. The calibration standards, the correlation coefficient, CCV, LCS, duplicates, and spikes are also reviewed to make sure values are within the limits.

20.3 Levels of review responsibility are described below:

20.3.1 Analyst Review: Mercury data are reviewed by the analyst after the run is complete and checked once more after data are entered in AlphaLIMS.

20.3.2 Peer Analyst Review: Another analyst familiar with mercury and its data reviews all data in detail.

20.4 Review of each level

20.4.1 Analyst Review: Analyst checks his/her own data and makes necessary corrections on any errors (i.e., writing wrong numbers, checks correlation coefficient again, dilution factors, and continuous calibration standards).

20.4.2 Peer Analyst Review: Reviews all data on the printout, data reported in the Mercury Data Run Logbook, Mercury Prep Logbook, and information that are on the computer printed data report. It is important at this level to check what preparation date was entered, dilution factors, concentrations of spikes, and CCVs. The Case Narrative Report is used to standardize items checked by peer analysts.

20.5 The complete data review process requires the use of the Mercury Prep Logbook, Prep data report, batch sheet, AlphaLIMS data report, raw instrument data, auto-run sequence record if the samples were analyzed using an autosampler, and Case Narrative Report

21.0 RECORDS

21.1 Prep data are recorded in accordance with Section 12 of this SOP.

21.2 Data from an analysis are recorded on a printout from the instrument and stored in digital format on the instrument computer or on the network server.

21.3 Reported values come from one sample run if the instrument calibration and other required instrument specifications are met. The data are reported as a raw value along with any dilution factors used.

21.4 Uploading data into AlphaLIMS

21.4.1 To upload data into AlphaLims for Hg_2 perform the following:

21.4.1.1 This can be done by double clicking on the icon AA WinLab Reformat. To open Design, double click “jeff.” Click OK.

21.4.1.2 Open data file by clicking Browse on the Reformat Design screen. Select appropriate data file and click OK.

21.4.1.3 Click save results button. When results are saved, exit AA WinLab Reformat.

21.4.1.4 Open Microsoft Excel: Click Create files marco. Enter data file name followed by .prn (ex. 051607w1.prn). Press Enter. Enter the AlphaLIMS initials of the analyst. Press Enter. When prompted, press any key to complete.

21.4.1.5 Click the View Edit files macro. This will pull up the data file created in the previous step. Make any changes if necessary and save.

21.4.1.6 Click AlphaLIMS. Upload macro to upload data to AlphaLIMS.

21.4.1.7 Double click Runlogs shortcut icon on the desktop, then double click Archived Runlogs folder. Select the appropriate file. Print.

21.4.1.8 If any changes were made to the data file prior to uploading drag and drop the runlog folder into the Ultra edit program and make the appropriate corrections. Repeat 21.4.7 to retrieve the corrected runlog.

21.4.2 To Upload data into AlphaLims for Hg_3 perform the following:

21.4.2.1 Upload by double clicking data manager

21.4.2.2 Highlight the data for the current day

21.4.2.3 Click “Export” button

21.4.2.4 Use existing Design and browse

21.4.2.5 Highlight GEL_Upload.xpt and open

21.4.2.6 Click Finish

21.4.2.7 Open Microsoft Excel and follow SOP for Hg2. Refer to step 21.4.1.4.

22.0 RECORDS MANAGEMENT

All data associated with the performance of this procedure, including relevant logbooks, are maintained as quality records in accordance with GL-QS-E-008 for Quality Records Management and Disposition.

23.0 LABORATORY AND WASTE HANDLING AND DISPOSAL

23.1 Standard solutions that must be disposed of are transferred by the Waste Management Technician to be disposed of in accordance with the Laboratory Waste Management Plan, GL-LB-G-001.

23.2 Special caution must be taken when samples are radioactive. Handling, delivery, transfer, and disposal of radioactive samples and residues must follow the related SOPs. Persons handling radioactive materials must first pass the training course.

24.0 REFERENCES

24.1 Methods for the Determination of Metals in Environmental Samples, Supplement 1, EPA 600/R-94-111. Method 245.1, Revision 3.0, May 1994.

24.2 Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010. Method 245.5, Revision 2.3, April 1991.

24.3 Perkin Elmer FIMS400/FIMS100 Flow Injection Mercury System.

24.4 Test Methods for Evaluating Solid Waste: Laboratory Manual Physical/ Chemical Methods, Volume 1A, EPA SW-846, Final Update III, June 1997. USEPA Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

24.5 Method 7470A, "Mercury in Liquid Waste (Manual Cold-Vapor Technique)," Revision 1, September 1994.

24.6 Method 7471A, “Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique),” Revision 1, September 1994.

24.7 Method 7471B, "Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)," Revision 2, February 2002.

24.8 Methods for Chemical Analysis of Water and Wastes, 1983, (EPA-600/4-79/020-PB84-128677).

24.9 Method for the Determination of Metals in Environmental Samples, Method 245.2, 1974.

24.10 Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0, July 2013

25.0 HISTORY

Revision 24: Updated section 12.3.1 to comply with multiple methods (7471A and 7471B).

Revision 25: Changed 95° ± 5° C to 95° ± 3° C to comply with audit finding.

Revision 26: Deleted SM references.

Revision 27: Revised to include post spike requirement.

Revision 28: Added DoD QSM Reference, corrected section 15.0

Revision 29: Deleted Section 12.4 and 12.5. Added clarification to 8.4 for temperature for solids and liquids. Section 12.2.6 changed temperature criteria to 95° ± 3° C to 90°-95° C.

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE

FOR

ION CHROMATOGRAPHY (IC)

(GL-GC-E-086 REVISION 24)

APPLICABLE TO METHODS:
EPA Method 300.0
SW-846 Method 9056A

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1.0 STANDARD OPERATING PROCEDURE FOR ION CHROMATOGRAPHY (IC)

2.0 METHOD CODES

2.1 EPA Method 300.0

2.2 SW-846 Method 9056A

3.0 METHOD OBJECTIVE/PURPOSE

3.1 This standard operating procedure (SOP) provides necessary instructions for the determination of the following inorganic anions by ion chromatography: bromide, chloride, fluoride, nitrate-N, nitrite-N, sulfate, orthophosphate-P, and iodide.

NOTE: For EPA Method 314.0 (Perchlorates by IC) refer to GL-GC-E-096.

3.2 The applicable matrixes to this method are as follows:

3.2.1 Drinking water

3.2.2 Surface water

3.2.3 Groundwater

3.2.4 Wastewater

3.2.5 Reagent waters

3.2.6 Aqueous extracts of solids

3.2.7 Leachates (when no acetic acid is used)

3.2.8 Collected solutions from bomb combustion of solid waste (Method 5050)

3.3 A small volume of sample is introduced into the ion chromatograph (IC). The anions of interest are separated and measured after traveling through a series of columns and a suppressor device. The sample passes through a conductivity detector (CDM).

3.4 An extraction procedure must be performed to use this method for solids.

3.5 Approximately 4.9 mL of sample is flushed through the sample loop prior to injecting the sample. The large amount of sample flushing prevents sample cross-contamination.

4.0 METHOD APPLICABILITY

4.1 Method Detection Limit: The MDL is updated and verified every six months.

For DoD QSM, LOD is verified quarterly.

NOTE: Because iodide reference Method 300.0 when analyzed, these MDLs are determined semiannually.

4.2 Method Precision: The limits are static at 100 ±10%.

4.3 Method Accuracy: Refer to the current SPC limits for these methods.

4.4 Technicians and analysts do not analyze client samples without supervision until they have been fully trained and have demonstrated the ability to generate acceptable data. Training records are maintained as quality records.

5.0 DEFINITIONS

5.1 Calibration Blank: A volume of reagent water without the analytes, internal standards or surrogates used within the calibration curve.

5.2 Calibration Standard (CAL): A solution prepared from the primary stock solution. The CAL solutions are used to calibrate the instrument.

5.3 Continuing Calibration Verification (CCV): A solution of the method analytes used to evaluate the performance of the instrument with respect to a defined set of criteria. The CCV concentration is varied throughout the calibration range.

5.4 Instrument Calibration Verification (ICV): A solution of the method analytes used to evaluate the performance of the instrument with respect to a defined set of criteria. The ICV concentration is at or near the calibration midpoint and is prepared from a different source than the calibration standards. A synonym for ICVs is an Instrument Performance Check (IPC).

5.5 Laboratory Control Sample (LCS): An aliquot of reagent water to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine whether methodology is in control. A synonym for LCS is a Lab Fortified Blank (LFB).

5.6 Linear Calibration Range (LCR): The concentration range over which the instrument response is linear.

5.7 Matrix Spike (MS): An aliquot of a known sample to which known quantities of the method analytes are added in the laboratory. The MS is analyzed like a sample and its purpose is to determine whether the sample matrix contributes to the analytical results. distribute

5.8 Method Blank (MB): An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents and reagents which are used with other samples. The Method Blank is used to determine if method analytes or other interferences are present in the laboratory environment.

5.9 National Institute of Standards and Technology (NIST): For the purpose of this method, the national scientific body responsible for the standardization and acceptability of analyte solutions.

6.0 METHOD VARIATIONS

6.1. Iodide is analyzed using a different instrument setup than that used for normal anions in accordance with SW846 9056A and EPA 300.0. These differences are described in section 14.3.

6.2. Retention Time study is done over a 3 day period instead of a 24-hour period.

7.0 SAFETY PRECAUTIONS AND HAZARD WARNINGS

WARNING

HYDROCHLORIC ACID IS A CORROSIVE AND A POISON.

SODIUM HYDROXIDE IS A CORROSIVE AND A POISON.

WORK UNDER A HOOD TO PREVENT INHALATION WHEN MAKING STOCK REAGENTS.

7.1 Wear eye protection with side shields while in the laboratory.

7.2 All chemicals and samples should be treated as potential health hazards, and exposure to these chemicals must be reduced to the lowest level possible. GEL maintains a current awareness file of OSHA regulations regarding the safe handling of the

chemicals in the laboratory as well as a reference file of Material Safety Data Sheets (MSDS). Individual sample MSDS forms provided by the clients are also maintained.

7.3 Personal protective equipment

7.3.1 Gloves are required when handling the chemicals in this procedure. The gloves approved for this procedure are:

7.3.1.1 Nitrile gloves for concentrated acids and bases.

7.3.1.2 Non-sterile ambidextrous gloves for sample prep and standard handling.

7.3.2 Work under a hood when using concentrated acids and bases, and acetonitrile.

7.4 Prior to handling radioactive samples, analysts must have had radiation safety training and understand their full responsibilities in radioactive sample handling. Some general guidelines follow:

7.4.1 Protect counter tops with counter paper or work from radioactive sample handling trays.

7.4.2 Prohibit admittance to immediate work area.

7.4.3 Post signs indicating radioactive samples are in the area.

7.4.4 Take swipes of the counter tops upon completion of work. Deliver those swipes to the designated swipe count box.

7.4.5 Segregate radioactive wastes in radioactive waste containers are obtained from Waste Management.

7.5 All samples, chemicals, extracts, and extraction residues must be transferred, delivered, and disposed of safely according to all related SOPs.

7.5.1 Segregate solid wastes from liquid wastes in the satellite area containers.

7.5.2 Segregate oil wastes from water-soluble wastes in the satellite area containers.

7.6 Never leave gas cylinders unchained or untied, including when they are on the moving carts.

7.7 In the event of an accident or medical emergency, call for help immediately. When time and safety permit, an accident report form should be completed and turned in to the safety committee.

7.8 Fire escape routes are posted in the lab, and all personnel should be familiar with them. In addition, fire safety equipment such as fire extinguishers is located in the lab. Training is available on the proper operation of this equipment.

8.0 INTERFERENCES/LIMITATIONS

8.1 Interferences may be caused by substances with similar retention times which overlap those of the anions of interest. High concentrations of one analyte may interfere with the detection of another analyte. Usually a sample dilution and/or a gradient elution will overcome interferences evidenced by retention time problems.

8.2 Limitations may occur if particulates remain in a sample after filtration, or if the client insists that the sample is analyzed without filtration.

8.3 Many interferences are caused by contaminants in the reagent water, reagents, glassware, etc., which lead to elevated baselines or artifacts on the chromatograms.

8.4 Any anion that is not retained by the column or just slightly retained will elute in the area of fluoride and interfere. Known coelution is caused by carbonate and other small organic anions. At concentrations of fluoride above 1.5 mg/L, this interference may not be significant.

8.5 Because nitrite, orthophosphate, and bromide elute very closely together, they are potential interferants. When any of these anions are to be quantified in the presence of others, dilutions may be necessary to completely resolve the analytes.

9.0 APPARATUS, MATERIALS, REAGENTS, EQUIPMENT AND INSTRUMENTATION

9.1 Apparatus and Equipment for Dionex IC:

9.1.1 Dionex 5 mL sample vials and filter caps or equivalent

9.1.2 Dionex 5 mL automated sampler cassettes or equivalent

9.1.3 4 L reservoirs

9.1.4 Helium tanks (minimum purity, 99.995%) or equivalent

9.1.5 1-5 mL Oxford, 10-100 µL, and 100-1000 µL Eppendorf pipets or equivalent

9.1.6 0.20 µm Acrodisc syringe filters or equivalent

9.1.7 10 cc disposable syringes or equivalent

9.1.8 10, 50, 100, 250 and 500 mL volumetric flasks

9.1.9 25, 50 and 100 mL graduated cylinders

9.2 Analyte Reagents: All reagents must be American Chemical Society certified or equivalent.

9.2.1 Sodium chloride (NaCl)

9.2.2 Sodium hydroxide (NaOH)

9.2.3 Acetonitrile

9.2.4 Hydrochloric acid (HCl), concentrated

9.2.5 Sodium carbonate

9.2.6 Sodium bicarbonate

9.2.7 Stock standards for anions of interest at concentration of 1000 ppm or greater. These are usually purchased as certified solutions either in individual standards or in mixes of anions.

9.2.8 2-Fluorocinnamic acid, 98% or equivalent (for use with Bomb Prep LCS)

9.2.9 Tin (IV) chloride bis(2,4-pentanedionate), 95% or equivalent (for use in Bomb Prep LCS)

9.2.10 Adenine sulfate, 98% or equivalent (for use with Bomb Prep LCS)

9.2.11 2-Amino-5-bromobenzoic acid, 98% or equivalent (for use in Bomb Prep LCS)

9.3 Eluent for IC methods 9056A/300.0 performed on the Dionex ICs

9.3.1 Eluent stock: 4.5 mM sodium carbonate/0.8 mM sodium bicarbonate.

9.3.1.1 Add 127.2 g of sodium carbonate and 67.2 g of sodium bicarbonate to a 2000 mL volumetric flask and fill to volume with DI water.

9.3.1.2 Working eluent: Dilute 79 mL stock (from 9.3.1.1) per four liters of DI water

9.3.1.3 Sparge with helium to degas.

9.3.2 Eluent for Iodite: 50 mM sodium hydroxide

9.3.2.1 Add 16.0 g of sodium hydroxide 50/50% solution to a 4L flask and bring to volume with DI water.

9.3.2.2 Sparge with helium to degas.

9.4 Column Cleaning Solution: Combine 800 mL acetonitrile with 20 mL of concentrated hydrochloric acid and 180 mL DI water for the Dionex ICs.

9.5 Instrumentation:

9.5.1 Dionex ICS 1600 Ion Chromatography instrument consisting of the following components:

9.5.1.1 SP Isocratic pump

9.5.1.2 Autosampler Models AS40 or better

9.5.1.3 CD Conductivity Detector

9.5.1.4 DC separation Center with Rheodyne valve and suppressor

9.5.1.5 Computer Pentium IV, 1.0 G RAM, or comparable Windows 2000 (SP4), Windows 7

9.5.1.6 Instrument Operation Software: Chromeleon 7.2

9.5.1.7 50 µL sample loop (used for anion method)

9.5.2 Dionex ICS 5000 Ion Chromatography instrument consisting of the following components:

9.5.2.1 SP Isocratic pump

9.5.2.2 Autosampler Models AS40 or better

9.5.2.3 CD Conductivity Detector

9.5.2.4 DC separation Center with Rheodyne valve and suppressor

9.5.2.5 Computer Pentium IV, 1.0 G RAM, or comparable Windows 2000 (SP4), Windows 7

9.5.2.6 Instrument Operation Software: Chromeleon 6.80 SP2

9.5.2.7 50 µL sample loop (used for anion method)

9.5.3 Dionex ICS 3000 Ion Chromatography instrument consisting of the following components:

9.5.3.1 SP Isocratic pump

9.5.3.2 Autosampler Models AS40 or better

9.5.3.3 CD Conductivity Detector

9.5.3.4 DC separation Center with Rheodyne valve and suppressor

9.5.3.5 Computer Pentium IV, 1.0 G RAM, or comparable Windows 2000 (SP4), Windows 7

9.5.3.6 Instrument Operation Software: Chromeleon 6.80 SP2

9.5.3.7 50 µL sample loop (used for anion method)

9.5.4 Dionex 500 I Ion Chromatography instrument consisting of the following components:

9.5.4.1 IP Isocratic pump

9.5.4.2 Autosampler Models ASM-3 and AS40

9.5.4.3 CD20

9.5.4.4 IC separation Center with Rheodyne valve and suppressor

9.5.4.5 Computer 486/33 PC or better

9.5.4.6 Instrument Operation Software: PeakNet 5.21 or better

9.5.4.7 50 µL sample loop (used for iodide method)

9.5.5 Dionex columns for anions by 9056A/300.0

9.5.5.1 Analytical Column; AS23

9.5.5.2 Guard Column; AG23

9.5.6 Dionex columns for iodide by 9056/300.0

9.5.6.1 Analytical Column; Dionex AS9HC

9.5.6.2 Guard Column; Dionex AG9HC

10.0 SAMPLE HANDLING AND PRESERVATION

10.1 Sample containers can be either glass or plastic. Samples should have no chemical additives for preservation purposes. All samples should be stored at an approximate temperature range of $0° \leq 6°C$ from the time of collection until the time of analysis.

10.2 All anions and iodide have 28-day holding times except nitrate (NO_3), nitrite (NO_2) and o-phosphate (PO_4), which have 48 hours. Holding times are calculated from the time and date of collection until the start of analysis, unless otherwise specified by the contract.

NOTE: The 48-hour hold time for solid samples (nitrate, nitrite, and o-phosphate) are calculated from the time of extraction.

10.3 If sample analysis is not performed before the holding time expires, the Project Manager will be notified. The Project Manager will determine if analysis should continue. If for any reason the Project Manger is unavailable, analysis will be performed and appropriate people notified as soon as possible.

10.4 Sample retrieval

10.4.1 The analyst/technician gives the list of samples needed to the sample custodian. The sample custodian removes the appropriate samples from

the cooler and scans them in AlphaLIMS to the appropriate code for the area delivers. The analyst takes custody of the samples and scans them in AlphaLIMS to the Batch number and area where the samples are to be prepared and analyzed.

10.4.2 Analysts and technicians are responsible for retrieving their own samples when the sample custodian is not available.

11.0 PREPARATION OF SAMPLES

11.1 All IC samples are marked in login as "UNPRESERVED." Only unpreserved samples should be run on the IC. Any sample preparation is done only with the consent of the analyst. Most sample preparations are in the form of filtrations and can be performed by using 0.2 µm acrodisc filters and a syringe.

NOTE: It is assumed that material within the sample container is considered the sample. Removal of any extraneous material (leaves, twigs, large rocks, etc.) must be documented in the case narrative.

11.2 Extractions: Most extractions are performed on soil samples where a known weight of approximately 4.0 g of sample is diluted with DI water to a volume of 40 mL. Mix thoroughly for a minimum of five minutes. The sample is then allowed to settle for a minimum of 1 hour. After 1 hour, if necessary, a centrifuge may be used. The extract is then filtered prior to injecting on the instrument. All prep data are recorded in AlphaLIMS prep logbooks.

11.3 Bomb Prep: Bomb preps are performed on sample matrices such as coal or oil. Here a known weight of approximately 0.5 g of sample is used and after being bombed, the residuals are filtered into a 100 mL volumetric flask and brought to volume with DI water. For instructions on performing a bomb prep, refer to GL-GC-E-079 for Bomb Preparation Method for Solid Waste. This prep procedure will not involve the various reagents from ASTM D 808-91 since the final analysis will be done by ion chromatography rather than gravimetrically. All prep data are recorded in the AlphaLIMS Prep logbook.

12.0 PREPARATION OF STANDARDS SOLUTIONS AND QUALITY CONTROL STANDARDS

12.1 Vendor-prepared stock standards are used to prepare calibration and check standard solutions for this analysis. Both individual analyte solutions and mixes of analytes may be purchased for use as standards. All stock standards are at least 1000 ppm concentration and are stable for at least one month when stored at $0° \leq 6°$C. Unopened stock solutions may be stored at ambient temperatures and their expiration is 1 year from receipt or the manufacturer's expiration date, whichever is sooner. There must be at least two independent sources of standards materials for calibration and calibration verification standard preparation.

12.2 Calibration standards are prepared from stock standards at a minimum of five concentration levels per analyte. The working standards for anions that include nitrate, nitrite and orthophosphate are prepared fresh daily and expire 48 hours after preparation. The working standards for iodide are prepared weekly (7 days). Refer to Appendix 2 for standard concentration.

12.3 Standard preparations are recorded in the AlphaLIMS system for documentation and recording of standards and reagents. Refer to GC-LB-E-007 for details on assigning unique standard IDs and establishing traceability.

12.4 Laboratory control sample(s) (LCS) may be prepared from the calibration standard source.

12.5 ICVs are separate sources from the standards used in the calibration curve.

12.6 CCVs are varied in concentration and may be from the same source as the calibration standards.

12.7 Spiking compounds are added from commercially prepared standards solutions.

13.0 INSTRUMENT CALIBRATION AND PERFORMANCE

13.1 Establish ion chromatographic operating conditions for the determination of target ions. An external calibration is then performed.

13.1.1 For each analyte of interest, prepare a minimum of five calibration standards and a blank by adding accurately measured volumes of source standards to a known volume of reagent water. One of the calibration standards shall be at the PQL/LOQ.

13.1.2 The standards are placed on the instrument for analysis from highest to lowest. To automatically update the calibration curve enter AUTOCAL in the sample ID, followed by the level number.

13.1.3 Tabulate each concentration against area count. Include the blank in the linear calibration curve. Do not force the points through zero. The results determine a calibration curve.

13.1.4 The final calibration curve must have a correlation coefficient of 0.995 or better. If one standard is inconsistent with the rest of the standards it is acceptable to rerun the outlying standard and replace it in the curve.

13.1.5 If a sample analyte concentration is greater than the highest standard in the calibration range, the sample will be diluted with reagent water to approximately mid-range and reanalyzed.

13.1.6 The analyte's retention time is updated from the last standard run. A typical retention window size is 5-10%. This can be modified based on the analyst's experience.

13.1.7 Retention time must be updated after method set-up and after major maintenance. The acceptance criteria for RT width is ± 3 times standard deviation for each analyte over a 24-hour period. The RT window width position must be established once per multipoint calibration and position shall be at midpoint of initial calibration curve.

13.2 Calibration is verified daily or with every batch of samples. If the concentration or retention time window shifts by more than 10% from the expected value, a new calibration must be performed prior to the analysis of any samples.

13.3 Linear Calibration Range (LCR): The LCR is determined initially by acceptance criteria of the curve (0.995 correlation coefficient or better for each analyte). It is verified by using a blank and at least 3 standards. The ICV which is run daily may be

used as a LCR verification, and the alternating concentrations of CCVs may also be considered for the same purpose. Acceptance criteria are 90-110% for all of these standards.

14.0 ANALYSIS AND INSTRUMENT OPERATION

14.1 Typical Run Sequence

14.1.1 ICV/IPC

14.1.2 ICB

14.1.3 MB

14.1.4 LCS (and LCS Duplicate if required)/LFB

14.1.5 Sample 1 through 8

14.1.6 CCV

14.1.7 CCB

NOTE: One LCS (and LCS duplicate, if applicable) per batch of 20 samples, and one matrix duplicate, matrix spike, and matrix spike duplicate (if applicable) for every 10 samples in a batch.

NOTE: A CCV and CCB are to be run after every 10 samples and at the end of the analysis sequence.

14.2 Analysis by Dionex ICS 3000

14.2.1 Fill the eluent reservoir as necessary with the proper eluent for the method that will be analyzed. This will be performed at the start of the working day. This will allow the daily checks to verify the calibration curve due to changing eluent.

14.2.2 All components should be turned on and the AS40 autosampler should be in local position.

14.2.3 On the computer go to Chromeleon icon. ICS 3000 Panel will come up. Click on startup button. Make sure all switches turn green except the prime off button it should remain red.

14.2.4 Go to window tab on toolbar and go to Browser window. This will pull the method and sequence.

14.2.5 Sequence: It is good practice to create a new sequence daily. Rename previous sequence the new date and edit accordingly.

14.2.6 Go to batch tab on toolbar, on dropdown go to edit and a window will open go to Batch list tab and add the days sequence. Click on Ready check button. If everything is good click ok. Go to AS40 autosampler and hit load button. When plunger is all the way down hit start button in window.

14.2.7 Shutdown: The shutdown method is the loaded from the sequence.

14.3 Analysis by Dionex IC 500I for Iodide Only

14.3.1 Fill the eluent reservoir as necessary with the proper eluent for the method that will be analyzed. This will be performed at the start of the working

day. This will allow the daily checks to verify the calibration curve due to the changing eluent.

14.3.2 Turn on the helium tank, if off, and adjust the regulator pressure to 80 psi. The tank should be left on at all times. When tank pressure reaches 100 psi change out the tank. Turn on pressure valve on eluent tank to 5 psi (may vary +/- 2 psi) and the pressure valve on water bottle to 7 psi.

14.3.3 To connect the computer to components open MenuDx icon. Open Run icon, click run tab on toolbar and scroll to Direct Control. On IP25 tab click on “on” button. On CD 20 tab go to the SRS current drop down and choose the current needed and then apply.

14.3.4 Method: On the computer, open the Method icon. Click File on toolbar, scroll to choose method (methods are named by date of calibration).

14.3.5 Schedule: It is good practice to create a new schedule daily. To do so go to Schedule tab in PeakNet main menu; at the blank schedule screen, enter the initial calibration and method verification sample names (ICV and ICB) and name the data file as the days date. Save schedule as the days date.

14.3.6 Load: Go to Run tab in PeakNet main menu, click on File on toolbar and load the days’ schedule.

NOTE: For the CDM, the temperature compensation defaults to 1.7, and the output range is set to 10.0 µS. With the Sodium Hydroxide eluent, the pump will flow at 1.1 ml/min for, and the pump pressure should normally be between 1600 and 2000 psi when using Dionex columns.

14.3.7 Prepare the initial rack of samples according to the run sequence:

14.3.8 Place 5 mL of the samples to be analyzed in the sample vials and place in the rack(s) as before; make necessary dilutions at this time.

14.3.9 With the first rack in the auto sampler, switch auto sampler “hold/run” switch to “run”.

14.3.10 Go to the computer terminal and pull up the main menu "Run" screen.

14.3.11 On the run screen, under "load" choose "schedule."

NOTE: A method should have been loaded in the start-up procedure. Sample, method, and datafile names are located in each schedule. Creating a schedule allows the analyst to designate which method to use for each sample in the run, as well as where and with what file name the analyst wishes to store the data. Remember, this run information should be entered in the main menu "Schedule" screen and saved with the appropriate naming convention.

14.3.12 At the load schedule screen, give the name of the schedule for the run. On the next screen, designate the injection number if other than 1 to start the run.

14.3.13 At this point (still under main menu run) make sure the auto sampler is in the run position and choose the "run" command.

14.3.14 Under run, select "start" and confirm at the OK prompt. The run will begin.

NOTE: Instrument shutdown is either performed manually.

14.4 Manual Shutdown:

14.4.1 Open Run icon, click run tab on toolbar and scroll to Direct Control. On IP25 tab click on off button. On CD 20 tab go to the SRS current drop down and choose the current off and then apply.

14.4.2 Turn off pressure valve on eluent tank and the pressure valve on water bottle.

15.0 EQUIPMENT AND INSTRUMENT MAINTENANCE

Routine maintenance for the IC most often includes the changing of eluent or of the helium tank, as well as, priming the pump and clearing the flow lines of any trapped air bubbles. It may also include any column work, such as cleaning, or it may call for regenerating the suppressor or changing of filters. These subjects are covered in the DX-500 Series Chromatography System manual. The column cleaning solution is made as detailed in section 8.4.

16.0 DATA RECORDING, CALCULATION, AND REDUCTION METHODS

16.1 The raw data are processed by the IC software system. The software creates a data file including the method, which is stored on the network drive. The software then provides a printout with the following information: sample name, method used to process data, date and time run, (if report time differs from collection time both will be listed), analytes found with concentration, analytes not found and the sample chromatography.

16.2 An external program is used to generate a runlog, which is placed in the runlog binder. The runlog contains the following information in summary format: sample name, date and time run, batch number, dilution, QC type and description.

16.3 The following calculations are used in processing the data.

$$\text{CSTD \% Recovery} = \text{Reported Value}/\text{Expected Value} \times 100$$

$$\text{RPD} = \text{Sample 1 - Sample 2}/(\text{Sample 1+ Sample 2})/2 \times 100$$

$$\text{\% Rec} = \text{Spike - Sample}/\text{Nominal Concentration} \times 100$$

$$\text{Bomb Prep} = \text{Sample x Final Volume}/\text{Sample Weight}$$

$$\text{Extraction} = \text{Sample x Final Volume}/\text{Sample Weight}$$

16.4 For Bomb Calculation:

16.4.1 Calculate the concentrations of each element detected in the sample according to the following equation:

$$C_o = \frac{C_{com} \times V_{com} \times DF \times \%moisture \times 100}{W_o}$$

Where:

C_o = Concentration of element in the sample, mg/kg

C_{com} = Concentration of element in the combustate, mg/L

V_{com} = Total volume of combustate, mL

DF = Dilution Factor

W_o = Weight of sample combusted, g

16.4.2 Percentage by weight of sulfur in sulfate (SO_4):

Where:

S = 32.06 amu,

O= 15.9994 amu x 4 = 63.9976 amu

SO_4= 96.0576 total amu

32.06 amu (S)/96.0586 amu (SO_4) = 0.333758 or 33.37% S in SO_4

16.4.3 MDLs and PQLs are 10X for all bombs.

16.5 Each compound of interest must be within the acceptable range to be reported as a positive detection. If the instrument is re calibrated during the day, the retention windows will be reset after the multipoint is complete.

17.0 QUALITY CONTROL (QC) REQUIREMENTS

17.1 According to EPA Method 300.0, a formal Quality Control Program for this method must be maintained by each laboratory. The GEL QC Program for method 300.0 consists of 2 main components.

17.1.1 MDL Study: a new MDL study covering IC analytes under EPA 300.0 Part A is performed every 6 months, using the guidelines set forth in GL-LB-E-001. For DoD samples LOD is verified quarterly on each instrument used for DoD sample analyses.

17.1.2 Quality Control Sample (QCS) study: A commercially available standard (traceable to NIST standards when possible) is run each time a client, state, or federal performance evaluation study is done. The results of this known must be within the vendor guidelines for the PE sample result to be considered acceptable. If the result is not acceptable the analyst must troubleshoot the problem immediately and reanalyze both the vendor known and the PE sample.

18.0 INSTRUMENT AND BATCH QC REQUIREMENTS

18.1 Instrument QC

18.1.1 A calibration curve is run any time the values or retention times of the check standards shift by more than 10%.

18.1.2 An initial calibration verification (ICV) is run as the first sample in each day's run.

18.1.3 An initial calibration blank (ICB) is run following the ICV.

18.1.4 A continuing calibration verification (CCV) of varying concentration is run after every 10 analytical samples and after the last analytical samples in the run.

18.1.5 A continuing calibration blank (CCB) is run after every CCV.

18.1.6 The ICV, ICB, CCVs of varying concentrations, and CCBs are used throughout the analysis to constantly check the linear range of the instrument. The ICB and CCB must not exceed the concentration of the low standard in the calibration curve. The ICV and CCVs of the varying concentrations must recover within 10% of the true value of the standard.

18.2 Batch QC

18.2.1 A sample spike and sample duplicate are run for every batch of <10 samples and for each set of ten samples in batches with >10 samples.

18.2.2 A Method Blank (MB) and Laboratory Control Sample (LCS) are run at least once for every batch of 20 samples or less.

18.2.3 For solid batches where the sample is prepped using DI water extraction, the LCS is made by spiking the aliquot of the Source standard onto 40 mL of DI water.

18.2.4 For nonaqueous liquids or solids not easily DI extracted, the LCS and method blank are bomb prepped in the same manner as the samples and a 20X dilution is used.

NOTE: Some clients have statements of work that call for additional QC such as LCS Duplicates or Matrix Spike Duplicates.

18.3 Acceptance limits:

18.3.1 Correlation coefficie nt must be 0.995 or greater.

18.3.2 ICV recovery must be 90-110% for all batches.

18.3.3 CCV recovery must be 90-110% recovery for all batches.

18.3.4 Matrix relative percent difference (RPD): Determined yearly by the Statistical Process Control (SPC) system of AlphaLIMS. The limits are given in spreadsheet form to each analyst.

NOTE: DoD requires RPD limits of 0 < 10% for sample DUPs and 0 ≤ 15% for MS/MSD.

18.3.5 Matrix spike recovery: The Limits are static at 90-110% recovery for samples analyzed by EPA 300.0. Matrix spike limits for samples analyzed by SW-846 9056 are determined yearly by the Statistical Process Control (SPC) system of AlphaLIMS.

18.3.6 Method Blank: Must be less than the CRDL or Practical Quantitation Limits (PQL). DoD QSM requires the method blank to be < ½ RL.

18.3.7 LCS: Determined yearly by the Statistical Process Control (SPC) system of AlphaLIMS. The limits are given in spreadsheet form to each analyst. If the % Recovery falls outside these limits, the batch must be reanalyzed.

For Method 300.0 the LCS acceptance limits are set at 90-110% for all liquid matrix batches.

18.3.8 LCS RPD: Determined yearly by the Statistical Process Control (SPC) system of AlphaLIMS. If the RPD falls outside these limits, the batch must be reanalyzed.

19.0 DATA REVIEW, VALIDATION, AND APPROVAL PROCEDURE

19.1 Before submitting results for data entry into AlphaLIMS, check the following items:

19.1.1 The run is dated and initialed.

19.1.2 All cross-outs are dated and initialed.

19.1.3 Standard preparation is documented in the AlphaLIMS standards logbook and standard identification numbers are recorded with the run in AlphaLIMS.

19.1.4 All dilution factors are clearly marked.

19.1.5 Sample prep logbook in AlphaLIMS has been filled out completely (if applicable).

19.1.6 Correlation coefficient is recorded accurately and is $\geq$ 0.995.

19.1.7 All quality control samples such as blanks, duplicates, and spikes are clearly identified and fall within current acceptance limits.

19.1.8 The correct units are recorded for the results.

19.1.9 Each nonconformance has been noted in the Case Narrative.

19.1.10 All manual reprocessing of chromatograms must have a reason for the reprocess. The changes must be signed by the person doing the reprocessing and a qualified peer.

19.2 After ensuring that the above items are properly documented, print the batch report. (Data are automatically transferred to AlphaLIMS.)

19.3 Review data report to ensure that all data are in, then status the batch to “Review.” This will trigger the qualifiers.

19.4 The batch sheet, data report, and case narrative are stapled together. This is the package that enters the main data review process.

19.5 The data review is done by the analyst who performed the analysis. The analyst completes the review, noting and correcting any discrepancies. When the analyst has a correct report of the data, the package is passed on for peer review.

19.6 When the data package associated with a given batch satisfactorily passes review, the batch status is updated to "DONE" in AlphaLIMS.

20.0 RECORDS MANAGEMENT

All data associated with the activity described in this procedure, including relevant logbooks, are maintained as quality records in accordance with GL-QS-E-008 for Quality Records Management and Disposition.

21.0 LABORATORY WASTE HANDLING AND DISPOSAL

For the proper disposal of sample and reagent wastes from this procedure, refer to the Laboratory Waste Management Plan, GL-LB-G-001.

22.0 REFERENCES

22.1 EPA Method 300.0, “The Determination of Inorganic Anions in Water by Ion Chromatography.”

22.2 SW-846, Method 9056A, Rev.1, “Determination of Inorganic Anions by Ion Chromatography,” February 2007.

22.3 Dionex Chromeleon software

22.4 Dionex ICS 3000 Ion Chromatography Instruction Manual

22.5 Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2, October 25, 2010.

22.6 Dionex DX-500 Series Chromatography System

22.7 Dionex PeakNet Chromatography Software User's Guide

22.8 Dionex DX-500 Operator’s Manual

23.0 HISTORY

Revision 24: Added clarification to section 6.0 and 13.1.7.

Revision 23: Updated to include iodide.

Revision 22: Deleted Autocal 7 from Appendix 2 and changed 10X dilution to 20X dilution.

Revision 21: Added Appendix 2 and updated SOP to comply with current procedure.

Revision 20: Remove SM 4110B reference.

Revision 19: Added note indicating 48-hour hold time for solid samples (nitrate, nitrite, and phosphate) calculated from the time of extraction.

Revision 18: Updated SOP to reflect version 4.1 DoD requirements and replaced Appendix 1.

APPENDIX 1: ACCEPTANCE LIMITS

Acceptance Criteria	GEL Standard	DoD QSM
CCV/ICV	90% - 110%	90% - 110%
CCB/ICB	± RL	± RL
Method Blank	<CRDL	± ½ RL, reprep failures, B flag for continued failures
LCS - liquid LCS - soil	90% - 110%	90% - 110% Glass beads/Teflon chips for solids, flag failures with Q if reprep not possible.
Matrix Spikes/ Matrix Spike Duplicates	90% - 110%	90% - 110%, when applicable. Flag failures with J.
Sample Duplicates	0% </= 20% when greater than 5X RL, +/-RL when less than 5X RL	0% </= 10% Flag failures with J.
MS/MSD RPD	RPD 0% </= 20% between MS/MSD	RPD 0% </= 15% between MS/MSD, J flag failures.
Qualifiers	COA = U/J/B for samples or MB. * for LCS, MS, MSD, DUP.	U for non detects, J for values estimated between LOD and LOQ
MDL/MDLV	MDL and MDLV are performed bi-annually per the methods	LODV performed quarterly on all instruments used for DoD analysis.

APPENDIX 2: CALIBRATION STANDARDS FOR IC

(For Illustrative Purposes Only)

Autocal 6
20 mg/L SO_4
10 mg/L Cl
5 mg/L Fl, NO_2, NO_3, I
3 mg/L Br, PO_4

Autocal 5
4 mg/L SO_4
2 mg/L Cl
1 mg/L Fl, NO_2, NO_3
2.5 mg/L Br, PO_4, I

Autocal 4
2 mg/L SO_4, I
1 mg/L Cl, Br, PO_4
0.5 mg/L Fl, NO_2, NO_3

Autocal 3
1 mg/L SO_4, I
0.5 mg/L Cl, Br, PO_4
0.25 mg/L Fl, NO_2, NO_3

Autocal 2
0.5 mg/L I
0.4 mg/L SO_4
0.2 mg/L Cl, Br, PO_4
0.1 mg/L Fl, NO_2, NO_3

Autocal 1
DI water

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE

FOR

DETERMINATION OF METALS BY ICP

(GL-MA-E-013 REVISION 24)

APPLICABLE TO METHODS:
EPA Method 200.7
EPA SW-846 Method 6010B
EPA SW-846 Method 6010C
and 200.7 CLP-M

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1.0 STANDARD OPERATING PROCEDURE FOR DETERMINATION OF METALS BY ICP

2.0 METHOD CODES

2.1 EPA SW-846 Method 6010B

2.2 EPA SW-846 Method 6010C

2.3 EPA Method 200.7

3.0 METHOD OBJECTIVE AND PURPOSE

This standard operating procedure (SOP) describes the procedure for the determination of metals with the Perkin Elmer (PE) Optima ICPs.

4.0 METHOD APPLICABILITY AND METHOD SUMMARY

4.1 Analytes: Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Si, SiO_2, Sn, Sr, Ti, Tl, U, V, Zn, P, and S.

4.2 Applicable Matrices: These methods are applicable to the determinations of any of the analytes listed above for various matrices including waters, oils, soils, sludges, Toxicity Characteristic Leachate Procedure (TCLP) extracts and other more unusual types of sample which are generally classified as a miscellaneous matrix.

4.3 General Method Summary: After samples are prepared in accordance with the sample preparation SOP, they are analyzed by Inductively Coupled Plasma (ICP) as follows:

4.3.1 The instrument is calibrated with a minimum of two calibration points for each element to be analyzed. The points consist of a calibration blank solution to define the lower calibration point and at least one standard calibration solution at the analyte concentrations to define the higher calibration point(s). A correlation coefficient of 0.995 or better (0.998 or better for SW-846 Method 6010C) is required for each analyte if multiple standards are used or the instrument is recalibrated for the analyte of interest.

4.3.2 Prepared client samples, check standards, and quality control samples identified in section 21.1 are then analyzed. The check standards and quality control samples are used to determine the quality and acceptability of the analytical data.

4.3.3 Continuing Calibration Verification Samples (CCV) are analyzed a minimum of every 10 samples to ensure that the instrument is continuing to perform correctly.

5.0 METHOD SCOPE AND PERFORMANCE CHARACTERISTICS

5.1 Calibration Range: The calibration range consists of the concentrations between the calibration blank and that of the highest calibration standard for each analyte.

5.2 Tested Concentration Range: For ICP analyses, the upper limit of the linear range is determined by analyzing a linear range verification check standard, near the expected linear range limit. The analytically determined concentration of this standard shall be within ± 10% of the true value (± 5% for CLP).

5.3 Method Detection Limit (MDL) studies for each analyte are performed and/or verified at least annually. These studies are conducted and calculated in accordance with SW-846, Chapter 1, Section 5.0, and GL-LB-E-001 for The Determination of Method Detection Limits. The Reported Quantitation Limit (RQL) reflects the current MDL study. If reporting data by CLP protocol, an Instrumental Detection Limit (IDL) study is performed quarterly in accordance with USEPA CLP, Inorganic Statement of Work, ILM04.0.

5.4 Instrument Detection Limits (IDLs) studies for each analyte are performed quarterly for each instrument. IDLs are determined by calculating the average of the standard deviations of three analytical runs performed on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.

5.5 Method Precision: To assure analytical precision of methods used, MS/MSD or sample DUP, or LCS/LCSD are analyzed with each batch or as method requires.

5.6 Method Bias (Accuracy): Determined by calculating recoveries of LCS of a similar matrix.

6.0 DEFINITIONS

6.1 AlphaLIMS: The Laboratory Information Management System used at GEL Laboratories, LLC.

6.2 Continuing Calibration Blank (CCB): An aliquot of reagent water or other blank matrix that is analyzed after each CCV. The CCB is used to determine whether the analytical sequence is in control during sample analysis.

6.3 Continuing Calibration Verification (CCV) Standard: An aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The CCV is analyzed exactly like a sample, periodically throughout the run sequence. Its purpose is to determine whether the analytical sequence is in control during sample analysis. It may be prepared from the same source as the calibration standards, and is usually of varied concentration.

6.4 Duplicate (DUP): A second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method.

6.5 Independent Calibration Blank (ICB): An aliquot of reagent water or other blank matrix that is analyzed after each ICV. The ICB is used to determine whether there is carryover contamination after injection of the mid-level ICV.

6.6 Independent Calibration Verification (ICV): A solution of method analytes of known concentrations that is used to fortify an aliquot of Blank or sample matrix. The ICV is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check laboratory performance with externally prepared test materials.

6.7 Laboratory Control Standard (LCS): An aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to

determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.

6.8 Linear Calibration Range (LCR): The concentration range over which the instrument response is linear.

6.9 Method Blank (MB): An aliquot of reagent water or other blank matrix that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The MB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

6.10 Method Detection Limit (MDL): The minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero.

6.11 Spike (Matrix Spike or Post Spike): An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The MS or PS is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS or PS corrected for background concentrations.

6.12 Statistical Process Control (SPC) Limits: Statistically derived limits that establish acceptable ranges for recoveries of analytes of interest, including LCS, MS, MSD, PS, PSD and internal standards.

6.13 Stock Standard Solution: A concentrated solution containing one or more method analytes prepared in the laboratory using certified reference materials or purchased from a reputable commercial source.

6.14 Limit of Detection (LOD): An analyte, method and matrix specific estimate of the minimum amount of a substance that can be reliably detected. GEL has established LOD = 2 x MDL.

6.15 Limit of Quantitation (LOQ): An analyte, method and matrix specific estimate of the minimum amount of a substance that can be reported with a specific level of confidence. The LOQ is set at or above the concentration of the lowest initial calibration standard. The laboratory must empirically demonstrate precision and bias at the LOQ. The LOQ and associated precision and bias must meet client requirements and must be reported. GEL uses the following guidance (LOD < LOQ):

When LOD < PQL, PQL = LOQ

When LOD > PQL, LOQ is raised to next lowest calibration standard.

6.16 Practical Quantitation Limit (PQL): The PQL is typically at or above the lowest point on an acceptable initial calibration curve. It may also be determined by multiplying the MDL by approximately 2 to 10. Concentrations of a target analyte determined to be greater than its PQL are defined as quantitative results. This limit is not used in DoD ELAP reporting.

7.0 INTERFERENCES TO THE METHOD

ICP analysis is subject to three types of interferences:

7.1 Physical interferences are those physical properties of a sample solution that prevent their introduction to the plasma with an efficiency equal to that of the calibration standards. This type of interference can be reduced through the use of an internal standard in accordance with the instrument operating manual, or by diluting the sample in reagent blank solution until the percent recovery is acceptable.

7.2 Chemical interferences are minimal in ICP Spectroscopy because the extremely high energy of the plasma breaks chemical bonds.

7.3 Interelement Spectral Interference can be overcome by use of Interelement Correction (IEC) factors. IECs are initially calculated when a new instrument or method is brought on-line. A quarterly verification is performed thereafter, when linear range verifications are performed. IECs may be checked as often as needed to ensure the correct factors are being used.

7.4 The IEC coefficients are calculated if the element interfered with is outside $\pm$ PQL when analyzing a single element standard at its linear range:

7.4.1 Perkin Elmer Optima ICPs: The interfering element uses the mg/L concentration. The IEC for Cd via PE software is $^{-}$18/490, or $^{-}$0.03673. The resulting IEC calculations can be verified by reanalyzing the single element standard, or by analyzing the ICSA standard. In either case, the non-spiked analyte concentration should be within $\pm$ 2x the PQL or $\pm$ 2x MDL for DoD QSM. IECs are calculated for all minerals at their linear range values and for commonly seen analytes that occur at high concentrations in environmental samples, i.e., manganese and zinc.

8.0 SAFETY PRECAUTIONS AND HAZARD WARNINGS

WARNING

PREVENT SKIN AND EYE CONTACT BY USING SPECIFIED PERSONAL PROTECTIVE EQUIPMENT WHEN MAKING STOCK REAGENTS.

WORK UNDER A HOOD TO PREVENT INHALATION WHEN MAKING STOCK REAGENTS.

8.1 Sample digestates are not extremely volatile or spontaneously combustible, but they are normally acidic and should be handled with care. Small spills may generally be wiped up with paper towels that can be disposed of in the trash. Larger spills may require the use of a mop. The mop head may have to be disposed of as potentially hazardous waste in accordance with the Laboratory Waste Management Plan, GL-LB-G-001. If the spilled digestates begin any obvious fuming or reacting, pour a generous amount of the acid neutralizer, located in each lab, onto the spill before attempting to clean it up.

8.1.1 Approved gloves will be worn to avoid skin contact with the digestate during clean-up.

8.1.2 Wear eye protection with side shields while performing procedures in the laboratory. An eyewash station is located in each analysis lab.

8.1.3 Do not persist in cleaning up a spill in the presence of strong fumes. Move out of the area, attempt to isolate the area, and notify your supervisor immediately.

8.2 These instruments use high voltage electricity and therefore should be shut completely down any time electronic components may be exposed to personnel or any liquids.

8.3 Prior to handling radioactive samples, analysts must have radiation safety training and must understand their full responsibilities in radioactive sample handling. Some general guidelines follow:

8.3.1 Protect counter tops with counter paper, or work from radioactive sample handling trays.

8.3.2 Prohibit admittance to immediate work area.

8.3.3 Post signs indicating radioactive samples are in the area.

8.3.4 Take swipes of the counter tops upon completion of work. Deliver those swipes to the designated swipe count box.

8.3.5 Segregate radioactive wastes. Radioactive waste containers are obtained from Waste Management.

8.3.6 For additional guidance, refer to GL-RAD-S-004 for Radioactive Material Handling, and GL-LB-G-001, the Laboratory Waste Management Plan.

8.4 Treat all chemicals and samples as potential health hazards, and limit exposure to these chemicals to the lowest level possible. GEL maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals in the laboratory as well as a reference file of Material Safety Data Sheets (MSDS). Individual sample MSDS forms provided by the clients are also maintained.

8.5 All samples, chemicals, extracts, and extraction residues must be transferred, delivered, and disposed of safely according to all related SOPs.

8.5.1 Segregate solid wastes from liquid wastes in the satellite area containers.

8.5.2 Segregate oil wastes from water-soluble wastes in the satellite area containers.

8.6 Never leave gas cylinders unchained or untied, even when they are on moving carts.

8.7 In the event of an accident or medical emergency, call for help immediately. When time and safety permit, an accident report form should be completed and turned in to the safety committee.

8.8 Fire escape routes are posted in the lab, and all personnel should be familiar with them. In addition, fire safety equipment such as fire extinguishers is located in the lab. Training is available on the proper operation of this equipment.

9.0 CAUTION WARNINGS

Special care should be taken when handling hydrofluoric acid to ensure that the acid does not come into contact with the skin.

10.0 APPARATUS AND MATERIALS; REAGENTS; EQUIPMENT AND INSTRUMENTS

10.1 Apparatus and Equipment

10.1.1 Replacement glass parts for the ICP such as quartz torch bodies, purge extension windows, injector tips, nebulizers, and spray chambers may be ordered from an approved vendor through GEL's Purchasing Agent.

10.1.2 High purity argon gas is provided to the ICP instruments, via a network of pipelines, into the lab from liquid storage tanks located outside the building. The argon is purchased from a GEL approved vendor.

10.1.3 Consumable materials such as tubing are often attainable from various scientific product companies. The GEL Purchasing Agent can help to find the best prices from an approved vendor. All orders are placed through GEL's Purchasing Agent.

10.2 Reagents, Chemicals, and Standards

10.2.1 Nitric acid, reagent grade and ultra pure

10.2.2 Hydrochloric acid, reagent grade and ultra pure

10.2.3 Lithium solution, 5% or 1%

10.2.4 Scandium solution, 1000 µg/mL

10.2.5 5% Cesium

10.2.6 Yttrium solution,1000 µg/mL

10.2.7 Other Chemicals: Additional compounds, surfactants, oils, cleaning agents, etc. may be routinely ordered through GEL's Purchasing Agent.

10.3 Instrumentation

10.3.1 PE Optima 5300DV with compatible PC and printer

10.3.2 PE Optima 8300DV with compatible PC and printer

10.3.3 PE Optima 7300DV with compatible PC and printer

10.3.4 ESI Autosampler

10.3.5 Polyscience6105 PE Chillers or equivalent

10.3.6 Appropriate Nebulizer (i.e., Meinhard or Burgener Mira Mist)

11.0 SAMPLE HANDLING AND PRESERVATION REQUIREMENTS

11.1 Aqueous samples should be preserved with nitric acid to a pH of < 2 prior to receipt by the analyst. Sediment samples should be kept at $0^\circ \leq 6^\circ$ C prior to analysis.

11.2 Refer to GL-SR-E-001 for Sample Receipt, Login, and Storage.

12.0 SAMPLE PREPARATION TECHNIQUES

12.1 All samples, except drinking water with Turbidity <1 NTU and samples specifically exempted by contract, are prepared in accordance with the SOPs for Metals Digestion: GL-MA-E-006 (USEPA SW-846 Method 3005A), GL-MA-E-008 (USEPA SW-846 Method 3010A), GL-MA-E-009 (USEPA SW-846 Method 3050A), and GL-MA-E-020 (NIOSH 7303). Other digestion procedures may also be used.

12.2 Additional filtration may be required to prevent clogging of sample introduction system. The method blank (MB) and laboratory control sample (LCS) should be filtered to check for contamination from the filtering process.

12.3 Sample spills should be handled as stated in Section 8.1.

13.0 EQUIPMENT AND INSTRUMENT MAINTENANCE

Routine Preventative and Special Operational (Failure)

13.1 Routine Preventative Maintenance (PM) is recommended as follows:

Frequency	Procedure
When Needed	Oil the peristaltic pump with silicon spray
	Replace peripump sample introduction tubing
	Change pump hoses on drain systems
	Check drain waste collection containers and empty as needed
	Clean/replace nebulizer
	Clean/replace torch. Align according to manufacturer's specifications
	Clean/replace air filters

13.2 Non-Routine Maintenance Procedures (Special, Operational or Failure Mode Maintenance)

13.2.1 If the instrument will not function properly, refer to the troubleshooting section in the appropriate operator's manual.

13.2.2 If the analyst is unable to fix the instrument, call the GEL Instrument Technician, and if needed, the manufacturer's Service Department.

13.3 Refer to the ICP Maintenance Logbook for routine records. Preventative maintenance and service should be recorded in the maintenance logbook.

14.0 PREPARATION OF STANDARD SOLUTION AND QUALITY CONTROL SAMPLES

14.1 Source standards records are recorded in the Metals Source Standards Logbook, which is maintained in the Metals laboratory. The preparation of working standards is fully described in the "Maintain Reference Materials" application in AlphaLIMS.

14.2 Standards are receipted, labeled, prepared and stored in accordance with GL-LB-E-007 for Laboratory Standards Documentation and GL-LB-E-015 for Control of Laboratory Standards.

15.0 INSTRUMENT CALIBRATION

15.1 Calibration and sample analysis are conducted automatically using the autosampler. (Samples can also be analyzed manually.)

15.1.1 Profiling: All analytical channels were aligned within specifications during initial installation or realigned after relocation of the instrument by profiling daily, all elements will be peak-on-center. Profiling should be done after plasma warm-up prior to sample analysis and verified as needed during the day (more frequently on days with high temperature and humidity fluctuations).

15.1.1.1 Operate/Profile instrument using the procedures found in the corresponding ICP Operator's or Hardware Manual.

15.1.1.2 The PE Optima ICPs are autoprofiled using a mercury lamp.

15.1.1.3 When an acceptable profile is attained, print the graphical profile and display. An acceptable profile is defined as having the mercury peak being perfectly centered on the 253.652 nm axis. If the peak is off-centered, run the diagnostic check or have service look at the instrument.

15.1.2 Standardization: Standardization is required every twenty-four when the instrument is in use. Additionally, restandardization and/or recalibration is required when calibration checks fail.

15.2 Calculations are described in the instrument manuals.

15.3 Calibration standards may vary according to method. A minimum of a blank and standard are required, but a typical calibration uses a blank and three standards of varying concentration. For the multiple standard curve, the correlation coefficient (r) must be equal to or greater than 0.995 (0.998 for 6010C).

15.4 For typical (recommended) calibration standards, refer to Appendix 2.

15.5 For continuing calibration requirements, refer to Section 21.

15.6 For actions concerning a calibration verification failing to meet requirements, refer to Section 21.3.

16.0 INSTRUMENT PERFORMANCE REQUIREMENTS

16.1 Before samples may be analyzed, the instrument must be calibrated and verified using a calibration standard readback analyses (for CLP only), an Initial Calibration Verification (ICV) which is prepared from an independent source, an Initial Calibration Blank (ICB), Interference Check Sample(s) (ICS-A, ICS-AB), Practical Quantitation Limit (PQL), and a Linear Range Verification (LR). These must meet the requirements stated in Section 21.2 for each analyte being reported, unless specified otherwise by the client or contract.

16.2 The instrument calibration and all continuing verification data are maintained on the printed hard copy and electronically saved onto the computer network. The printouts are kept in chronological order by instrument. Recent files are stored in the respective metals laboratories and older records are archived in the warehouse.

17.0 ANALYST AND METHOD VERIFICATION REQUIREMENTS

17.1 Analyst training is conducted in accordance with GL-HR-E-002 for Employee Training.

17.2 Method performance is verified by conducting MDL studies in accordance with GL-LB-E-001 for The Determination of Method Detection Limits, and by the evaluation of laboratory proficiency samples (audits).

18.0 ANALYSIS PROCEDURES AND INSTRUMENTAL OPERATION

18.1 All samples are introduced to the instrument via a peristaltic pump. The amount of sample entering the instrument is dependent on the pump speed, the diameter of the pump tubing, and the nebulizer efficiency.

18.2 Run Sequence

18.2.1 Calibration sequence (may vary slightly under different autosampler files/see Appendix 2 also).

18.2.1.1	S0	(reagent blank, 3% HCl/1%HNO_3)
18.2.1.2	S0.1	(100 ppb standard)
18.2.1.3	S0.5	(500 ppb standard)
18.2.1.4	SCAL	(1000 ppb standard)
18.2.1.5	S10	(20 to 50 ppm standard)

18.2.2 The calibration verification steps include:

18.2.2.1 ICV
18.2.2.2 ICB
18.2.2.3 PQL (low level ICV for 6010C)
18.2.2.4 ICS-A
18.2.2.5 ICS-AB
18.2.2.6 LR1
18.2.2.7 LR2
18.2.2.8 CCV
18.2.2.9 CCB

18.2.3 Samples (10 samples or less)

18.2.4 Continuing Calibration Verification (CCV), Low Level Calibration Verification (PQL) required for SW-846 6010C, and Continuing Calibration Blank (CCB)

18.2.5 Repeat steps 18.2.3 and 18.2.4 through the end of the run or until applicable verification is out of specifications.

18.2.6 Final verification steps in order:

18.2.6.1 ICS-A (required for 200.7 or CLP only)
18.2.6.2 ICS-AB (required for 200.7 or CLP only)
18.2.6.3 CCV
18.2.6.4 PQL (required for SW-846 6010C)
18.2.6.5 CCB

NOTE: 6010C only requires there to be a closing low level continuing calibration standard (PQL). For ease of analysis, the PQL standard can be analyzed every 10 samples.

18.2.7 ICS-A and ICS-AB are analyzed at least every 8 hours or after the analytical batch for 200.7 analyses.

18.3 For data storage see section 23 and 24.

18.4 General operation of the instrument

18.4.1 The Perkin Elmer Optima 5300V, 7300V, and 8300DV are simultaneous, dual view, inductively coupled, argon plasma emission spectrometers. As

configured for GEL, it is capable of analyzing 32 substances: Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, SiO_2, Sr, Ti, Sn, Tl, U, V, and Zn. The operating software of the system is a menu driven type.

18.4.2 Typical Analytical Challenges

18.4.2.1 Sample Overrange: If an analyte is above the working linear range of the instrument, even if this element is not required, dilute the sample to an acceptable range and rerun, especially if the over ranged element is an interferant of the reported analyte. Dilutions are required if the value of an analyte exceeds 100% of the working linear range when the element of interest is being reported, or is interfering with an element that will be reported. Dilution factors must be taken into account when reporting final values. Additionally, further rinse and/or an acidified rinse solution may be required before continuing with the next sample.

18.4.2.2 Torch/Sample Introduction Drift: Various changes in torch plasma conditions, sample introduction, or other external factors can have a great effect on the analysis.

18.4.2.2.1 If sample introduction drift is suspected several items should be reviewed. Check the peristaltic pump tubing for wear and replace as needed. Check the internal standard to make sure it is being introduced to the instrument at a constant rate. Check the nebulizer to ensure that it's free of clogs and that the spray is a continuous mist.

18.4.2.2.2 Profile drift may mimic torch/sample introduction drift. Reprofiling should be done routinely. Profile drift is a function of temperature and should be checked more frequently when large temperature swings are observed. During an analytical run profile drift is evident when a clean blank shows significant deviation from zero. As suggested by the manufacturer, two elements to track for this problem are Na and Al.

18.4.2.2.3 Tubing connections may become loose, allowing air to bubble into the sample path. Tighten or replace tubing connection as necessary.

18.4.2.3 Sample Matrix: The internal standard technique is used to correct for physical interferences. Each ICP has a Scandium (Sc) internal standard that is continuously fed through the sample introduction system via a peristaltic pump. Scandium is used as the internal standard. It is used at 10 ppm both

radially and axially on the Optimas. In addition, the Optimas run yttrium at 2 ppm to reprocess as an internal standard if Sc is suspected in the sample.

18.5 Power switches and auxiliaries are addressed in detail in the appropriate operator's manual and/or hardware guide.

18.6 Start-up and shutdown procedures are addressed in detail in the appropriate operator's manual and/or hardware guide.

18.7 Sample quantity requirements vary based on several different factors such as nebulizer type, diameter of tubing, and pump rate.

18.8 Autosampler can be used with various nebulizers by attaching the sample introduction tube to the autosampler sample tube. The autosampler rinse should be setup by connecting the autosampler rinse tubing to the peristaltic pump in the instrument.

19.0 CALCULATIONS AND DATA REDUCTION METHODS

19.1 Any dilutions, concentrations, or preparation factors must be taken into account prior to reporting data to a client. The appropriate factors are entered into AlphaLIMS.

19.2 Care must be taken that the correct units are being employed. Analytical results originating from the ICPs are reported in ppb or µg/L.

20.0 DATA RECORDING

20.1 The Optima data are stored on the Network as a CSV file and printed at the instrument as each sample is analyzed.

20.2 ICP samples and standards are generally analyzed in three replicates (minimum of 2), and the reported value is the average of the replicates. At times, one replicate may be removed due to an attributable cause. This attributable cause should be documented on the hard data (i.e. third replicate ran out of volume). The average of the two remaining replicates is subsequently recalculated prior to reporting the data to the client.

20.3 Data are retrieved by the data entry personnel where unused data can be eliminated, dilution factors entered, and conversions made prior to uploading to AlphaLIMS.

21.0 QUALITY CONTROL REQUIREMENTS

21.1 Frequency of Quality Control Activities (refer to Appendix 3)

21.1.1 The Initial Calibration Verification (ICV) is performed following each calibration. The Continuing Calibration Verification (CCV) is performed following every ten or less samples. Any quality control samples excluding the CCV and CCB are counted as samples. Additionally, no more than two hours should pass between analyzing successive CCVs that bracket reportable data.

21.1.2 An Initial Calibration Blank (ICB) is performed immediately following the ICV, and Continuing Calibration Blanks (CCB) must follow each CCV.

21.1.3 The PQL standard is analyzed after each calibration and recommended at least every 10 samples, between the CCV and CCB analyses for SW-846 Method 6010C. Method 6010C requires analysis at the end of every batch and only recommends analysis every 10 samples. This standard may also be labeled as a CRDL standard.

21.1.4 An Interference Check Standard is analyzed after the calibration. For 200.7 analysis, an ICSA and ICSAB must be performed before the final CCV, CCB. Interference check standards are analyzed at least every 8 hours per Method 200.7.

21.1.5 A method blank (MB) is performed for each batch of twenty or fewer samples, or more frequently per client contract requirement.

21.1.6 A matrix spike (MS) and a sample duplicate (DUP), or a matrix spike (MS) and a matrix spike duplicate (MSD) are analyzed for each batch of 20 or fewer samples or per client or method requirements. For a matrix spike recovery to be applicable the sample value may not exceed four times the nominal concentration of the spike.

21.1.7 A laboratory control sample (LCS) is normally analyzed with each batch of twenty or fewer samples. A LCS Duplicate (LCSD) is performed at the same frequency as the LCS when required by a specific program or client.

21.1.8 Serial dilutions are analyzed to indicate the presence or absence of interferences. The analyte concentrations must be greater than 50 times the detection limit for a serial dilution to be applicable. The serial dilution is generally performed at a 5x dilution of the test sample or requested by client contracts.

21.1.9 A serial dilution will be performed for each SDG of up to twenty samples.

21.1.10 When performing 6010C analyses, a post-spike must be performed on the original sample when the matrix spike recovery falls outside the control limits and the sample result does not exceed 4x the spike added. Otherwise, post spikes are analyzed per client request.

21.1.11 Linear Range standards are analyzed after each calibration. These standards are labeled LR1 and LR2.

21.2 Acceptance Limits (refer to Appendix 4)

21.2.1 ICV and CCV results must fall between 90% to 110% of the true values for work under EPA SW-846 Method 6010B/6010C. ICV must be between 95% to 105% of the true value for work under EPA Method 200.7. The ICV/CCV Relative Standard Deviation (RSD) (minimum of 2 replicates) must be < 5% for all methods, with the exception of samples analyzed for Arizona. The RSD for AZ samples must be ≤ 3% RSD.

NOTE: The ICV is a second source standard and may be used as the CCV to show calibration verification.

21.2.2 The ICB and CCB results must have an absolute value less than or equal to the PQL results or the LOD for DoD QSM.

21.2.3 The PQL should fall within 70% to 130% of the accepted value or per client request and 80%-120% for DoD QSM work. For SW-846 Method 6010C, the PQL standard must be 70%-130% of the true value or recalibration is required. This also includes the low level continuing calibration verification standard analyzed every 10 samples or at the end of the analytical batch. Sample results can be evaluated for reporting if they are at least 2x the PQL for a given analyte. For 6010B or 200.7 analysis no specific acceptance criteria have been established for the PQL, however an unofficial range of 50% to 150% has been set for guidance purposes.

21.2.4 The analytes for the ICS-AB results must fall between 80% and 120% of the true value. The analytes for the ICS-A must have an absolute value ± 2 times the CRDL and 80% to 120% for analytes present in the solution. For DoD QSM, the ICSA must have an absolute value ± LOD for all non-spiked analytes.

21.2.5 Method blank results should fall less than the RDL but no less than the negative RDL. Additionally, the method blank may exceed the RDL provided that the blank value is insignificant relative to the lowest value of the samples in the batch. Specifically, the blank value must fall less than 10 times the lowest value of the samples in the batch. For DoD QSM the method blank must have an absolute value less than ½ RL or less than 10x the lowest value of the samples in the batch. Al, Fe, Mg, Ca, Na, and K must be less than RL. All failures must be reprepped.

21.2.6 Matrix spike and matrix spike duplicates recoveries should fall between 75% and 125% or per client contract. Matrix spike recoveries are applicable to those sample values that do not exceed four times the nominal concentration of the spike. Recoveries of one or more of the matrix spikes that fall outside recommended ranges may indicate an improper sample digestion, sample inhomogenity, or matrix interference. The LCS and LCSD are therefore used for indicators of sample digestion validity.

21.2.7 LCS and LCSD recoveries and RPDs must fall within process control limits as established by Statistical Process Control, manufacturer's certification, or method requirements.

21.2.8 Serial dilution results that agree within 10% of an initial raw value greater than 50 times the IDL or MDL suggest the absence of interference. Failures of a serial dilution should be noted, but are not considered pass/fail criteria. A criterion of greater than 50 times the MDL may be requested by some clients. The criterion of greater than 50 times the LOQ is used for DoD QSM.

21.2.9 The relative percent difference (RPD) between an MS and MSD or a sample and DUP should fall within ≤ 20% if the analyte level is sufficiently high (5x the CRDL for CLP analyses).

21.2.10 The LR1 and LR2 standards must fall within 90-110% of the known value. If any analyte fails to meet the 10% criteria, the working linear range is then defined as the high standard concentration used in the calibration curve.

21.2.11 Post spikes with recoveries between 75% and 125% under EPA Method 200.7 and SW-846 Method 6010B, and 80% and 120% under SW-846 6010C and DoD QSM suggest the absence of interferences.

21.3 Out-of-Control situations

21.3.1 ICV and/or CCV failure requires a recalibration of the instrument and/or repreparation of standard solutions. Samples bracketed by calibration verifications that are not acceptable for required analytes must be reanalyzed. An ICV or CCV that has failed may be rerun provided there is an attributable cause known to have affected the check standard only and not the previous samples. Examples of an acceptable cause may be a sample tip out of solution during analysis, an incorrectly prepared CCV, or obvious carryover in the CCV from a very high sample immediately prior to the CCV. If a CCV is reanalyzed, the data must be lined through, initialed and dated, and the reason for the rerun must be documented on the raw data. In addition, corrective action should be taken to eliminate the cause of the initial CCV failure to prevent future occurrence.

21.3.2 ICB and CCB failure requires recalibration of the instrument and/or repreparation of the calibration blank. When analyzing under SW-846, a CCB may be accepted above the RDL level under two conditions: 1) the CCB is acceptable if the sample value is below the RDL and 2) the CCB is acceptable if the level of analyte in the CCB is less than 1/10 the analyte value in the lowest reported sample. For DoD QSM, the ICB and CCB must have an absolute value less than the LOD or less than 10x value of the samples bracketed by the blank.

21.3.3 ICS failure requires that the interferences be corrected, via recalculation, of Interelement Correction Factors or selection of background correction factors so that the ICS can be read within the required limits before samples are analyzed. ICS failure at the end of an analysis period will require that the samples run for the affected analyte(s) during that period to be reanalyzed

21.3.4 PQL failure should be evaluated, but no action is required if the results are outside of the 70% to 130% range for all methods unless otherwise specified by the client. DoD QSM analysis must have passing PQL recoveries or the instrument needs recalibration. For PQL recovery failures for SW-846 Method 6010C, refer to section 21.2.3. Further failures need to be communicated to the client for guidance.

21.3.5 Matrix spikes, duplicates, post spikes, and spike duplicates are used only as indicators of method effectiveness on that sample and will not be used as acceptability criteria for the process, unless it's a special requirement of the client.

21.3.6 LCS and/or LCS duplicate results outside of established acceptance limits require the batch to be redigested and reanalyzed.

21.3.7 When analytical results suggest the presence of interference, the method listed in Section 21.1.8 must be employed.

21.3.8 The intensity and percent recovery of the internal standard are monitored per sample. There is no acceptance criterion per SW-846 and 200.7; however, the laboratory has adopted a ± 50% recovery criterion. If the internal standard fails to meet the criteria, reprocess the data using a different internal standard if available or dilute the sample within acceptable parameters.

21.4 Analytical data are evaluated for conformance with the requirements stated in Section 21.2 by the analyst during and/or after the analysis but before the data are entered into AlphaLIMS. Data may be accepted or rejected by the analyst at this point or by the data reviewer(s) as stated in Section 22.

21.5 Corrective actions taken for data not conforming to the requirements in Section 21.2 are stated in Section 21.3. If these corrective actions can be taken by the analyst prior to the acceptance of the data, then no nonconformance documentation is required. However, if these corrective actions include redigestion of the batch or sample and if the data have already been accepted, then a nonconformance/ corrective action report should be completed. This report includes the date, person requesting the action, sample(s) or batch(es) affected, and action requested, all provided by the requester. The person taking the action will provide any pertinent comments, a signature, and the date the action is completed. The disposition of the nonconformance will then be verified by the Group Leader and Quality Assurance Officer if pertinent. These reports will be kept on file in AlphaLIMS. Refer to GL-QS-E-004 for Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items.

22.0 DATA REVIEW, VALIDATION, AND APPROVAL PROCEDURES

22.1 The AlphaLIMS Data Report and the original batch sheet are provided to the ICP reviewer.

22.2 A knowledgeable person other than the originating analyst shall review the data within the day or specified time limit. When this review is completed and all of the data are found to be acceptable, the reviewer signs and dates the batch data report. If the reviewer determines that the reviewed data are not acceptable and requires additional work or correction, they are returned to the Group Leader or representative with an appropriate explanation.

22.3 Listed below are the data review responsibilities at the Analyst, Peer Review and Validator levels:

22.3.1 Analyst Review is performed by the analyst who generated the data before the data are submitted for entry into AlphaLIMS. The analyst uploads the data to AlphaLIMS and completes the batch data report.

22.3.2 Peer Analyst Review is performed by an individual who did not perform the analysis but is familiar with the analytical method used and the reporting requirements. This person reviews the complete data report after all data are entered and ensures that any data entry corrections are made before the data are approved, and then signs the batch data report. If the data do not meet the necessary quality requirements and need further analysis, they are returned to the analyst.

22.3.3 Data Validation: For data requiring forms packages, the forms are generated per contract requirements and validated per GL-MA-E-017.

22.4 Specific items that are reviewed at each level include the following:

22.4.1 Analyst Review: Before data are submitted for entry into AlphaLIMS.

22.4.1.1 All analyses in the batch are completed with explanations of exceptions.

22.4.1.2 Any corrections and comments on the data are properly initialed and dated.

22.4.1.3 Proper standard identification numbers appear on the runlog to ensure traceability from the data to original source standards.

22.4.1.4 Data acceptance limit criteria identified in Section 21.2 are met or an explanation given.

22.4.2 Peer Analyst Review: before Data are statused to DONE in AlphaLIMS:

22.4.2.1 All data are complete and accurate in the AlphaLIMS Data Report.

22.4.2.2 Any exceptions or shortcomings have been sufficiently explained or corrected.

22.4.2.3 Data are reported in the proper units, or an explanation is given.

22.4.2.4 Prep factor and dilution calculations by AlphaLIMS are present in the data report and AlphaLIMS calculations are correct.

22.4.2.5 LCS and Spike Recoveries and RPD calculations by AlphaLIMS are correct and are within control limits.

22.4.3 Valildation: Before data are reported out of the lab:

22.4.3.1 Analyst and Peer Level reviews have been completed and any corrections or comments made.

22.4.3.2 Preparation data have been entered and reviewed by a peer.

22.4.3.3 Analytical data are present for all analyses.

22.4.3.4 Weight/Volume, dilution, spike recovery, RPD, and LCS recoveries appear to be calculated correctly.

22.4.3.5 All forms, raw data, and log sheets requested by the client are present.

22.4.3.6 Results are accurate on forms (refer to GL-MA-E-017).

22.5 Documentation and review process are reflected in the Data Review Flow Chart in Appendix 1.

23.0 DATA REPORT

23.1 To report data after the initial review process has been completed:

23.1.1 Enter the AlphaLIMS program through GEL home page and click on AlphaLIMS application.

23.1.2 Click on MAINTAIN BATCHES and type in the queue at SELECT A QUEUE (ICP for the analytical).

23.1.3 Select batch number at SAMPLE ID column, and the run status will show whether data are ready to calculate.

23.1.4 When data are ready to calculate, click on CAL.

23.1.5 Click on SAVE to save the data.

23.1.6 Send data to review at STATUS column for quality purposes.

23.1.7 Print data, and initial and date for final review.

23.2 The Final Reviewer is responsible for changing the batch status to DONE in AlphaLIMS and initialing and dating the data report.

24.0 RECORDS MANAGEMENT AND DOCUMENT CONTROL

24.1 Records of the instrumental analysis, operation, and maintenance are maintained as follows:

24.1.1 Run logs are accurate chronologies of what the instrument did during a specified period of time. They detail the standard name or sample number for each standardization or analysis, the analyst identification, and the date and time of each analysis or standardization. This information is periodically retrieved from the instrument data files, printed in chronological sequence, and maintained as documentation of the sequence of events and as a reference for the raw data.

24.1.2 Extraction/Digestion Logs are maintained in accordance with the established procedures in the areas where these processes are performed.

24.1.3 Instrument Maintenance Logs are chronological representations of all maintenance activities involving the instrument operation. This record is kept in bound composition books and consists of the details of the action, who performed it, when it was performed, and when instrument was returned to operation.

24.1.4 Batch Sheets accompany the batch of samples through digestion and analysis and then accompany the raw analytical data through data entry and data review until the batch status is changed to "DONE" in the laboratory. The

person responsible for each of these actions initials and dates the batch sheet. This record is maintained in the Metals group files.

24.1.5 Batch Data Reports are generated from AlphaLIMS after the data are entered and attached to the batch sheet to be used in the peer review and validation. After the batch is reviewed, corrected if necessary, and updated to "DONE," the batch data report is stored with the batch sheet.

24.1.6 Raw instrument data are generated as the analyses are performed and are used in the data review process and kept in the Metals group files.

25.0 LABORATORY WASTE HANDLING AND DISPOSAL

All Laboratory wastes are handled and disposed in accordance with the Laboratory Waste Management Plan, GL-LB-G-001.

26.0 METHOD VARIATION

SW-846 requires that ICB and CCB results must agree within three standard deviations of the mean blank value. GEL uses the absolute value of the PQL for evaluating ICB and CCB results. The acceptance limits are further discussed in Appendix 4.

27.0 REFERENCES

27.1 Perkin Elmer Optima 4300DV Operator's Manual

27.2 Perkin Elmer Optima 4000 Series Hardware Guide

27.3 Perkin Elmer Optima 5300DV Operator's Manual

27.4 Perkin Elmer Optima 7300DV Operator's Manual

27.5 Test Methods for Evaluating Solid Waste: Laboratory Manual Physical/ Chemical Methods, Volume 1A, SW-846, 3rd Edition, Nov. 1986. Method 6010B, "Inductively Coupled Plasma-Atomic Emission Spectroscopy," Rev 2, Sept. 1994. USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460.

27.6 Test Methods for Evaluating Solid Waste: Laboratory Manual Physical/ Chemical Methods, Volume 1A, SW-846, 3rd Edition, Nov. 1986. Method 6010C, "Inductively Coupled Plasma-Atomic Emission Spectroscopy," Rev 3, February 2007. USEPA Office of Solid Waste and Emergency Response, Washington, DC 20460.

27.7 EPA Method 200.7, Revision 4.4

27.8 Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2 October 25, 2010 and Version 5.0, July 2013.

28.0 HISTORY

Revision 20: Added DoD QSM revision.

Revision 21: Updated SOP reference in section 12.1 from GL-MA-E-012 to GL-MA-E-020 (NIOSH 7303).

Revision 22: Updated instrumentation to include PE Optima 7300DV.

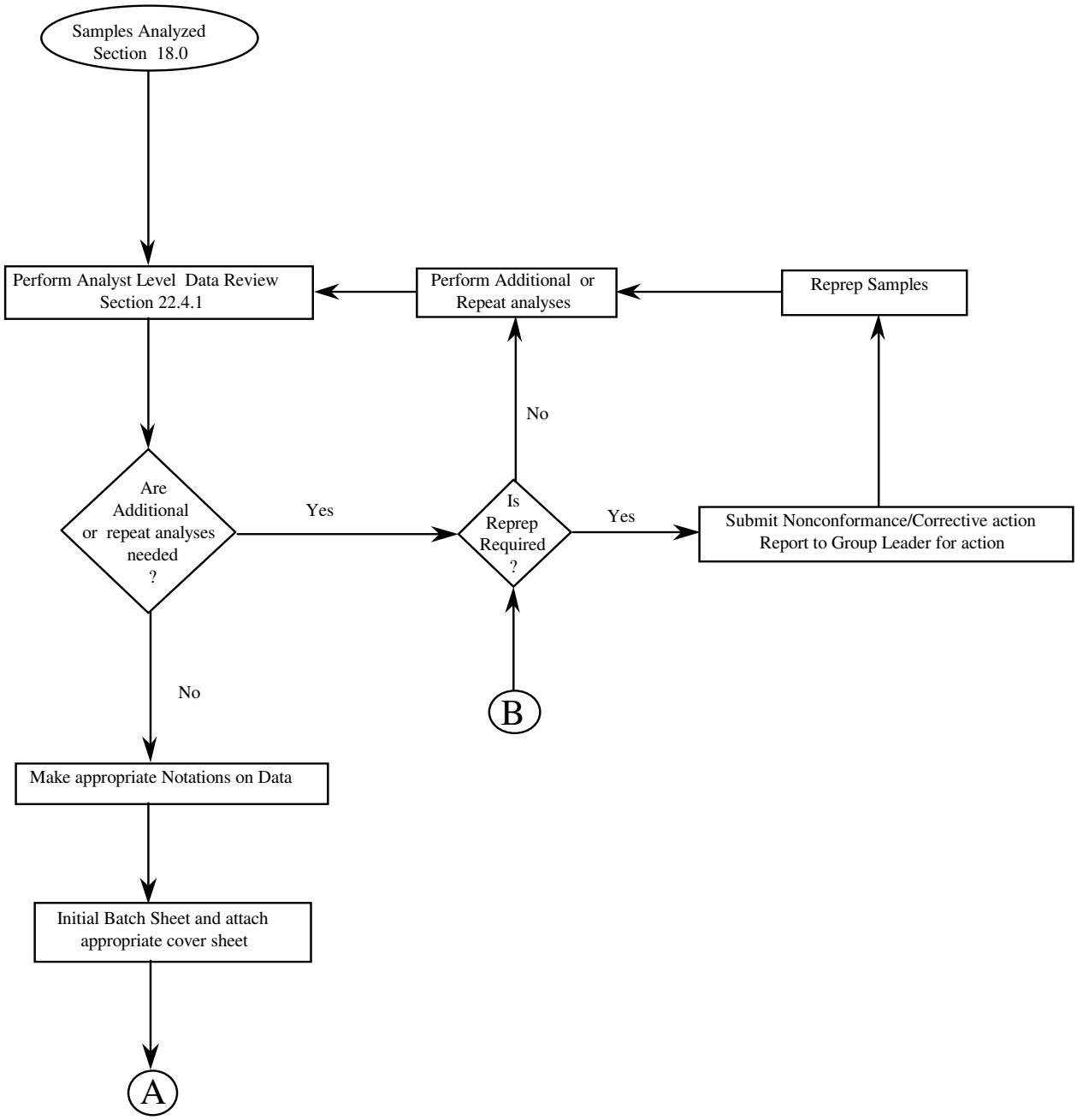
Revision 23: Various changes to remove CLP references and add instrument models.

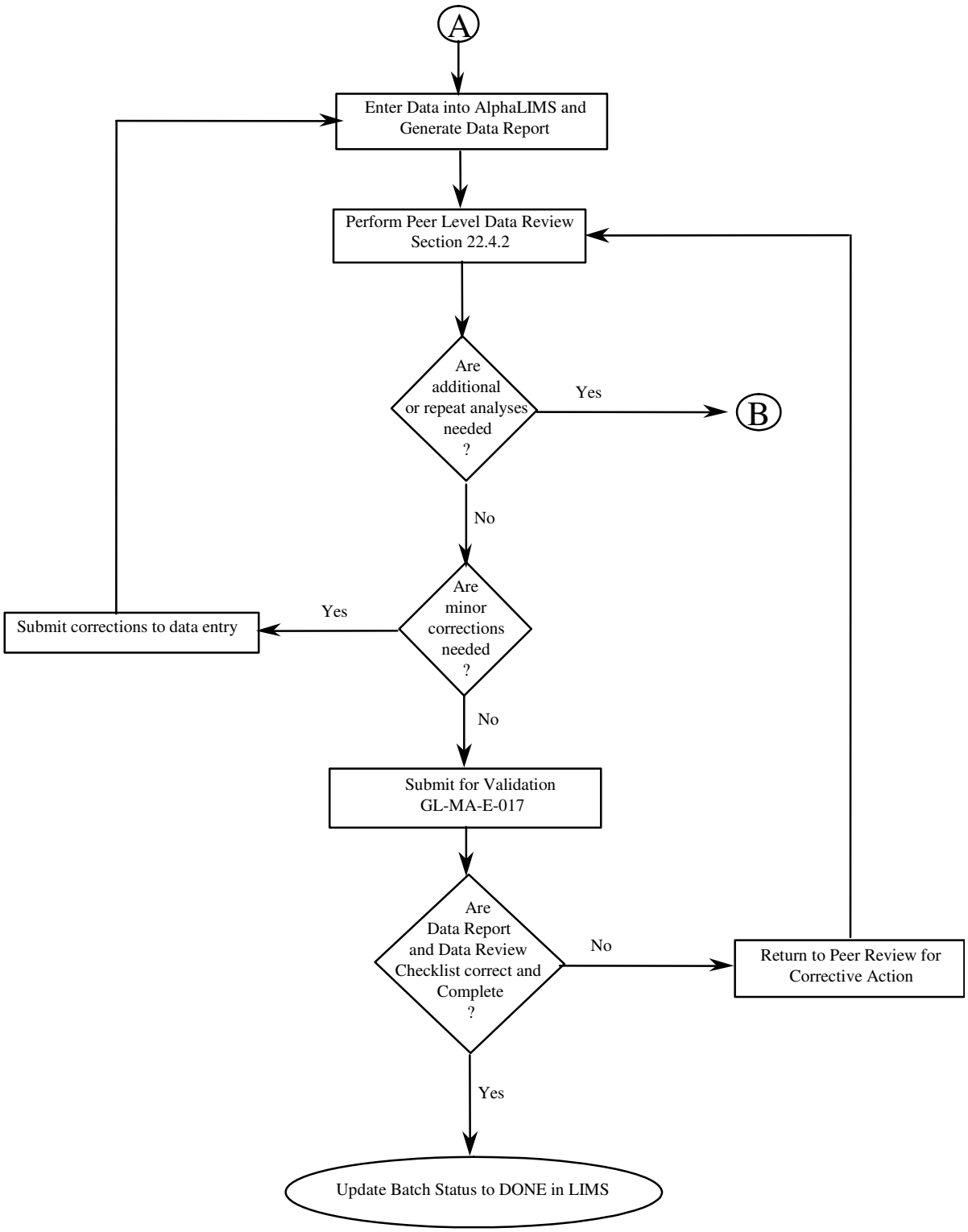
Revision 24: Added sentence to section 15.1.1.3 to discuss the mercury axis peak being centered and steps to take should the peak be off centered.

APPENDIX 1: PRODUCTION FLOW CHART

(For Illustrative Purposes Only)

Data Review Flow Chart




A
Enter Data into AlphaLIMS and Generate Data Report
Perform Peer Level Data Review Section 22.4.2
Are additional or repeat analyses needed ?
Yes
B
No
Are minor corrections needed ?
Yes
Submit corrections to data entry
No
Submit for Validation GL-MA-E-017
Are Data Report and Data Review Checklist correct and Complete ?
No
Return to Peer Review for Corrective Action
Yes
Update Batch Status to DONE in LIMS

APPENDIX 2: CALIBRATION STANDARDS FOR TRACE

(For Illustrative Purposes Only)

S0 reagent blank (3% HCl / 1% HNO_3)

S0.1 0.1 ppm (100 ppb) As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Sr, Tl, U, V, Zn Sb, Mo, Ag, Sn, Ti

0.2 ppm (200 ppb) S

0.5 ppm (500 ppb) Si, P

1 ppm (1000 ppb) Al, Ca, Mg, K, Na

S0.5 0.5 ppm (500 ppb) As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Sr, Tl, U, V, Zn Sb, Mo, Ag, Sn, Ti

1 ppm (1000 ppb) S

2.5 ppm (2500 ppb) Si, P

5 ppm (5000 ppb) Al, Ca, Mg, K

SCAL 1 ppm (1000 ppb) As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Sr, Tl, U, V, Zn Sb, Mo, Ag, Sn, Ti

2 ppm (2000 ppb) S

5 ppm (5000 ppb) Si, P

10 ppm (10000 ppb) Al, Ca, Mg, K, Na

S10 50 ppm (50000 ppb) Ca, Al, Mg
20 ppm (20000 ppb) Fe, Na

(Analytes and concentrations may change with further method development)

APPENDIX 3: FREQUENCY OF QUALITY CONTROL ACTIVITIES

(For Illustrative Purposes Only)
Frequency of Quality Control Activities

Method/ Frequency	SW-846 6010B	EPA 200.7	SW-846 6010C
Calibration Std readbacks	Not required	Not required	Not required
Linear Range Std	Per calibration	Per calibration	Per calibration
ICV	Per calibration	Per calibration	Per calibration
ICB	Per calibration	Per calibration	Per calibration
PQL/CRI (CLP)	Per calibration	Per calibration	Per calibration and at end of each analytical batch.
ICSA	Per calibration	Per calibration; every 8 hours after or end of analytical run	Per calibration
ICSAB	Per calibration	Per calibration; every 8 hours after or end of analytical run	Per calibration
CCV	Every 10 instrument runs	Every 10 instrument runs	Every 10 instrument runs
CCB	Every 10 instrument runs	Every 10 instrument runs	Every 10 instrument runs
Method Blank	5% or per batch	5% or per batch	5% or per batch
LCS - liquid LCS - soil	5% or per batch	5% or per batch	5% or per batch
Matrix Spikes	5% or per request	10% or per request	5% or per request
Sample Duplicates	5% or per request	5% or per request	5% or per request
Serial Dilutions	5% or per request	5% or per request	5% or per request
Matrix Spike Duplicates	5% or per request	10% or per request	5% or per request
Post Digestion Spikes	5% or per request	5% or per request	5% or per request

APPENDIX 4: ACCEPTANCE LIMITS

Method/ Acceptance Criteria	SW-846 6010B	EPA 200.7	DOD QSM	SW-846 6010C
Calibration Std readbacks	Not required	Not required	Not required	Not required
Linear Range Std	± 10% of true value	± 10% of true value	± 10% of the true value	± 10% of true value
ICV	90% - 110%	95% - 105%	90%-110%	90% - 110%
ICB	< absolute value of RL	< absolute value of RL	< absolute value of LOD	< absolute value of RL
PQL/CRI (CLP)	70% - 130% advisory limits only	70% - 130% advisory limits only	80%-120% or investigate and recalibrate	70% - 130% or investigate and recalibrate
ICSA	80-120% for major components, 2XRL for others	80-120% for major components, 2XRL for others	80%-120% for major components, < ± LOD for non spiked	80-120% for major components, 2XRL for others
ICSAB	80%-120%	80%-120% (may be requested)	80%-120%	80%-120%
CCV	90% - 110%	90% - 110%	90%-110%	90% - 110%
CCB	± RL	± RL	± LOD	± RL
Method Blank	± RL	± RL	±1/2 RL, except for Al, Fe, Ca, Mg, Na and K	± RL
LCS - liquid LCS - soil	80% - 120% current SPC limits	85% - 115% current SPC limits	80%-120%	80% - 120% current SPC limits
Matrix Spikes	75% - 125%, when applicable	75% - 125%, when applicable	80%-120%, when applicable	75% - 125%, when applicable
Sample Duplicates	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL
Serial Dilutions	0% - 10% of initial raw value, when applicable	0% - 10% of initial raw value, when applicable	0% - 10% of initial raw value, when > 50X LOQ	0% - 10% of initial raw value, when applicable
Post Digestion Spikes	75%-125%, when applicable	75%-125%, when applicable	75%-125%	80%-120%, for all
Internal Standards	50%-150%, then evaluate dilution	50%-150%, then evaluate dilution	N/A	50%-150%, then evaluate dilution
Matrix Spike Duplicate	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL	0% - 20% when greater than 5X RL, +/-RL when less than 5X RL

VERIFY THE VALIDITY OF THIS SOP EACH DAY IN USE

STANDARD OPERATING PROCEDURE

FOR

DETERMINATION OF METALS BY ICP-MS

APPLICABLE TO METHODS:
EPA Method 200.8
EPA SW-846 Method 6020 and 6020A

(GL-MA-E-014 REVISION 26)

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1.0 STANDARD OPERATING PROCEDURE FOR DETERMINATION OF METALS BY ICP-MS

2.0 METHOD CODES

2.1 EPA SW-846 Method 6020

2.2 EPA SW-846 Method 6020A

2.3 EPA Method 200.8

3.0 METHOD OBJECTIVE AND PURPOSE

This standard operating procedure (SOP) describes the determination of metals using a Perkin Elmer ICP-MS Model ELAN 9000 Spectrometer, Perkin Elmer ICP-MS ELAN DRC-e, and Perkin Elmer ICP-MS NexION 300x and 350x. Prior to analysis, samples must be digested using appropriate sample preparation methods (such as Methods 3005, 3010, 3050, or 200.2) and other applicable requests.

4.0 METHOD APPLICABILITY AND METHOD SUMMARY

4.1 Refer to Appendix 3 for analyte lists and masses.

4.2 Applicable Matrices: These methods are applicable to the determinations of any of the analytes listed above for various matrices including waters, oils, soils, sludges, biological tissues, Toxicity Characteristic Leaching Procedure (TCLP) extracts and other more unusual types of sample which are generally classified as a miscellaneous matrix.

4.3 General Method Summary: After the samples are prepared in accordance with the sample preparation SOP, they are analyzed by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) as follows:

4.3.1 The instrument is calibrated with a minimum of two calibration points for each element to be analyzed. The points consist of a calibration blank solution to define the lower calibration point and at least one standard calibration solution at the analyte concentrations to define the higher calibration point(s). A correlation coefficient of 0.995 or better (0.998 or better for SW-846 Method 6020A) is required for each analyte if multiple standards are used or the instrument is recalibrated for the analyte of interest.

4.3.2 Prepared client samples and numerous check standards and quality control samples, identified in Section 22.1 are then analyzed. The check standards and quality control samples are used to determine the quality and acceptability of the analytical data.

4.3.3 Continuing Calibration Verification standards (CCV) and Continuing Calibration Blanks (CCB) are analyzed a minimum of every 10 samples to ensure that the instrument is continuing to perform correctly. For 6020A, low level continuing calibration verification standards are analyzed in conjunction with the CCVs and CCBs.

4.4 Method Codes: Analyses must conform to SW-846 Method 6020, SW-846 Method 6020A, EPA Method 200.8, and/or customer contract specifications.

4.5 Radiochemistry conversion calculations for the uranium isotopes are included in Appendix 4.

5.0 METHOD SCOPE AND PERFORMANCE CHARACTERISTICS

5.1 Calibration Range: The range of concentrations between the calibration blank, typically 0, and that of the highest calibration standard for each analyte. Calibration standards vary according to method and equipment. A minimum of two, a blank and value standard, are required.

5.2 Linear Dynamic Range standards (LRS) are analyzed with each calibration. The linear calibration range that may be used for the analysis of samples should be judged by the analyst from the resulting data. The instrument is calibrated. The target linear range should be prepared and analyzed. The LRS results must fall within ± 10% of the target value. This LRS value is entered into the instrument's software. Any hits below this value will be valid. Hits at or above this value will be flagged by the system and must be diluted to fall within the linear dynamic range. If a linear range standard is not used for a specific calibration, the highest calibration standard becomes the upper limit of reporting.

5.3 Instrument Detection Limits (IDLs) in µg/L are determined by calculating the average of the standard deviation of the three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day. Each measurement must be performed as though it were a separate analytical sample (i.e., each measurement must be followed by a rinse and/or any other procedure normally performed between the analysis of separate samples). IDLs must be determined at least every three months.

5.4 Method Detection Limit (MDL) studies for each analyte are performed and/or verified at least annually. These studies are conducted and calculated in accordance with SW-846, Chapter 1, paragraph 5.0, and GL-LB-E-001 for the Determination of Method Detection Limits. The relevant quantitation limits are established based on the most current MDL study. The current MDLs are maintained and can be found in the AlphaLIMS database.

5.5 Method Precision: To assure analytical precision of methods used, Laboratory Control Samples (LCS) are analyzed with each batch. LCS duplicates are analyzed with each batch when requested.

5.6 Method Bias (Accuracy) is determined by calculating recoveries of LCS of a similar matrix.

5.7 If uncertainty and total propagated uncertainty measurements are needed, they may be determined using GL-QS-E-014 for Quality Assurance Measurement Calculations and Processes.

6.0 DEFINITIONS

6.1 AlphaLIMS: The Laboratory Information Management System used at GEL Laboratories, LLC.

6.2 Analysis Date/Time: The date and military time (24-hour clock) of the introduction of the sample, standard, or blank into the analysis system.

6.3 Analytical Sample: Any solution of media introduced into an instrument on which an analysis is performed excluding instrument calibration, initial calibration verification (ICV), initial calibration blank (ICB), continuing calibration verification (CCV), and continuing calibration blank (CCB).

6.4 Calibration Standard (CAL): A solution prepared from the primary dilution standard solution or stock standard solutions and the internal standards surrogate analytes. The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.

6.5 Continuing Calibration Blank (CCB): An aliquot of reagent water or other blank matrix that is analyzed after each CCV. The CCB is used to determine whether the analytical sequence is in control during sample analysis.

6.6 Continuing Calibration Verification (CCV) Standard: An aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added. The CCV is analyzed exactly like a sample, periodically throughout the run sequence. Its purpose is to determine whether the analytical sequence is in control during the sample analysis. It may be prepared from the same source as the calibration standards, and is usually of varied concentrations.

6.7 Contract Required Detection Limit (CRDL): Minimum level of detection acceptable under the client project requirements.

6.8 Control Limits: A range within which specified measurement results must fall to be compliant. Control limits may be mandatory, requiring corrective action if exceeded, or advisory, requiring that noncompliant data be flagged.

6.9 Correlation Coefficient: A number (r) that indicates the degree of dependence between two variables (concentration-absorbance). The more dependent they are, the closer the value to one. Determined on the basis of the least squares line.

6.10 Data Qualifiers: The following qualifiers should be used in order to identify analytical situations that might need additional information stated in narrative before the release of the data.

U - Non-Detect. Below the Instrument or Method Detection Limit (depending upon specific project requirements)

B - Sample concentration value is between the MDL (or IDL) and the CRDL or analyte was detected in the Method Blank (Client Specific)

J - Sample concentration is between the MDL (or IDL) and the CRDL-client specific qualifier.

Blank - Concentration value is above the CRDL

* - An RPD value in the duplicate sample is out of criteria

N - A percent recovery value in the spike sample is out of criteria

E - A percent difference in the serial dilution sample is out of criteria because of the presence interference.

6.11 Duplicate: A second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method.

6.12 Initial Calibration Blank (ICB): An aliquot of reagent water or other blank matrix that is analyzed after each ICV. The ICB is used to determine whether there is carryover contamination.

6.13 Initial Calibration Verification (ICV): A solution of method analytes of known concentrations. The ICV is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check laboratory performance with externally prepared test materials.

6.14 Instrument Performance Check Solution (IPC): A solution of one or more method analytes, surrogates, internal standards, or other test substances used to evaluate the performance of the instrument system with respect to a defined set of criteria.

6.15 Interferants: Substances that affect the analysis for the element of interest.

6.16 Internal Standard: Pure analyte(s) added to a sample, extract, or standard solution in known amounts and used to measure the relative responses of other method analytes.

6.17 Laboratory Control Standard (LCS): An aliquot of reagent water or other blank matrix to which known quantities of the method analytes are added in the laboratory. The LCS is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements.

6.18 Linear Calibration Range (LCR): The concentration range over which the instrument response is linear.

6.19 Method Blank (MB): An aliquot of reagent water or other blank matrix that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The MB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

6.20 Method Detection Limit (MDL): The minimum concentration of an analyte that can be identified measured and reported with 99% confidence that the analyte concentration is greater than zero.

6.21 Serial Dilution: The dilution of a sample by a known factor. When corrected by the dilution factor, the diluted sample should agree with the original undiluted sample within the specified limits. Serial dilution may reflect the influence of interferants.

6.22 Spike (Matrix Spike or Post Spike): An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The MS

or PS is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS or PS corrected for background concentrations.

6.23 Limit of Detection (LOD): An analyte, method and matrix specific estimate of the minimum amount of a substance that can be reliably detected. GEL has established LOD = 2 x MDL.

6.24 Limit of Quantitation (LOQ): An analyte, method and matrix specific estimate of the minimum amount of a substance that can be reported with a specific level of confidence. The LOQ is set at or above the concentration of the lowest initial calibration standard. The laboratory must empirically demonstrate precision and bias at the LOQ. The LOQ and associated precision and bias must meet client requirements and must be reported. GEL uses the following guidance (LOD < LOQ):

When LOD < PQL, PQL = LOQ

When LOD > PQL, LOQ is raised to next lowest calibration standard.

6.25 Practical Quantitation Limit (PQL): The PQL is typically at or above the lowest point on an acceptable initial calibration curve. It may also be determined by multiplying the MDL by approximately 2 to 10. Concentrations of a target analyte determined to be greater than its PQL are defined as quantitative results. This limit is not used in DoD ELAP reporting.

6.26 Statistical Process Control (SPC) Limits: Statistically derived limits that establish acceptable ranges for recoveries of analytes of interest, including LCS, MS, MSD, PS and PSD.

6.27 Stock Standard Solution: A concentrated solution containing one or more method analytes prepared in the laboratory using certified reference materials or purchased from a reputable commercial source.

6.28 10% Frequency: A frequency specification during an analytical sequence allowing for not more than 10 analytical samples between required calibration verification measurement, as specified by the EPA methodology.

7.0 INTERFERENCES TO THE METHOD

7.1 Chemical interferences are minimal in ICP-MS Spectroscopy because the extremely high energy of the plasma breaks nearly all the chemical bonds. However, ICP-MS analysis is subject to the following three types of interferences:

7.1.1 Physical interferences are those physical properties of a sample solution that prevent their introduction to the plasma with efficiency equal to that of the calibration standards. This type of interference can be corrected via the bias correction calculation in SW-846, Chapter 1, paragraph 5.0, through the use of an internal standard in accordance with the instrument operating

manual or by diluting the sample in reagent blank solution until the percent recovery falls with method guidelines.

7.1.2 Isobaric elemental interferences are caused by isotopes of different elements that form singly or doubly charged ions of the same nominal mass-to-charge ratio and that cannot be resolved by the mass spectrometer. If analytical isotopes are selected that may have an isobaric interference, then all data obtained under such conditions must be corrected by measuring the signal from another isotope of the interfering element and subtracting the appropriate signal ratio from the isotope of interest.

7.1.3 Isobaric polyatomic ion interferences are caused by ions consisting of more than one atom that have the same nominal mass-to-charge ratio as the isotope of interest, and that cannot be resolved by the mass spectrometer in use. These ions are commonly formed in the plasma or interface system from support gases or sample components. Most of the common interferences have been identified and are listed in Method 200.8, Table 2 together with the method elements affected. Such interferences must be recognized, and when they cannot be avoided by the selection of alternative analytical isotopes or sample prep procedures, appropriate corrections must be made to the data.

8.0 SAFETY PRECAUTIONS AND HAZARD WARNINGS

8.1 PREVENT SKIN AND EYE CONTACT BY USING SPECIFIED PERSONAL PROTECTIVE EQUIPMENT WHEN MAKING STOCK REAGENTS.

8.2 WORK UNDER A HOOD TO PREVENT INHALATION WHEN MAKING STOCK REAGENTS.

8.3 Sample digestates are not extremely volatile or spontaneously combustible, but they are normally acidic and should be handled with care. Small spills may generally be wiped up with paper towels that can be disposed of in the trash. Larger spills may require the use of a mop, and the mop head may have to be disposed of as potentially hazardous waste in accordance with the Laboratory Waste Management Plan (GL-LB-G-001). If the spilled digestates begin any obvious fuming or reacting, pour a generous amount of the acid neutralizer, which is located in each lab, onto the spill before attempting to clean it up.

8.3.1 Gloves should be worn to avoid skin contact with digestate during clean-up.

8.3.2 Eye protection is required when handling samples and an eyewash station is located in each analysis lab.

8.3.3 Do not persist in cleaning up a spill in the presence of strong fumes. Move out of the area, try to isolate the area and notify your supervisor immediately.

8.4 Handling radioactive samples requires the use of gloves, a lab coat or an apron in addition to eye protection. Refer to GL-RAD-S-004 for Radioactive Material Handling

8.5 These instruments use high voltage electricity and therefore, should be shut completely down any time electronic components may be exposed to personnel or any liquids.

8.6 Wear eye protection with side shields while performing procedures in the lab.

8.7 All chemicals and samples should be treated as potential health hazards, and exposure to these chemicals must be reduced to the lowest level possible. GEL maintains a current awareness file of Occupational Safety and Health Administration (OSHA) regulations regarding the safe handling of the chemicals in the laboratory as well as a reference file of Material Safety Data Sheets (MSDS). These documents are maintained in the laboratory. Individual sample MSDS forms provided by the clients are kept in Login.

8.8 Personal protective equipment

8.8.1 Gloves are required when handling the chemicals in this procedure.

8.8.2 Work under a hood when using concentrated acids.

8.9 Prior to handling radioactive samples, analysts must have had radiation safety training and must understand their full responsibilities in radioactive sample handling. Some general guidelines follow:

8.9.1 Wear a lab coat when working with radioactive samples.

8.9.2 Prohibit admittance to immediate work area.

8.9.3 Protect counter tops with counter paper or work from radioactive sample handling trays.

8.9.4 Post signs indicating radioactive samples are in the area.

8.9.5 Take swipes of the counter tops upon completion of work. Deliver those swipes to the nearest swipe count box.

8.9.6 Segregate radioactive wastes. Radioactive waste containers are obtained from Waste Management.

8.10 All samples, chemicals, extracts, and extraction residues must be transferred, delivered, and disposed of safely according to all related SOPs.

8.10.1 Segregate solid wastes from liquid wastes in the satellite area containers.

8.10.2 Segregate oil wastes from water-soluble wastes in the satellite area containers

8.11 Never leave gas cylinders unchained or untied, including when they are on the moving carts.

8.12 In the event of an accident or medical emergency, call for help immediately. When time and safety permit, an accident report form should be completed and turned in to the safety committee.

8.13 Fire escape routes are posted in the lab; all personnel should be familiar with them. In addition, fire safety equipment such as fire extinguishers is located in the lab. Training is available on the proper operation of this equipment.

9.0 CAUTION WARNINGS

9.1 Because they can be health hazards, the exhaust gases from the plasma and vacuum systems must be eliminated through the laboratory's ventilation duct, which is attached to the instrument's exhaust vent. If inadequate ventilation occurs, pump-fluid vapor, ozone, and other toxic products of combustion can accumulate in the laboratory and cause bodily harm. Hydrofluoric acid (HF) fumes, if inhaled, extensively burn lung tissue. Ensure that the exhaust system established at installation continues to operate effectively.

9.2 Prepare sample and transfer acids using a hood to avoid fumes.

9.3 Store and prepare sample away from the instrument to minimize corrosion.

9.4 Clean up any spills quickly.

9.5 The drain vessel contains the spray chamber's effluent, which can be toxic. Corrosion of the vessel and connecting tube can result in leaks that damage the instrument or cause bodily harm.

9.5.1 Use the capped plastic drain vessel that was provided with the instrument. Never use glass.

9.5.2 Place the drain vessel on the instrument table below the peristaltic pump where the container is easy to check.

9.5.3 Check the drain vessel frequently. Empty it before it is three-fourths full.

9.5.4 Check the tubing and vessel for deterioration. If the tubing becomes brittle or cracked, replace it. Organic solvents cause more rapid deterioration than aqueous solutions.

9.6 The torch and interface remain hot after the plasma is turned off. Do not touch the torch box or interface cones for 10 minutes after the plasma has been shut off.

9.7 High voltages and radio frequencies are potential hazards of the ICP-MS. Shut the instrument down completely before removing any of the outside panels (to clean air filters, replace a fuse, etc.).

9.8 When changing the rotary pump oil, remember that the pump oil may be hot. The oil can cause a burn if allowed to contact the skin.

10.0 APPARATUS, MATERIALS, REAGENTS, EQUIPMENT, AND INSTRUMENTS

10.1 Apparatus and Equipment

10.1.1 Replacement special glass parts for the ICP-MS such as quartz torch bodies, injector tips and spray chambers may be ordered from a qualified vendor through the GEL Purchasing Agent.

10.1.2 Replacement ICP-MS interface parts such as sampling cones, skimmer cones and ion-optics can be purchased from a qualified vendor through the GEL Purchasing Agent.

10.1.3 Consumable materials such as tubing are often attainable from various scientific product companies. The GEL Purchasing Agent can help to find the best prices. These items may also be ordered from the instrument manufacturer if necessary. All orders must be placed through the GEL Purchasing Agent.

10.2 Reagents, Chemicals, and Standards

10.2.1 Reagents: Refer to Reagent Logbook

10.2.2 Standards: Refer to GL-LB-E-007 for Laboratory Standards Documentation and GL-LB-E-015 for Control of Laboratory Standards.

10.2.3 Other Chemicals: Additional compounds, surfactants, oils, cleaning agents, etc., may be routinely ordered through the GEL Purchasing Agent.

10.3 Instrumentation

10.3.1 Perkin Elmer ICP-MS ELAN Model 9000 with PC monitor and printer.

10.3.2 Perkin Elmer ICPMS ELAN Model DRC-e with PC, monitor and printer.

10.3.3 Perkin Elmer ICP-MS NexION 300x and 350x with PC, monitor and printer

10.3.4 ESI SC4 DX

10.3.5 CETAC Model ASX-510 Autosampler with accessory autodiluter (PE 9000).

10.3.6 Neslab CFT75 recirculating bath or equivalent provides cooling to the ICP-MS.

11.0 SAMPLE HANDLING AND PRESERVATION REQUIREMENTS

11.1 Aqueous samples should be preserved with nitric acid to a pH of < 2 prior to receipt by the analyst. Solid samples should be kept at $0° \leq 6°$ C prior to digestion.

11.2 Refer to GL-SR-E-001 for Sample Receipt, Login and Storage.

12.0 SAMPLE PREPARATION TECHNIQUES

12.1 All samples except drinking water with Turbidity < 1 NTU and samples specifically exempted by contract, are prepared in accordance with the following SOPs:

12.1.1 GL-MA-E-016 for Sample Preparation for Total Recoverable Elements by EPA Method 200.2 (USEPA Method 200.2)

12.1.2 GL-MA-E-006 for Acid Digestion of Total Recoverable or Dissolved Metals in Surface and Groundwater Samples for Analysis by ICP or ICP-MS (USEPA SW-846 Method 3005A)

12.1.3 GL-MA-E-008 for Acid Digestion of Total Metals in Aqueous Samples and Extracts for Analysis by ICP or ICP-MS (USEPA SW-846 Method 3010A)

12.1.4 GL-MA-E-009 for Acid Digestion of Sediments, Sludges and Soils (USEPA SW-846 Method 3050B)

12.2 Additional filtration may be required to prevent clogging of sample introduction system.

12.3 All sample preparation records are stored in AlphaLIMS.

12.4 Sample spills should be handled as stated in Section 8.3.

13.0 EQUIPMENT AND INSTRUMENT MAINTENANCE

13.1 Routine Preventative and Special Operational (Failure)

13.2 Routine Preventative Maintenance (PM) Procedures are done as follows:

Frequency	Procedure
When Needed	Clean nebulizer tip after use. Replace peripump sample introduction tubing. Change pump hoses on drain systems. Check drain waste collection containers, and empty as necessary. Check Neslab water level and add water if required. Clean/replace interface cones. Clean/replace nebulizer. Clean/replace torch. Check/replace water filter.
Quarterly	Change oil in interface rotary pump (or as needed). Clean ion lenses 4-6 months (or as needed).
6 Months	Clean air filters.
12 months	Change pump oil in backing rotary pump. Evaluate/replace EM (electron multiplier)

13.3 Non-Routine Maintenance Procedures (Special, Operational or Failure Mode Maintenance)

13.3.1 If the instrument will not function properly see the trouble shooting section in the appropriate Maintenance Manual.

13.3.2 If the analyst is unable to determine cause/fix instrument, the GEL Service Engineer is called, and if needed, the manufacturer's customer support number may be found in the owner's maintenance manuals.

13.4 Refer to ICP-MS Maintenance Logbook for routine records. Service call records are also available.

14.0 PREPARATION OF STANDARD SOLUTION AND QUALITY CONTROL SAMPLES

14.1 Source standards records are recorded in AlphaLIMS.

14.2 Recommended Suppliers: Refer to source log and use Approved Vendors List maintained in Procurement.

14.3 Standards are receipted, labeled, prepared and stored in accordance with the GL-LB-E-007 for Laboratory Standards Documentation.

15.0 INSTRUMENT CALIBRATION

15.1 Samples may be analyzed manually or automatically.

15.1.1 Tuning for each instrument is performed daily according to the following directions and criteria.

15.1.2 Aspirate a tuning solution consisting of 10 µg/L each of ^{9}Be, ^{24}Mg, ^{59}Co, ^{115}In and ^{208}Pb. Perform 5 replicates. Manufacturer's recommended tune criteria are as follows:

Parameter	Starting Point
^{9}Be	± 0.10 amu
^{24}Mg	± 0.10 amu
^{59}Co	± 0.10 amu
^{115}In	± 0.10 amu
^{208}Pb	± 0.10 amu
Ba^{++} net intensity mean	< 0.05 or 5%
CeO net intensity mean	< 0.03 or 3%
Be, Mg, Co, In, Pb net intensity RSD	< 5%
Resolution at 10% peak height	< 0.9 amu

15.1.3 Conduct additional tuning procedures as specified by client contract or other methodology.

15.1.4 If any of the preceding tune criteria does not meet the recommended requirements, investigate the problem, correct the situation, and reanalyze the tune sequence.

15.1.5 Standardization: Standardization is required on a daily basis.

15.2 Internal standards are used as appropriate for the analytes of interest. The internal standards are made in the appropriate acid and contain varying concentrations of such elements as ^{45}Sc, ^{74}Ge, ^{115}In, ^{175}Lu, and/or ^{181}Ta. The internal standard solution is mixed in-line with the sample stream using a dedicated channel of the peristaltic pump. Internal standards may be added at the time of analysis as an alternative to in-line mixing. Alternate internal standards may be used to meet client needs.

15.3 Calculations are described in the instrument manual.

15.4 Calibration standards vary according to method and equipment. A minimum of two, a blank and value standard, is required.

15.5 For required quality control standards refer to Section 21.0.

15.6 For continuing calibration requirements refer to Section 21.0.

15.7 For what to do when initial or continuing calibrations fail to meet requirements, refer to Section 21.0.

16.0 INSTRUMENT PERFORMANCE REQUIREMENTS

16.1 Before samples may be analyzed to generate reportable data, the instrument must have been tuned and calibrated. Also, the Initial Calibration Verification (ICV), which is prepared from an independent source, Initial Calibration Blank (ICB), the Reportable Detection Limit (CRDL), the Interference Check Standards (ICS-A, ICS-AB), and the Linear Range Standards (LRS) must meet the requirements stated in Section 21.2 for each analyte being reported, unless otherwise required by methodology, clients or contracts.

16.2 The instrument calibration and all continuing verification data is maintained in the printed hard copy file. The printouts are kept in chronological order by instrument. Recent files are in the metals laboratory; older records are archived in short or long-term storage.

17.0 ANALYST AND METHOD VERIFICATION REQUIREMENTS

17.1 Analyst training is conducted and certified in accordance with the GL-HR-E-002 for Employee Training.

17.2 Method performance is verified by the conductance of MDL studies in accordance with GL-LB-E-001 for The Determination of Method Detection Limits, and by the evaluation of LCS and LCS duplicates for each batch of samples.

18.0 ANALYSIS PROCEDURES AND INSTRUMENTAL OPERATION

18.1 All samples are introduced in a set measured quantity, via a peristaltic pump, through a nebulizer into a spray chamber and carried with argon gas through the Radio Frequency (RF) field to generate analyte ions that are selected and measured by the quadruple mass spectrometer.

18.2 Run Sequence

18.2.1 Instrument Calibration executed in accordance with Section 16.

18.2.2 Initial Calibration Verification steps include:

18.2.2.1 ICV

18.2.2.2 ICB

18.2.2.3 CRDL (low level ICV for 6020A)

18.2.2.4 ICS-A

18.2.2.5 ICS-AB

18.2.2.6 CCV

18.2.2.7 CCB

18.2.2.8 LRS

18.2.2.9 CCV

18.2.2.10 CCB

18.2.3 Sample Run (10 samples or less)

18.2.4 Continuing Calibration Verification:

18.2.4.1 CCV

18.2.4.2 CRDL (for SW-846 Method 6020A only and analyzed at end of batch).

18.2.4.3 CCB

18.2.5 Repeat steps 18.2.3 and 18.2.4 until end of run or verification is out of specification. When the latter occurs, repeat step 18.2.1 and continue with steps 18.2.2 and 18.2.3.

18.2.6 Repeat steps 18.2.3 through 18.2.5 until the end of the run or verification is out of specification. When latter condition occurs, repeat 18.2.1 and continue sequentially through 18.2.7.

18.2.7 Final Verification Steps

18.2.7.1 ICS-A (if required)

18.2.7.2 ICS-AB (if required)

18.2.7.3 CCV

18.2.7.4 CRDL (for SW-846 Method 6020A only)

18.2.7.5 CCB

NOTE: Method 6020A only requires there to be a closing low level continuing calibration standard (CRDL). For ease of analysis, the CRDL standard can be analyzed every 10 samples.

18.3 For data storage refer to Section 24.1.

18.4 General operation of the instrument.

18.4.1 The Perkin Elmer ICP-MSs are inductively-coupled argon plasma mass spectrometers. The ICP-MS is capable of determining analytes from m/z = 6 (Li) through m/z = 238 (U). The operating software of the system is based on Microsoft Windows.

18.4.2 Set-up

18.4.2.1 Attach the nebulizer argon line to the quick-connect on the nebulizer's argon tube and ensure that it is tightly in place.

18.4.2.2 Attach the nebulizer and endcap to the spray chamber.

18.4.2.3 Attach sample pump tubing to the front peristaltic pump (various sizes may be used depending on need), and attach feed end to endcap.

18.4.2.4 If running manually, place the suction end of the sample tubing in acidified rinse water; otherwise attach it to the autosampler.

18.4.2.5 Ensure that drain hose is connected to the spray chamber and properly plumbed through the drain peristaltic pump.

18.4.3 Run Procedure

18.4.3.1 Refer to the respective owner's manuals for specific instructions for tuning, sequence loading, and method development on each instrument; ELAN 9000 software guide, NexION 300x/350x software guide, or ELAN DRC-e software guide.

18.4.3.2 The owner's manual for each instrument is located in the ICP-MS laboratory.

18.4.4 Typical Analysis Problems

18.4.4.1 Sample Overrange: If a requested element is overrange for a sample, it is necessary to dilute the sample and rerun. Dilution factors must be taken into account when reporting final values.

18.4.4.2 Interferences: Although the ICP-MS can compensate for many interferences with appropriate correction factors, unpredicted interferences may still occur. If the analyst suspects this, then the sample should be diluted and rerun. Dilution factors must be taken into account when reporting final values.

18.4.4.3 Torch/Sample Introduction Drift: Various changes in torch plasma conditions or sample introduction can have a great effect on the detector counts. They must be corrected or the instrument must be re-standardized.

18.4.4.3.1 If oils or solid samples have been run, and the CCV is not acceptable, allow the instrument to rinse 15 to 20 minutes. If CCV is then acceptable, reanalyze the samples and continue. If the CCV again fails its requirements, re-standardize as necessary.

18.4.4.3.2 If sample introduction drift is suspected, check peristaltic pump tubing for collapse and replace as needed.

18.4.4.3.3 Tubing connections may become loose allowing air to bubble into the sample path. Tighten or replace tubing. If necessary, seal with Parafilm.

18.4.4.4 Serial dilution: If the analyte concentration is sufficiently high (minimally, a factor of 100 times above the IDL for non-DOE Clients, 100 x the MDL for DOE-Alb Clients, and 50 times the LOQ for DoD QSM in the original sample), an analysis of a

five fold (1 + 4) dilution should agree within 10% of the original determination. If not, a chemical or physical interference effect should be suspected.

18.5 Power switches and auxiliaries

18.5.1 Each instrument has one main power switch. Refer to the respective maintenance manuals for the location. This switch remains on except while servicing the instrument.

18.5.2 The computer system has 3 power cords all connected to a switchable power strip: the computer main, the monitor and the printer power cords. The power to these is left on while the instrument is not in use for short times (e.g. overnight).

18.5.2.1 The main computer switch is on the front of the CPU.

18.5.2.2 The ***monitor switch*** is on the front of the monitor itself.

NOTE: If the computer is left in use without an analyst present for an extended period of time, turn the monitor off to prevent screen burn-in.

18.5.2.3 The ***printer switch*** is on the lower front of the printer. Refer to printer manual for operating instructions.

18.5.3 Argon gas is provided through a manifold from the storage tank. Under normal conditions a constant argon flow is available.

18.5.4 Start-up

18.5.4.1 Before starting, ensure that the power is on and the vacuum system is switched on.

18.5.4.2 The owner's manual for each instrument provides specific instructions for ignition of the plasma (refer to Section 18.5.1 for software manuals).

18.5.4.3 The plasma should be steady and should not flicker.

18.5.4.4 Once ignition has occurred, levels may be adjusted; it is best to set levels appropriate to the method by loading or editing an appropriate tune file and allow 30 minutes for warm-up.

18.5.5 Shutdown

18.5.5.1 When the plasma is off, the instrument is either in Standby or Shutdown mode. The ICP-MS should be completely shut down only in case of major maintenance, relocation of the instrument, or when the lab is closed for an extended time.

18.5.5.2 Daily shutdown (if required): Refer to the respective owner's manual shutdown procedures (Refer to Section 18.5.1 for software manuals.)

18.6 Sample quantity requirements are approximately 5 mL for each run with the nebulizer. If out of specification or range, further sample may be necessary for reruns.

18.7 The autosampler can be used by attaching introduction tube to sample introduction system, and rinsing tubing to peristaltic pump and following autosampler table set-up and procedures. To define a sequence, refer to the appropriate software manual (refer to Section 18.5.1).

19.0 CALCULATIONS AND DATA REDUCTION METHODS

19.1 Any dilutions, concentrations, or preparation factors must be taken into account prior to reporting data to a client.

$$\text{Relative Percent Difference} = \frac{100 * |\text{Sample 1 Value} - \text{Sample 2 Value}|}{\frac{(\text{Sample 1 Value} + \text{Sample 2 Value})}{2}}$$

$$\text{Matrix Spike Recovery} = \frac{100 * (\text{Spike Value} * \text{DF} * \text{PF} - \text{Sample Value} * \text{DF} * \text{PF})}{\text{Spike Nominal Concentration} * \text{DF} * \text{PF}}$$

$$\text{Post Spike Recovery} = \frac{100 * (\text{Spike Value} - \text{Sample Value})}{\text{Spike Nominal Concentration}}$$

$$\text{LCS Recovery} = \frac{100 * (\text{Sample Value} * \text{DF} * \text{PF})}{\text{Nominal Concentration} * \text{DF} * \text{PF}}$$

Where: Sample Value = instrument reading for the sample
Spike Value = instrument reading for the spiked sample
DF = Dilution Factor
PF = Preparation Factor

Relative Error Ratio (RER) 2 sigma equation:

$$\text{RER} = \frac{|\text{Sample Activity} - \text{Duplicate Activity}|}{\sqrt{(\text{Sample 2 sigma TPU}/1.96)^2 + (\text{Duplicate 2 sigma TPU}/1.96)^2)}} = \leq 3$$

NOTE: Activity calculations can be found in Appendix 4 of this SOP. Two sigma TPU calculations can be found in SOP GL-QS-E-014.

19.2 Care must be taken that the correct units are being employed.

20.0 DATA RECORDING

20.1 ICP-MS data are generally stored to the hard disk drive of the ICP-MS computer system and printed at the instrument as each sample is analyzed.

20.2 ICP-MS samples are generally analyzed in three replicates (minimum of 2) and the reported value is the average of the replicates. The data for individual replicates is stored in the computer.

20.3 Data are processed locally by manual or programmable procedures to eliminate unused data, to enter dilution factors, and to enter relevant conversion factors prior to uploading to AlphaLIMS.

21.0 QUALITY CONTROL REQUIREMENTS

21.1 Frequency of Quality Control Activities (also refer to Appendix 1)

21.1.1 Initial Calibration Verification (ICV) is performed immediately following each calibration and Continuing Calibration Verification (CCV) is performed after at least every 10 samples.

21.1.2 Initial Calibration Blank (ICB) is performed immediately following the ICV and Continuing Calibration Blanks (CCB) must run with each CCV.

21.1.3 An Interference Check Standard (ICS) is analyzed at the beginning of each analytical run and at least once every twelve hours (if required). Additional requirements may be specified by client contract or methodology.

21.1.4 The PQL standard is analyzed after each calibration and recommended at least every 10 samples between the CCV and CCB analyses for SW-846 Method 6020A. Method 6020A requires analysis at the end of every batch and only recommends analysis every 10 samples. This standard may also be labeled as a CRDL standard.

21.1.5 A method blank (MB) is performed for each batch of 20 or fewer samples or per client requirement.

21.1.6 A matrix spike (MS) and a duplicate (DUP), or matrix spike (MS) and matrix spike duplicate (MSD) are analyzed for each batch of 20 or fewer samples or per client requirements (5% frequency). For EPA 200.8, the same QC are analyzed for each batch of 10 or fewer samples (10% frequency).

21.1.7 A laboratory control sample (LCS) is analyzed with each batch of 20 or fewer samples. An LCS duplicate (LCS DUP) may be added if required by the client.

21.1.8 Serial dilutions or analytical spikes are analyzed to confirm the presence or absence of interferences when analyzing a new matrix type. The serial dilution is generally performed at a 5x of the test sample.

21.1.9 A post spike (PS) is required for DoD-QSM or SW 846 6020A if the matrix spike (MS) or matrix spike duplicate (MSD) recoveries fall outside

of the limits in section 21.2.8. Post spikes can also be performed at client request.

21.2 Acceptance Limits (also refer to Appendix 2)

21.2.1 ICV results must be between 90% and 110% of the true values for work under EPA SW-846 Method 6020A or EPA Method 200.8. CCV results must be between 90% and 110% of the true values for work under EPA Method 200.8 or SW846 Method 6020A.

NOTE: The ICV is the second source standard and may be used as the CCV as it also will show calibration verification.

21.2.2 ICB and CCB results must have an absolute value less than the Reporting Limit (RL). For DoD QSM analysis, the absolute value must be less than the LOD. If this is not the case, the reason for the out-of-control condition must be found and corrected, or any data reported must be 10 times greater than the absolute value for the element or less than the RL.

21.2.3 Interference Check Sample results must be monitored at the beginning of an analytical run or once every 12 hours, whichever is more frequent, for work under SW-846. The ISCA and ICSAB must recover 80-120% the reporting level for the spiked analysis and must have an absolute value less that 2x the reporting level for the non-spiked analyte. For DoD QSM, the ICSA must have an absolute value of less than the absolute value of the LOD analytes.

21.2.4 The Linear Range Standard (LRS) is analyzed within the calibration verification read back and must fall between 90% and 110% of the true values. Meeting these criteria allows target analyte concentration to be reported up to the LRS concentration thus extending the calibration range of the instrument. Any sample concentrations above the LRS concentration will be diluted to fall below the concentration of the linear calibration range standard.

21.2.5 The intensities of all internal standards must be monitored for every analysis. When the intensity of any internal standard fails to fall between 30% and 120% (or 70% and 130% for SW-846 Method 6020A) of the intensity of that internal standard in the initial calibration then the sample must be diluted five fold (1 + 4) and reanalyzed with the addition of appropriate amounts of internal standards. The intensity levels of the internal standards for the calibration blanks (ICB and CCB) and instrument check standards (ICV and CCV) must agree within $\pm$ 20% of the intensity level of the internal standard of the original calibration solution. For work done under EPA Method 200.8, the internal standard responses of any one internal standard must not deviate more than 60% to 125% of the original response in the calibration blank. Five internal standards (^{45}Sc, ^{74}Ge, ^{115}In, ^{175}Lu, and/or ^{181}Ta) are used to cover the mass ranges reported. Refer to

Appendix 3 for list of internal standard/ analyte associations. Other exotic analytes may be used as needed. Refer to Section 15.2.

21.2.6 Method blank results must be lower than the PQL or less than 10% of the determined value of all samples in the batch. When performing work under EPA Method 200.8, if LRB (laboratory reagent blank) values are 10% or more of the analyte level determined for a sample or are 2.2 times the analyte MDL, then fresh aliquots of the samples must be prepared and analyzed again for the affected analytes after the source of contamination has been corrected and acceptable LRB values have been obtained. For DoD QSM work, the absolute value must be less than ½ RL or less than 10% of the determined value of all samples in the batch. Al, Fe, Mg, Ca, Na, and K must be less than the RL.

21.2.7 LCS results, and LCS duplicate (if performed), must be within process control limits as established by Statistical Process Control, manufacturer's certification, or method requirements.

21.2.8 Matrix spikes with recoveries between 75% and 125% suggest the absence of interference for work under EPA Method 200.8. Matrix spikes with recoveries between 75% and 125% suggest the absence of interference for work under SW-846 Method 6020 and SW-846 Method 6020A. Matrix spikes with recoveries between 80% and 120% suggest the absence of inteferences for work under DoD QSM.

21.2.9 The relative percent difference (RPD) between a sample and a sample duplicate should be within ± 20% if the analyte concentration in the sample or duplicate is greater than 5 times the RL. If either the sample or duplicate concentration is less than 5 times the RL, the results should agree within the absolute value of the RL. Results less than the MDL or IDL are not evaluated. The relative error ratio (RER) between a sample and a sample duplicate should be ≤ 3%.

21.2.10 Serial dilution results that agree within 10% of the original analytical results, if the original results are greater than 100 times the instrument detection limit or greater than 50 times the LOQ, suggest the absence of interference.

21.2.11 Post spikes with recoveries between 75% and 125% under EPA Method 200.8 and SW-846 Method 6020, and between 80% and 120% under SW-846 6020A suggest the absence of interference.

21.3 Out-of-Control Situations

21.3.1 ICV and/or CCV failure requires recalibration of the instrument and/or preparation of new standard solutions. Samples analyzed prior to or after calibration verifications that are not acceptable for required analytes must be reanalyzed. An ICV or CCV that has failed may be rerun once only if there is an attributable cause known to have affected the CCV only and not

the previous samples. Examples of an acceptable cause may be a sample tip out of solution during analysis, an incorrectly prepared CCV, or obvious carryover in the CCV from a very high sample immediately prior to the CCV. If a CCV is reanalyzed, the data must be lined through, initialed and dated, and the reason for the rerun must be documented on the raw data. In addition, corrective action should be taken to eliminate the cause of the initial CCV failure to prevent future occurrence.

21.3.2 ICB and CCB failure requires recalibration of the instrument and/or calibration blank solution to be remade. The CCB is acceptable if the level of analyte in the corresponding sample(s) is 10 times greater or less than the PQL for the failing element. For DoD QSM work, the absolute values must be less than the LOD or less than 10% of the determined value of all samples in the batch.

21.3.3 ICS failure requires that the instrument be re-calibrated or the interferences be corrected, via recalculation, of Interelement Correction Factors so that the ICS can be read within the required limits before samples are analyzed. ICS failure at the end of an analysis period will require that the samples' ICSA run for the affected analyte(s) during that period to be reanalyzed. The ICSA and ICSAB must recover 80-120% for the spiked analytes and must have an absolute value less than 2x the reporting level for the non-spiked analytes. For DoD QSM, the ICSA must have an absolute value of less than the LOD for the non-spiked analytes.

21.3.4 LRS failures limit the reportable calibration range to the high standard in the calibration curve. Any sample concentration that falls above the high calibration standard will be diluted to fall within the calibration range.

21.3.5 Internal Standard failure requires one or more of the following: five-fold dilution of the sample, correction of the problem, termination of analysis, recalibration of the instrument, and/or reanalysis of the affected samples depending on whether the failure is due to the samples or the instrumental drift.

21.3.6 Method blank results higher than the PQL and greater than 10% of any sample value in that batch that has concentrations above the PQL require that batch be redigested and reanalyzed. If the method blank results are less than -2x PQL there may be significant interference, calibration, or contamination problems with the sample, instrument, or calibration standards that must be resolved before the batch can be analyzed. For DoD QSM work, the absolute value must be less than ½ RL or less than 10% of the determined value of all samples in the batch. Al, Fe, Ca, Mg, Na, and K must be less than RL.

21.3.7 Matrix spikes, duplicates and spike duplicates are used only as indicators of method effectiveness on that sample and will not be used as

acceptability criteria for the process, unless a special requirement of the client.

21.3.8 LCS and/or LCS duplicate results outside of established acceptance limits require the batch to be redigested and reanalyzed.

21.3.9 When analytical results suggest the presence of interference, one of the methods listed in Section 18.4.4.2 should be employed.

21.3.10 The CRDL standard should be evaluated, but no action is required if the results fall outside of the 70-130% advisory window. For DoD QSM, the CRDL standard must be 80-120% of the true value or recalibration is required. For SW-846 Method 6020A, the CRDL standard must be 70-130% of the true value or recalibration is required. This also includes the low level continuing calibration verification standard analyzed every 10 samples. Sample results can be evaluated for reporting if they are at least 2x the CRDL for a given analyte.

21.4 Corrective actions taken for data not conforming to the requirements in Section 21.2 are stated in Section 21.3. If these corrective actions can be taken by the analyst prior to the acceptance of the data, then no nonconformance documentation is required. However, if these corrective actions include redigestion of the batch or sample, if the data have already been accepted, or if the corrective action requires an instrument service call, then a nonconformance and/or corrective action report should be completed. This report includes the date, person requesting the action, sample(s) or batch(s) affected, and action requested, all provided by the requester. The person taking the action will provide any pertinent comments, their signature, and the date the action is completed. The disposition of the nonconformance will then be verified by the Quality Systems specialist. These reports will be kept on file. Refer to GL-QS-E-002 for Documentation of Nonconformance Reporting and Dispositioning and Control of Nonconforming Items.

21.5 Analytical data are evaluated for conformance with the requirements stated in Section 21.2 by the analyst during and/or after the analysis, but before the data are entered into AlphaLIMS. Data may be accepted or rejected by the analyst at this point or by the data reviewer(s) as stated in Section 22.0.

22.0 DATA REVIEW, VALIDATION, AND APPROVAL PROCEDURES

22.1 After samples are analyzed, the data must go through the review process before it can be reported out of the lab. The analyst who performed the analysis will review the raw data prior to uploading it into AlphaLIMS. The upload process may be handled by the analyst or by a data entry clerk.

22.2 After the upload is complete, an AlphaLIMS data report is generated that will be passed (along with the batch sheet, data review checklist, and the raw data) to another analyst for a peer review. Discrepancies found in this review will be resolved before the batch data are passed and the status updated.

22.3 When this peer review is completed and all of the data are found to be acceptable, the reviewer signs and dates the batch data report and updates the status of the batch to done. If the reviewer determines that the reviewed data are not acceptable and requires additional work or correction, data are returned to the analyst or representative with an appropriate explanation.

22.4 Listed below are the data review responsibilities of the Analyst and Peer Reviewer:

22.4.1 Analyst Review is performed by the analyst who generated the data before the data are submitted for entry into AlphaLIMS. Analyst completes and attaches the run data cover sheet to the printout.

22.4.2 Peer Analyst Review is performed by an individual who did not perform the analysis but is familiar with the analytical method used and the reporting requirements. This person will review the complete data report after all data are entered, will ensure that any data entry corrections are made before data are approved, and will complete the reviewer portion of the data review check list. If the data do not meet the necessary quality requirements and need further analysis, they are returned to the analyst or representative.

22.5 A Third Review is performed for Data Packages (level 3 to level 6 CLP-Like) and/or by client requirement. This review is by the Metals Team Validator or other qualified person.

22.6 Specific items that are reviewed at each level include the following:

22.6.1 Analyst Review: Before data is submitted for entry into AlphaLIMS.

22.6.1.1 All analyses in the batch are completed.

22.6.1.2 Any corrections and comments on the data are properly initialed and dated.

22.6.1.3 Proper standard identification numbers appear on the runlog to ensure traceability from the data to original source standards.

22.6.1.4 All data are complete and accurate in the AlphaLIMS data report.

22.6.1.5 Data acceptance limit criteria identified in Section 21.2 are met or an explanation given.

22.6.2 Peer Analyst Review: Before data are submitted for further review or update:

22.6.2.1 All data are complete and accurate in the AlphaLIMS Data Report.

22.6.2.2 Any exceptions or shortcomings have been sufficiently explained or corrected.

22.6.2.3 Data are reported in the proper units or an explanation is given.

22.6.2.4 Prep factor and dilution calculations by AlphaLIMS are present in the data report and AlphaLIMS calculations are correct.

22.6.2.5 LCS and Spike Recoveries and RPD calculations by AlphaLIMS are correct, and the values are within control limits.

22.7 When the data review is completed and the data have been reported out of the lab, they are bound with the batching sheet and kept on file in the lab.

22.8 The complete data review process requires the use of the Prep Log Book, Prep data report, batch sheet, AlphaLIMS data report, raw instrument data, and runlog.

23.0 DATA REPORTING

23.1 To report data after the review process has been completed:

23.1.1 Enter the AlphaLIMS program through an available terminal and select DATA MENU, BATCH ITEMS, CHANGE BATCH STATUS.

23.1.2 Enter the Batch Number and "Submit."

23.1.3 Use the down arrow key to move the cursor down the new status column to the end. Change status from REVW to DONE and "Save."

24.0 RECORDS MANAGEMENT AND DOCUMENT CONTROL

24.1 Records of the instrumental analysis, operation, and maintenance are maintained as follows:

24.1.1 Run logs are an accurate chronology of what the instrument did during a specified period of time. The logs detail the standard name or sample number for each standardization or analysis, the analyst identification, and the date and time of each analysis or standardization. This information is periodically retrieved from the instrument data files, printed in chronological sequence, and maintained as documentation of the sequence of events and as a reference for the raw data.

24.1.2 Extraction/Digestion Logs are maintained in accordance with the established procedures in the areas where these processes are performed.

24.1.3 Instrument Maintenance Logs are chronological representations of all maintenance activities involving the instrument operation. This record is kept in bound composition books and consists of the details of the action, who performed it, when it was performed, and when instrument was returned to operation.

24.1.4 Batch Sheets accompany the batch of samples through digestion and analysis and then accompany the raw analytical data through data entry and data review until the batch status is changed to "DONE" in the laboratory. This record is maintained in the Metals group files.

24.1.5 Batch Data Reports are generated to be used in the peer data review. After the batch is reviewed, corrected if necessary, and updated to "DONE," the batch data report is stored with the Batch sheet.

24.1.6 Raw Instrument Data are generated as the analyses are performed and from AlphaLIMS after the data are entered and attached to the batch sheet to be used in the data review process and kept in the Metals group files.

25.0 LABORATORY WASTE HANDLING AND DISPOSAL: SAMPLES, EXTRACTS, DIGESTATES, AND REAGENTS

25.1 Standard solutions that must be disposed are taken to the Waste Disposal coordinator for disposal in accordance with Laboratory Waste Management Plan, GL-LB-G-001.

25.2 Sample digestates are stored in the lab for a specified period of time following analysis. At this time, they are composited into a waste container that is picked up by the Waste Management Technician for proper disposal.

25.3 Radioactive Waste:

25.3.1 Samples returned to sample storage

25.3.2 Drain waste collected in the radioactive waste carboy is dumped when full into the appropriate 55 gallon drum sitting outside the ICPMS laboratory. Ultimate disposal of liquid radioactive waste done by waste management department.

25.3.3 Implements, vials, gloves, etc., are wrapped and labeled with radioactive tape and placed in the radioactive waste container in high bay area.

25.3.4 Expired Standard Solutions: Refer to Section 25.1.

26.0 REFERENCES

26.1 Perkin Elmer ELAN 9000 Hardware Guide

26.2 Perkin Elmer ELAN DRC-e Hardware Guide

26.3 Perkin Elmer ELAN 9000 Software Guide

26.4 Perkin Elmer ELAN DRC-e Software Guide

26.5 Perkin Elmer NexION 300x/350x Hardware

26.6 Perkin Elmer NexION 300x/350 Software Guide.

26.7 Test Methods for Evaluating Solid Waste: Laboratory Manual Physical/Chemical Methods. Volume 1A, USEPA SW-846, Third Edition, Revision 2, September 1994.

26.7.1 Method 6020A, “Inductively Coupled Plasma – Mass Spectrometry,” Revision 1, February 2007.

26.7.2 Method 6020, “Inductively Coupled Plasma – Mass Spectrometry,” Revision 0, September 1994.

26.7.3 Method 3005A, “Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by FLAA or ICP Spectroscopy”, Revision 1, July 1992.

26.7.4 Method 3010A, "Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy," Revision 1, July 1992.

26.7.5 Method 3050B, "Acid Digestion of Sediments, Sludges, and Soils", Revision 2, December 1996.

26.8 USEPA Method 200.8, "Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry," Revision 5.4, May 1994.

26.9 Conversion Constants for Uranium Isotopes, Dr. Robert Litman, April 2009.

26.10 Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2, October 25, 2010.

26.11 U.S. Department of Energy, Quality Systems for Analytical Services (DOE QSAS). Rev 2.6, November 2010.

27.0 HISTORY

Revision 25: Clarifications on analyte lists, internal standards, and method requirements.

Revision 24: Updated section on sample preparation techniques to include procedure GL-MA-E-016

Revision 23: Updated sections 15.2, 21.2.5 and Appendix 3 to four internal standards. Removed outdated SOP references.

Revision 22: Editorial corrections only.

APPENDIX 1: FREQUENCY OF QUALITY CONTROL ACTIVITIES

(For illustrative purposes only)

Frequency of Quality Control Activities

Method/ Frequency	SW-846 6020	EPA 200.8	SW-846 6020A
Calibration Std readbacks	Not required	Not required	Not required
ICV	Per calibration	Per calibration	Per calibration
ICB	Per calibration	Per calibration	Per calibration
PQL	Per calibration	Per calibration	Per calibration and at end of each analytical batch.
ICSA	Per calibration	Per calibration	Per calibration
ICSAB	Per calibration; every 12 hours after	Per calibration	Per calibration; every 12 hours after
Linear Range Standard (LRS)	Per calibration, if applicable	Per calibration, if applicable	Per calibration, if applicable
CCV	Every 10 instrument runs	Every 10 instrument runs	Every 10 instrument runs
CCB	Every 10 instrument runs	Every 10 instrument runs	Every 10 instrument runs
Method Blank	5% or per batch	5% or per batch	5% or per batch
LCS – liquid LCS – soil	5% or per batch	5% or per batch	5% or per batch
Matrix Spikes	5% or per request	10% or per request	5% or per request
Sample Duplicates	5% or per request	5% or per request	5% or per request
Serial Dilutions	5% or per request	5% or per request	5% or per request
Matrix Spike Duplicates	5% or per request	10% or per request	5% or per request
Post-Digestion Spikes	5% or per request	10% or per request	5% or per request

APPENDIX 2: ACCEPTANCE LIMITS

Method/ Acceptance Criteria	SW-846 6020	EPA 200.8	DoD QSM	SW-846 6020A
Calibration Std readbacks	Not required	Not required	Not required	Not required
ICV	90% - 110%	90% - 110%	90%-110%	90% - 110%
ICB	< absolute value of RL	< absolute value of RL	< LOD	< absolute value of RL
PQL/CRI (CLP)	70% - 130% advisory limits only	70% - 130% advisory limits only	80%-120% or investigate and recalibrate	70% - 130% or investigate and recalibrate
ICSA	80-120% for major components; ± 2x RL for non-spiked	80-120% for major components; ± 2x RL for non-spiked	80%-120% for major compounds; ± LOD for non-spiked	80-120% for major components; ± 2x RL for non-spiked
ICSAB	80%-120%	80%-120% (may be requested)	80%-120%	80%-120%
Linear Range Standard (LRS)	90%-110%, or up to the high calibration standard	90%-110%, or up to the high calibration standard	90%-110%, or up to the high calibration standard	90%-110%, or up to the high calibration standard
CCV	90% - 110%	90% - 110%	90%-110%	90% - 110%
CCB	± RDL	± RDL	< LOD	± RDL
Method Blank	± RDL	± RDL	± ½ RL except for Al, Fe, Mg, Ca, Na, and K	± RDL
LCS - liquid LCS - soil	80% - 120% current SPC limits	85% - 115% current SPC limits	80%-120%	80% - 120% current SPC limits
Matrix Spikes	75% - 125%, when applicable	75% - 125%, when applicable	80%-120%	75% - 125%, when applicable
Sample Duplicates	0% - 20% when greater than 5X RL, ± RL when less than 5X RL	0% - 20% when greater than 5X RL, ± RL when less than 5X RL	0% - 20% when greater than 5X RL, ± RL when less than 5X RL	0% - 20% when greater than 5X RL, ± RL when less than 5X RL
Serial Dilutions	0% - 10% of initial raw value, when applicable	0% - 10% of initial raw value, when applicable	0% - 10% of initial raw value, when applicable (> 50x LOQ)	0% - 10% of initial raw value, when applicable
Post-digestion spikes	75%-125%, when applicable	75%-125%, when applicable	75%-125%	80%-120%, when applicable
Internal Standards	30%-120%, samples 80%-120% for ICB, ICV, CCV, CCB	60%-125% for all	30%-120%	70%-130%, for all

APPENDIX 2: CONT'D

Method/ Acceptance Criteria	SW-846 6020	EPA 200.8	DoD QSM	SW-846 6020A
Matrix Spike Duplicate	0% - 20% when greater than 5X RL, ± RL when less than 5X RL	0% - 20% when greater than 5X RL, ± RL when less than 5X RL	0% - 20% when greater than 5X RL, ± RL when less than 5X RL	0% - 20% when greater than 5X RL, ± RL when less than 5X RL
Sample Duplicates RER activity	≤ 3%	≤ 3%	≤ 3%	≤ 3%

APPENDIX 3: INTERNAL STANDARDS WITH ASSOCIATED ANALYTES/ISOTOPES

IS ^{45}Sc	IS ^{74}Ge	IS ^{115}In	IS ^{175}Lu ^{181}Ta
^{7}Li	^{66}Zn	^{88}Sr	^{133}Cs
^{9}Be	^{67}Zn (calc)	^{90}Zr	^{135}Ba (calc)
^{11}B	^{68}Zn (calc)	^{98}Mo	^{137}Ba
^{23}Na	^{75}As	^{103} Rh	^{178}Hf
^{24}Mg	^{77}Se (calc)	^{107}Ag	^{181} Ta
^{27}Al	^{82}Se	^{111}Cd	^{184}W
^{31}P	^{83}Kr (calc)	^{114}Cd (calc)	^{187}Re
^{39}K		^{120}Sn	^{205}Tl
^{43}Ca		^{121}Sb	^{208}Pb
^{47}Ti		^{123}Sb (calc)	^{209}Bi
^{51}V			^{232}Th
^{52}Cr			^{233}U
^{53}Cr(calc)			^{234}U
^{55}Mn			^{235}U
^{57}Fe			^{236}U
^{59}Co			^{238}U
^{60}Ni			
^{63}Cu(calc)			
^{65}Cu			

*(calc) – isotope used in calculations

APPENDIX 4: RADIOCHEMISTRY CONVERSION CALCULATIONS FOR URANIUM ISOTOPES

Conversion for liquids (µg/L x CF = pCi/L)

^{233}U (µg/L to pCi/L) = 9640.6
^{234}U (µg/L to pCi/L) = 6224.9
^{235}U (µg/L to pCi/L) = 2.1615
^{236}U (µg/L to pCi/L) = 64.698
^{238}U (µg/L to pCi/L) = 0.33627

Conversion for solids (mg/kg x CF = pCi/g)

^{233}U (mg/kg to pCi/g) = 9640.6
^{234}U (mg/kg to pCi/g) = 6224.9
^{235}U (mg/kg to pCi/g) = 2.1615
^{236}U (mg/kg to pCi/g) = 64.698
^{238}U (mg/kg to pCi/g) = 0.33627

Appendix C-2
Examples of Hazardous Waste Burn Slip and Boiler Waste Receipt Slip

PPE requirements: For sampling from sample pot use AK22 nitrile Rubber Gloves (or equivalent), face shield, and a rain jacket. For other sampling or for other activities that may expose operator to waste, use Rain Suit, Face Shield, AK22 Rubber Gloves. If material warrants (per Safey Policies), goggles may also be needed. Respiratory protection may be required by supervision depending on conditions.

UPDATES TO BURN SLIP

After each compliance test, limits for boiler #4 waste fuel content may change and the burn slip spreadsheet will need to be updated. Burn Slip can be found on the S Drive (S:\ENVIRON\0 - REPORTS MWAG\Boiler #4).

SAMPLING

1. Isolate the tank or trailer to be sampled. Close all inlet valves (except in the re-circulating line to tank). Tag inlet valves with equipment isolation tags.

   Note: Adding waste to the tank / trailer after the certification analysis has been performed will require the analysis be repeated before the waste can be approved to be burned.

2. Circulate the tank for at least 4 hours before sampling, longer if time allows. ~~Trailers for direct burn should have not have been sitting for more than 48 hours. Have traffic haul the trailers around the plant to stir the contents.~~

3. a. Note: two samples must normally be taken. One for the plant lab and one for the contract lab.
   b. For tanks, stand out of the line of fire and slowly open the sample valve, fill jar about half full, then close the valve.
   ~~c. For trailers, ensure trailer is grounded. Then, stand out of the line of fire and slowly open the sample valve. When the sample jar is about half full, close the sample valve. Alternatively, a trailer sample can be dipped from the top dome.~~

4. Seal the sample jars and inspect them to ensure that no material is on the outside of the jar and that there are no leaks. Label sample jars appropriately. Fill out chain of custody form. For plant lab, fill out form OCD-527 (Request for Analysis). Use Unit 1 and Code 80 for T30M61, Unit 2 and Code 80 for T30M66, Unit 99 and Code 80 for trailers. Put the tank or trailer number on the 527.

5. Send samples to the QC lab along with appropriate paperwork. The contract lab normally picks up their sample from our lab.

6. Close the Discharge valve from the tank, or trailer, and tag with an equipment isolation tag.

7. When the waste passes specifications, the Hazardous Waste Burn slip must be approved by supervision before start burning.

BURNING

1. Remove tag on tank outlet valve. Line up the valves from the certified waste tank ~~or trailer~~ to feed the waste to the boiler. ~~If burning from a tank,~~ Circulate through the mixing eductors.

~~2. If burning from a trailer, open vent on trailer to prevent collapsing trailer.~~

3. Line up valves through burner nozzle to waste storage tank. Start waste fuel feed pump. Circulate through burner nozzle for 5 minutes to get feed uniform before firing to boiler.

4. Begin to burn waste. Fill out boiler operating log. ~~If burn from a trailer, inspect trailer, pump, and area hourly~~.

5. Upon completion of burning, complete Waste Burn Slip and Waste Receipt Slip (if from trailer) and send to supervision. Remove tags on inlet valves.

~~6. If burn was from a trailer,~~
   ~~a. When trailer is empty, close the valves to the trailer and stop the pump.~~
   ~~b. Blow the line empty into waste storage tank, close valves and disconnect the trailer hose.~~
   ~~c. Attach caps on the trailer bottom nozzle and the flex hose. Close vent on trailer. Remove grounding clamp.~~

Date	Revision #	Comments/Changes
5 Apr 05	N/A	Corrected limits, revised format
11 Sept 05	N/A	Added checking pH, 5.0 minimum. This is just an internal specification.
01 Mar 06	N/A	New permit requirements added.
03 Mar 06	N/A	Modified approval - removed Return to Originator, added Rejected & optional limit on feed rate limit (added sign off that limit on feed changed in CEMS)
13 Mar 06	N/A	Changed silver to ND, based on lab capability (PQL is too high, so using MDL). Limits based on Btu removed from table since the minimum Btu calculated limits are higher than permit limits.
23 Mar 06	N/A	typo's - left off ppm on some metals
31 May 06	N/A	add MDL's for Hg & Ag
21 July 06	N/A	revised sample/burn procedure to match current practice
Dec 4 2008	N/A	revised slip to use the new Cadmium+Lead limit also
Mar 31 2009	N/A	Made tagging and isolating inlet and outlet valves of burn tank mandatory.
Sept 11 2009	N/A	Added comments to input HWC parameters to pool constants page before starting burn
5-6-10	N/A	Corrected calculations for LVM and SVM. Improved formatting and commenting.
7/10/12	N/A	Review.
1/24/13	N/A	Revised Thallium calculation in spreadsheet.
11/2014	N/A	Revised limits on metals according to compliance burn testing in spring of 2014
11/9/2015	N/A	Annual Review - Removed screenshot of boiler burn slip spreadsheet, added note about revisions of burn slip spreadsheet.
12/3/2015 ...Ag	N/A	Modify burn slip excel file for max Btu of 21,460 per max permit limit of 32,200,000 But/hr
3/25/2017	1.0	Moving Procedure to SharePoint as Revision 1.0. Removed reference to burning from a trailer - NMM

Waste Receipt Form

Date: _____ **Area:** _____

☐ **Waste will be shipped off for disposal and NOT burned in Boiler No. 4.**

☐ Hazardous ☐ Non Hazardous **Description:** _____ **Waste ID:** _____

Contact Name (PRINT): _____ **Signature:** _____

****

☐ **Waste will be burned in Boiler No. 4.**

Waste Owner complete Sections 1, 2, and 4. Boiler Operator complete Sections 3 and 5.

Section 1: Waste Identification

✓	Category	Waste ID	Waste Description, Waste Codes	Density (lbs/gal)	Composition, weight percent	Waste Codes	PPE Code	Note
	I	002	330/330 Still Bottoms (Heel)	7.52	Fuel Oil. 0-50%, Alkylated Phenols 0-50%, Normal and Isobutylbenzene 0-50%, solids 0-50%	D001	1	
	I	003	IBB Still Bottoms	7.35	IBB 0-100%, Normal butyl Benzene 0-100%	D001	1	
	II	005	T-10M-21 (WWT Organics)	7.70	Process oil 80-95%, Exxal8 0-2%, 2,6 DTBP0-5%, PME -1%, TTBP 0-1%, OTBP 0-1%, IBAP 0-1%, Water 0-0.5%	Non Hazardous	1	
	II	006	Hexane from DR-3 process	5.64	Hexane 25-100%, Methanol 0-50%, Ibuprofen or other heavies 0-25%	D001, F003	1	C
	I	007	Toluene Lights from IBB (T-15M-42)	6.80	Toluene 0-10%, 4 methyl 1 pentene 30-65%, 4 methyl 2 pentene 25-40%, hexene 0-10%	D001	1	
	I	016	Used Lubricating, Hydraulic & Cutting Oil	7.67	90-100% oil, 0-10% water. Waste oils and lubricants from maintenance activities	D001, or Non Hazardous	1	
	II	023	Methanol-Hexane Washout Area 3	6.30	Methanol 0-80%, Hexane 0-80%, IBAP 0-10%, HME 0-10%, Misc. compounds	D001, F003	1	D
	I	085	702/703 Still Bottoms with SHF Naphtha	7.77	Naphtha 0-25%, 702 0-50%, 703 0-50%, cumene 0.75%, total xylenes 0.75%; formaldehyde 0.5%, 1,2,4 Trimethylbenzene 0-5%	D001	1	
	II	090	DIPA Column Bottoms	7.10	DIPA <85%, Heavy Compounds < 75%	Non Hazardous	1	
	I	099	Process Oil from Alkyl Aluminum Cylinder Cleaning	7.52	Process Oil 90-100%, water 0-10%, alkyl organics 0-5%	Non Hazardous	1	A
	I	104	DR-3 Heel	8.93	Ibuprofen 0-10%, hexane 0-20%, para DR3 20-40%, meta DR3 10-20%	D001	1	C
	I	108	Alkyl Aluminum Vacuum Pump Oil	7.10	Process Oil 80-100%, NaOH 0-5%, Aluminum 0-2%	Non Hazardous	1	A
	II	123	Organics from DR3 Aqueous (D9069 water cut tank)	7.40	IBB 0-50%, IBAP 50-90%, PME 0-50%, HME 0-20%, Hexane 0-50%	D001	1	
	II	125	DIP Miscellaneous Organics	8.14	water 0-5%, phenol 10-15%, propoxylbenzene 0-5%, 2-isopropylphenol 35-40%, 3 ethyl 5 methylphenol 10-15%, propofol 30-35%, 2,4,6 tri-isopropylphenol 0-3%	Non Hazardous	1	C
	II	127	E4716 Organics	7.50	2,6-DTBP 0-5%, Methyl Acrylate 0-20%, Process Oil 0-95%, Exxal 8 Alcohol 10-90%, Methanol 0-5%, E4716 0-5%, AN 650 0-5%	D001	2	
	II	149	AN-701 Lights	6.51	OTBP 10-20%, 2,6 DTBP 40-55%, 2,4 DTBP 0-5%, TTBP 10-20%, 702 0-5%, phenol 5-10%, water <0.5%	D001	3	
	II	162	DIPA Waste Solvents	7.10	Aniline 15%, OIPA 7%, PIPA 1%, 2,6 DIPA 17%, Super High Flash Naphtha 0- 60%, 1,2,4 Trimethylbenzene 0-10%	D001	3	
	II	389	E4716 Methanol Byproduct	6.66	Water 0-2%, Methanol 90-100%, Methyl Acrylate 0-3%, Exxal 8 (isooctyl alcohol) 0-10%, 2, 6 DTBP 0-15%	D001	1	
	I	554	Heat Transfer Fluid	8.42	Therminol 0-100%, Water 0-50%, Dowtherm 0-100%, Thermoflo 0-10%	Non Hazardous	1	
	**I	687	T-15M-60 Recycle Toluene	7.3	Toluene 75-98%, hexane 0-5%, isobutyl benzene <1%, n-butyl benzene < 1%, methanol <0.05%, methyl acrylate <1%	D001	1**	
	II		Other_____ (Obtain Env. Dept approval)					B, C

Section 2: Completed by Waste Owner for Waste to be Burned

(1) Waste Information:

Apparent pH _____ (5.0 min) Approx. Gals. _____ Area: _____ Source (Tank): _____

(2) Transfer type: ☐ pipeline transfer or ☐ Trailer# _____ (note that trailer transfers must be monitored every hour during transfer)

(3) Waste Stream Notes (refer to Page 2 – 'Note' Column). Complete as appropriate. If no note in column, skip this section.

- **Note (A)** - Waste **IDs 99 and 108:** These wastes must be hydrolyzed by operating area before pickup by traffic. Hydrolysis Certified By: _____ (Supervisor) Date: _____
- **Note (B) - New Waste Stream:** New wastes must have an EN-PP-310 (Waste Disposition Form completed before transporting to the RCRA Facility. **Must have an ID # to unload See LOADING / UNLOADING procedures within this procedure.**
- **Note (C) Waste IDs 006, 104, and 125** - Organics from Pharma*Process can accepted if apparent pH is above 3.
- **Note (D)** Only Organic waste can be sent to the boiler.

(4) Complete the **Waste Loading (Section 4)** for trailers/buggies of waste**.**

(5) Certification: Sign below to verify that material above meets the waste description noted. Also verify for non-pipeline transfers that: (1) container is properly labeled and in good condition, (2) the Waste Loading instruction in Section 4 were followed and (3) the transfer was monitored ever hour.

Name (PRINT): _____ Signature: _____ Date: _____

(6) The Boiler Operator will either accept or reject the request. Approval from Boiler Operator/Env. Operations is required before placing waste at the No. 4 Boiler Trailer pad.

Section 3: Completed by Boiler Operator for Waste to be Burned

(1) Category of Waste:

☐ Category I Wastes, put only into T-100M-5

☐ Category II Wastes, put only into burn tanks (due to water concerns). **IDs No. 06 and No. 23 waste can only be offloaded after the water cut has been made from the burn tank. Other Category II waste may be able to have water cuts pending Env. Ops approval.**

☐ T-30M-61 ☐ T-30M-66 ☐ T-10M-32

(2) For Trailers, verify the container is in good condition, properly labeled and that the Waste Container Pre-Inspection & Load Instructions are attached. If not, do not accept at boiler.

(3) Acceptance of Waste:

☐ Accepted for burning in Boiler No. 4 Signature: _____ Date: _____

☐ Waste NOT accepted. Reason: _____
Signature _____ Date: _____

(4) Unload Waste:

FOLLOW the unload procedures in Section 5 for trailers/buggies.

Tank level measurement after transfer _____ inches
Tank level measurement before transfer _____ inches
Waste Received at No. 4 Boiler Area for waste stream: _____ inches
Convert from inches of waste to gallons and pounds:
T-100M-5: 1" = 347 gals, T-30M-61/66: 1" = 70 gals, T-10M-32: 1" = 43 gals
Use densities in waste table above to convert from gallons to lbs
_____ gallons _____ lbs

Waste Off-loaded by: _____ Date: _____

(5) Post Unload:

After unload, does trailer contain residual solids? ( ) Y ( ) N
If yes, contact Environmental Department (x5490).
If No, contact Area Owner once trailer is emptied so the trailer can be returned to Traffic.

Section 4 – Waste Loading Sheet (Completed by Waste Owner)

SAFETY EQUIPMENT: Note the appropriate PPE based on the PPE column on page 1.

I. ☐ Chemical Resistant Suit, Goggles Or Chin-Cup Face Shield, Nitrile Gloves, PVC Boots

II. ☐ Chemical Resistant Suit, Full-Face Organic Vapor Cartridge Respirator, Nitrile Gloves and Boots

III. ☐ Chemical Resistant Suit With Hood Up, Full-Face Organic Vapor Cartridge Respirator, Neoprene Gloves And Boots, Gloves Taped To Sleeves

1. **Trailer/Buggy selection**.
   a. Assist traffic in spotting the trailer/buggy. Verify pressure check date is within 6 weeks of valid pressure test end date if HAZARDOUS waste is to be loaded.
   b. Place wheel chocks and attach ground wire.
   c. Place "DO NOT MOVE" sign in front of tractor/buggy if attached to the tractor.
   d. Assure trailer/buggy discharge valves are closed.
   e. Record trailer/buggy tare weight on WASTE RECEIPT SLIP if trailer/buggy is to be weighed loaded.

2. **Inspect the trailer/buggy.**
   a. LEAVE DOME LID CLOSED EXCEPT to INSPECT TRAILER/BUGGY. Lid must always be kept closed (other than inspection and loading waste) to control air emissions.
   b. If trailer/buggy is not empty or is leaking, notify foreman. Do not load until issues are corrected.

3. **Load trailer.**
   a. Connect trailer/buggy and attach HMIS label to trailer/buggy.
   b. If Hazardous Waste, attach HAZARDOUS WASTE LABEL (which notes EPA Waste Codes, and initial accumulation start date) onto trailer/buggy. Attach HMIS Label or complete HMIS table on Waste Label. If non –hazardous waste, attach Non HAZARDOUS WASTE LABEL. Obtain waste label from Traffic or Environmental Department.
   c. Place HMIS labeled pail under trailer/buggy outlet. Connect flex-hose.
   d. Open all valves from tank or vessel to trailer. Open vent on trailer/buggy. Remove cap from 3" nozzle and verify nozzle not plugged or have manway cover open during loading.
   e. Start pump.
   f. Operator must remain in area while trailer/buggy is being loaded.

4. **After trailer/buggy is loaded.**
   a. Stop pump and close valves to trailer/buggy.
   b. Close the loading valve at tank or vessel.
   c. Open the circulating line and with N2 at the trailer/buggy loading connection, blow the line empty back to the tank.
   d. Close the circulating line.
   e. Bleed the pressure from the line before disconnecting.
   f. Disconnect the flex-hose from the trailer/buggy and close trailer/buggy vent. Attach caps on trailer/buggy bottom nozzle and flex hose.
   g. Empty 5 gallon pail into appropriate waste SAA drum for the area. Clean up as needed spill pads also are to be disposed in the appropriate waste SAA drum.

5. **Prepare trailer/buggy for transport.**
   a. Remove the ground clamp and the "DO NOT MOVE" sign in front of the trailer/buggy if needed.
   b. Notify Traffic Dept. to transport to No. 4 Boiler Trailer Pad (if hazardous waste).

Section 5 – Waste Unloading Sheet (Completed by Boiler Operator)

SAFETY EQUIPMENT: Note the appropriate PPE based on the PPE column on page 1.

I. ☐ Chemical Resistant Suit, Goggles Or Chin-Cup Face Shield, Nitrile Gloves, PVC Boots

II. ☐ Chemical Resistant Suit, Full-Face Organic Vapor Cartridge Respirator, Nitrile Gloves and Boots

III. ☐ Chemical Resistant Suit With Hood Up, Full-Face Organic Vapor Cartridge Respirator, Neoprene Gloves And Boots, Gloves Taped To Sleeves

1. **Assist the Traffic driver in spotting the trailer/buggy**. Trailer/buggy must be spotted within No. 4 Boiler Trailer Pad, which has proper secondary containment for hazardous waste.
   a. Place wheel chocks and attach ground clamp. Place "DO NOT MOVE" sign in front of trailer if attached to the tractor.
   b. Assure discharge valves are closed and no leaks are present. Notify foreman if trailer is leaking.

2. **Determine disposition of the waste.**

3. **Waste Off load.**
   Note if Waste ID **No. 06 or No. 23, ensure that any required water cuts have already been performed on the burn tank PRIOR to offloading this waste. No water cuts are allowed from the burn tank once this waste stream has been offloaded into the burn tank. This is to ensure that water cuts do not carry the F003 listed waste codes.** If waste is to be off-loaded into one of the No. 4 Boiler permitted waste storage tanks, verify that tank has enough space for the waste.
   *Monitor vent to flare. If flowrate exceeds limit, stop transfer. If material being unloaded is over 60 C (140F), unload slowly until confirm not generating vapor rate greater than flare vent limit.

   a. Do not transfer waste into tank if max level will be exceeded. Wait until tank level has been lowered.
   b. If an ID sample was not taken, contact the Area Supervisor to determine if sampling is required. Area Supervisor_____ Date _____
   c. Place HMIS labeled pail under trailer outlet and connect flex hose to trailer/buggy outlet to line to pump P-8335.
   d. Open vent on trailer/buggy. Remove cap from 3" nozzle and assure nozzle is clear, or have manway cover open during unloading.
   e. Line-up valves from the trailer to the tank. Start pump. Operator must monitor transfer at least every hour.
   f. When the trailer/buggy is unloaded, close the valves from the trailer and stop the pump. Replace cap on 3" nozzle, or close manway cover.
   g. With N2 at the trailer unloading connection, ***slowly*** blow the line empty to the waste storage tank, making sure flare flow rate stays below limits.
   h. Close the valves to the tank.
   i. Bleed the pressure from the line before disconnecting. Clean up as needed – disposing of spill pads/waste in the appropriate SAA drum.

4. **Prepare trailer for transport.**
   a. Verify that the trailer/buggy is empty. Remove labels from trailer/buggy as necessary. Mark trailer as "EMPTY".
   b. Close valves and disconnect the flex-hose from the trailer/buggy and close the trailer/buggy vent. Attach caps on the trailer bottom nozzle and the flex hose. Close vent.
   c. Remove the ground clamp and the "DO NOT MOVE" sign in front of the trailer/buggy if needed.
   d. Inform traffic that trailer/buggy is ready to move.
   e. Record amount of waste received in boiler database.
   f. Send completed Waste Receipt Slip to supervisor.

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APPENDICES

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SECTION D.2
WASTE STORAGE TANK SYSTEM
[40 CFR 264 Subpart J and 40 CFR 270.16; SC R.61-79.264 Subpart I and R.61-79.270.16]

D.2 Tank Systems

D.2.1 Tank System Descriptions

The SI Group HWMUs include four aboveground waste storage, blend, and feed tanks enclosed in a secondary containment structure that is located just east of the boiler building (see Figure D.2-1 located in Appendix D-2). Each of the four waste storage tanks is used to hold hazardous waste prior to incineration in the boiler. Each storage tank has a unique identification number (process reference codes are in parentheses) and is equipped with heater coils for the purpose of maintaining product viscosity. These tanks were permitted as new tank systems in the 2003 RCRA Permit Application.

All plant wastes designated for burning in Boiler No. 4 are collected and blended in tanks T-100M-5, T-30M-61, T-30M-66, and T-10M-32. Wastes are delivered to these tanks from truck trailers and plant pipelines. The flexible nature of ancillary piping interconnecting the tanks and the boiler allows for each tank to serve as a storage tank, blending tank, or waste burn tank. Waste is sampled and analyzed prior to burning. After being qualified to burn, waste is transferred to Boiler No. 4 via centrifugal pumps P-8331A through fuel filter F-8331.

D.2.1.1 Dimensions and Capacity of Each Tank

Tank	(Ref.#)	Capacity	Dimensions	Year Constructed	Roof
T-100M-5	(T-8332)	100,000 gal	27-foot dia x 24-foot ht.	1994	Fixed
T-30M-61	(T-8333)	30,000 gal	12-foot dia x 36-foot ht.	1990	Fixed
T-30M-66	(T-8331)	30,000 gal	12-foot dia x 36-foot ht.	1993	Fixed
T-10M-32	(T-8345)	10,000 gal	9.5-foot dia x 20-foot ht.	1993	Fixed

D.2.1.2 Description of Feed Systems, Safety Cutoff, Bypass Systems, and Pressure Controls

All of the tanks are equipped with a Magnetrol Echotel III Series 916 (or equal) Two-Wire, Intrinsically Safe Ultrasonic Level Control set to sound an alarm and close an actuated inlet valve in the tank fill line when the liquid level rises to within 16 inches of the top of the tank.

This overfill protection is a fail-safe device with a continuous self-test feature to ensure proper operation. All of the tanks are equipped with a Protectoseal Series 18540 (or equal) Conservation Breather Vent with Pipe-Away designed to provide pressure and vacuum relief in applications that require hazardous vapors to be piped away. These vents are sized to handle the maximum rates of pump-in and pump-out. SI Group employs a vapor recovery system at the facility. The vapor vents from tanks T-10M-3, T-30M-61, and T-30M-66 are directed to T-100M-5 with no liquid traps between tanks. Conservation vents on these three tanks are car-sealed closed and are no longer used. Vapors from the T-100M-5 tank are routed to a knock out pot and then to the flare for destruction.

All of the tanks are also equipped with a Protectoseal Series 53300 (or equal) Manhole and Emergency Pressure Cover Vent sized to meet Occupational Safety and Health Association (OSHA) Standard 1910.106 for Storage Vessels for Flammable and Combustible Liquids. These vents provide emergency pressure relief as well as convenient access for tank cleaning, inspection, and repair work. Under emergency fire conditions, the cover opens fully to allow escape of vapors and prevent damage to the tank due to excessive pressure. These manhole cover vents do not provide vacuum relief.

All of the tanks are equipped with an Appalachian Controls Company Series 79 (or equal) Inert Gas Blanketing System sized to provide adequate vacuum relief for the maximum pump-out rate. Inert gas blanketing is used to maintain an artificial atmosphere above the liquid in storage to prevent the entrance of air that, due to its oxygen content, can cause corrosion of the tank, or react with the liquid and to prevent the entrance of atmospheric moisture with its resultant condensation. Nitrogen is the inert gas utilized by SI Group for this gas blanketing system.

D.2.1.3 Ignitable, Reactive, and Incompatible Wastes

All flammable or ignitable wastes are transported to the boiler storage tank by truck trailer or via pipeline. The wastes delivered to the boiler storage tanks are compatible; however, some streams are segregated based on water solubility. On occasion, drums or totes of flammable waste are offloaded via a vacuum skid into the tanks.

No reactive wastes are received at the boiler tanks. All hazardous wastes stored at SI Group are separated and protected from external sources of ignition or reaction including, but not limited to, smoking, open flames, cuffing and welding, hot surfaces or radiant heat, frictional heat, sparks (static, electric, or mechanical), and spontaneous ignition (i.e., from heat-producing chemical reactions). Hazardous wastes are stored at the boiler facility in aboveground tanks constructed to American Petroleum Institute (API) 650 code requirements. Smoking is only allowed in designated

areas around the plant. Spark-proof tools and equipment are available for use, should any actions (such as spill clean-up) be necessary around ignitable or reactive wastes. Use of welding equipment or other sources of open flames within the SI Group complex are restricted; appropriate notification procedures, approvals, and permit requirements must be complied with prior to initiation of any hot work.

Sunlight is a source of radiant heat that could affect wastes stored at the SI Group facility; however, as wastes will be stored within storage tanks and tank trailers, these materials will not be exposed to direct sunlight. There is no spark-generating equipment used within the active storage area, should corrective actions or implementation of the contingency plan occur. Finally, the waste segregation and storage measures described above will prevent spontaneous ignition of wastes. Storage tanks are also equipped with nitrogen-blanketing systems to provide inert atmospheres to prevent the formation of flammable gaseous mixtures in their vapor spaces.

Storage tanks may contain various combinations of waste types; however, all wastes stored will be compatible. Incompatible or difficult to blend wastes, i.e., methanol, alcohols, and amine are transported to the boiler facility in tank trailers. At the time of generation, these wastes are loaded into one of the burn tanks to prevent contact with water. As is discussed in Section C, detailed documentation is provided regarding the nature of the waste. SI Group's waste index data sheet contains the identification number, waste name, and U.S. EPA waste code. Date of delivery to boiler area, waste generation area, amount of waste delivered, as well as waste I.D. number and waste name are shown in the Waste Receipt Slip.

D.2.2 Assessment of Tank System's Integrity

All four waste storage tanks are constructed of carbon steel and built to API 650 code requirements for vertical tanks. All waste transfer and feed piping is carbon steel or stainless steel, coated with a zinc-rich primer for corrosion protection and then insulated with 1 and 1/2 inches of calcium silicate. Piping diagrams and process flows for each of the tank systems are shown in Figures D.2-2 through D.2-11. Figures D.2-12 and D.2-13 (Appendix D-2) are the legend for tank drawings, including symbol terminology and abbreviations. The storage tanks have a 1/8-inch corrosion allowance, are primed with a zinc-rich primer for outside corrosion protection, are painted and labeled with the words "HAZARDOUS WASTE".

An independent, registered professional engineer supervised the installation of storage tanks T-100M-5, T-30M-61, T-10M-32, and T-30M-66 and ancillary piping and provided a written assessment of their structural integrity and suitability for handling hazardous waste upon completion, as documented in the 2003 RCRA Permit Application. The tanks were hydrotested and the tank welds

were partially radiographed prior to entering service. Copies of cover pages of these reports and the professional engineer's certifications are provided in Appendix D-2.1.

All tanks and all ancillary piping are inspected by SI Group (which as a company is accredited and authorized by The National Board of Boiler & Pressure Vessel Inspectors) and in accordance with SI Group Procedures PS-PP-007 (*Pressure Vessel & Storage Tank Inspection Procedure)* and PS-PP-009 (*Vessel, Piping, & Process Equipment Inspection Intervals)* by certified, SI Group employees (see Section F.2). Copies of completed inspection reports are maintained by the SI Group Maintenance Department and Environmental Department. Copies of PS-PP-007 and PS-PP-009 are provided in Appendix D-2.2. Copies of SI Group's Certificate of Authorization and Certificate of Accreditation from The National Board of Boiler & Pressure Vessel Inspectors are provided in Appendix D-2.3.

Storage tanks T-100M-5, T-30M-61, T-30M-66, and T-10M-32 are located within a single secondary containment structure which is constructed of 12-inch thick concrete masonry unit walls and a 4-inch thick concrete floor reinforced with welded wire fabric. The interior walls and floor of the structure are coated with an epoxy resin that is compatible with the wastes that are to be placed in the tank system. The storage tank secondary containment area is approximately 60 feet wide by 80 feet long with walls approximately 4.5 feet high. This structure can contain approximately 134,000 gallons, which is greater than 100 percent of the capacity of the largest tank (100,000 gallons) plus precipitation from a 25-year, 24-hour rainfall event (approximately 20,000 gallons). Calculations for determining the containment volume are shown in Appendix D-2.4. All of the waste pumps, ancillary equipment, and most of the piping are also located within the containment structures so that potential leaks from this equipment may also be contained within the facility.

The floor of the secondary containment structure slopes to a sump that is located in the northeast corner of the containment area. Any waste releases or accumulated liquids will be contained within the area and collected in this sump. An installed pump, for removal of storm water, pumps from this sump to the SI Group wastewater treatment plant. This pump must be manually activated after any significant accumulation of liquids. The sump contents are visually inspected for signs of contamination such as an oily sheen or discoloration. If contamination is suspected or a spill of hazardous material has occurred, the sump contents will be pumped into a tanker or other appropriate container within 24 hours and properly disposed. The secondary containment area and sump are inspected daily for evidence of a release, presence of debris and structural deterioration (see Section F.2).

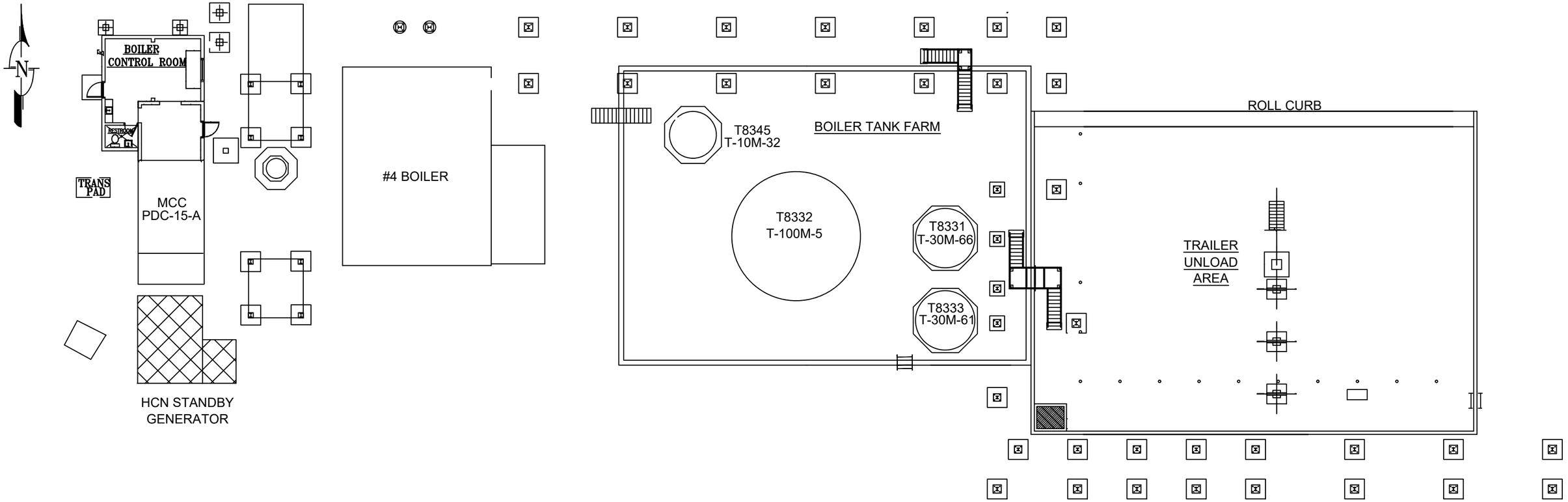
As shown in Figure D.2-1 (Appendix D-2), three stairways provide access to the HWMUs containment area. A concrete stairway is located at the northwest corner and metal stairways provide access over the north and east containment walls. All are approximately 3 feet wide and just clear the 4–foot 6 inch containment walls. Safety equipment located in the storage tank secondary containment area includes an emergency shower with an eyewash, two ANSUL 30-pound dry chemical fire extinguishers and a telephone. A fire protection turret nozzle is located 50 feet northeast of the facility just across 10th Street. Safety equipment locations are shown on Figure F-3. All safety equipment is inspected monthly, as discussed in Section F.

D.2.3 Secondary Containment and Detection Requirements for Ancillary Equipment

All ancillary devices such as pumps, piping, gauges, and the secondary containment are inspected on a daily basis to check for leaks. The three checklists that SI Group uses in its daily inspection are located in Appendix F-1. The checklist for the RCRA tanks in the secondary containment includes the ancillary equipment in addition to the tanks. The checklist for two additional temporary storage tanks at the facility (T-15M-42 and T-1546) also includes ancillary equipment. Refer to Section B.1(c)(3) for additional details on <90-day activities at SI Group.

Appendix D-2
Figures

TENTH STREET



I:\CAD PROJECTS\SI GROUP\25569 SI GROUP\PLANS\25569_B005_HAZ WASTE_SI GROUP_SC.DWG

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE RCRA FACILITY LOCATION	8/6/04 RDS	8/9/04 RDS	8/9/04 MGC	8/9/04 JWR		8/10/04 RAT

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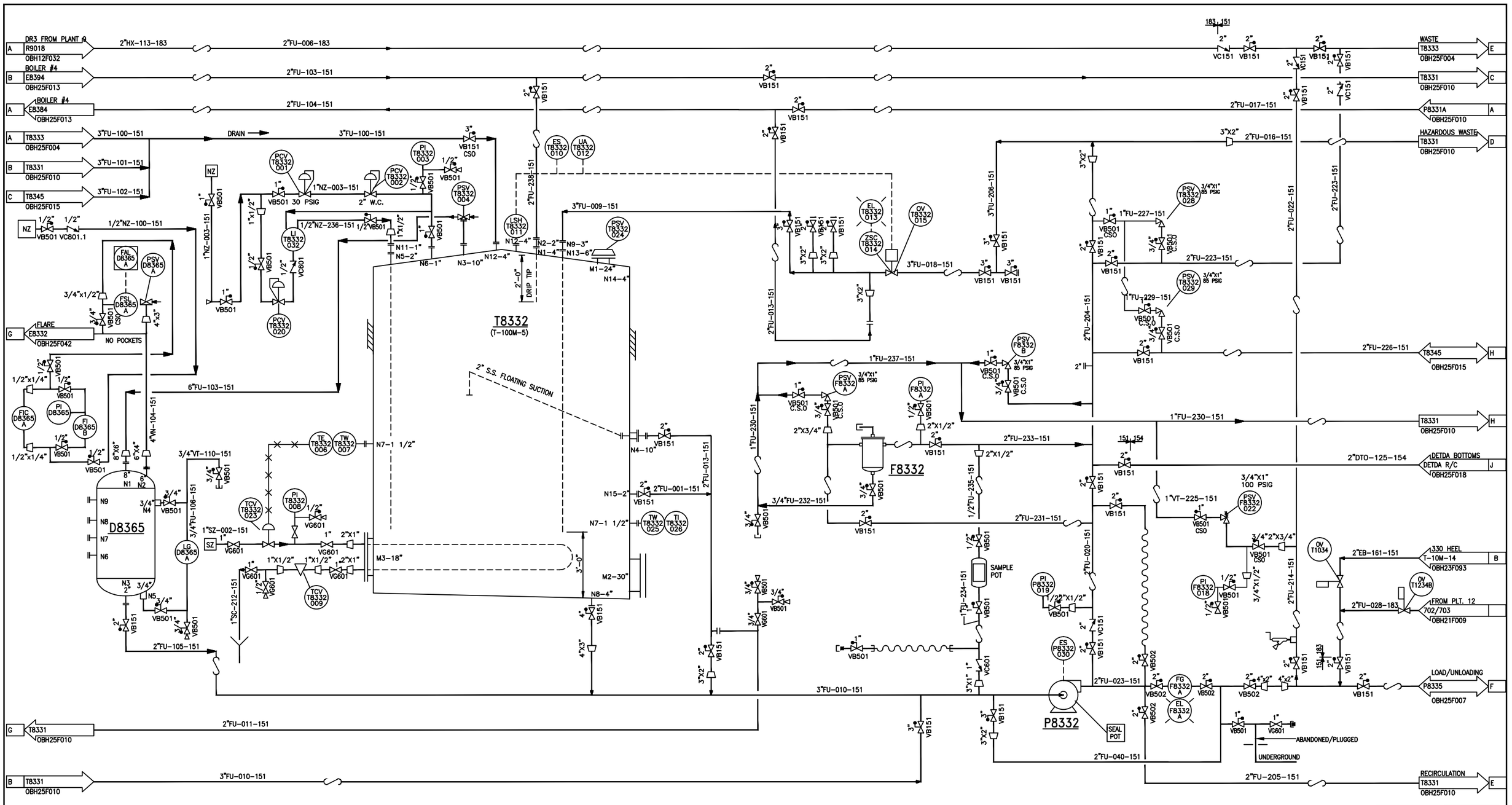
FIGURE D-2.1
ALBEMARLE ORANGEBURG
HAZARDOUS WASTE MANAGEMENT UNITS

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A410	0
SCALE: NONE	OPERATING AREA:	BUILDING NO: –



D8365
(T-250-25)
VENT COLLECTION DRUM
250 GAL 3'-0" DIA.
MAWP 104 PSI @ 450°F
VAC. 15 PSI @ 450°F
C.S.

T8332
(T-100M-5)
HAZARDOUS WASTE
100,000 GALLONS
27'-0" I.D. X 24'-0" S.S.
PRESS. AMT.
TEMO. AMB.
CARBON STEEL

F8332
4" OD
2" SPIRAX
SPARCO FILTER
TYPE 2V RSHO

P8332
(PC-200-90-10)
200 GPM @ 90 FOT HEAD
MOTOR 7.5 H.P. @ 1750 RPM
3"X2"

FIGURE D.2-2

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	AS-BUILT FOR UTILITIES	10/01/91	10/03/91			10/3/91	5/20/92
	PER PROCESS SAFETY REVIEW	RDS	RR			GFW	EG
26	REVISED PER TSR# 13046 FLARES, THERMAL OXIDE, VENT HEADERS PHA AS-BUILT WALKDOWNS	8/5/13	9/25/13	9/25/13	9/25/13	9/25/13	9/30/13
		JSJ	SA	SA	HAB	HAB	RLT
27	TSR-13290, MOC IBUPROFEN-2013-9-16	1/31/14	2/4/14	2/4/14	1/31/14	1/31/14	2/24/14
	CHANGE DR-3 HEEL LINE MATL. OF CONST. TO 183	H BASS	MDB	MDB	H BASS	H BASS	JDL
28	TSR-14211, MOC AN 330-2012-6-7	7/16/14	7/17/14	7/17/14	7/16/14	7/16/14	7/31/14
	MOVE 330 HEEL LINE	H BASS	ZGS	ZGS	H BASS	H BASS	JDL
24	TSR-9164, MOC-UTILITY SYSTEMS-2009-3-4	9/23/09	4/23/09	4/23/09	9/23/09	9/23/09	9/24/09
	SIGHT GLASS FOR T-100M-5 WATER CUTS	JWR	JSS	JSS	JWR	JWR	RLT
25	TSR-0027, MOC-AN-702/703-2009-4-1	2/24/10	2/25/10	2/25/10	2/24/10	2/24/10	3/2/10
	702 HEEL LINE TO 316 SS CONSTRUCTION	JWR	JM	JM	JWR	JWR	RLT

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WASTE FUEL STORAGE T-8332 (T-100M-5) P&IC

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F009	28

SCALE: NONE | OPERATING AREA: – | BUILDING NO: –

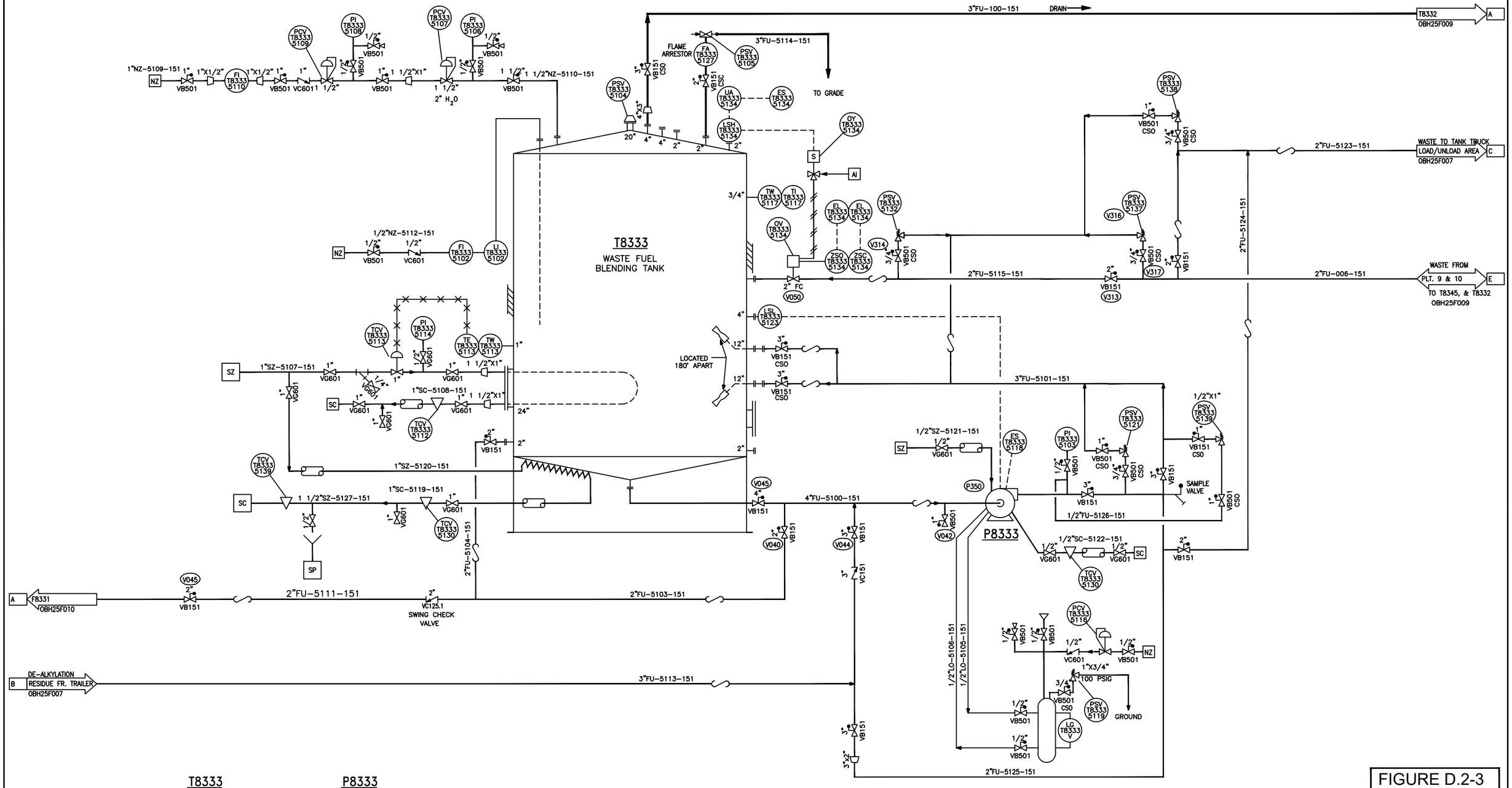

FIGURE D.2-3

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ISSUED FOR CONSTRUCTION	12/13/89					
		JSJ					
16	AS-BUILT PER TSR# 3005	7/25/03	7/30/03		7/30/03	7/29/03	8/5/03
	PHA UTILITIES	JWR	GTK		NLK	GFW	RAT
17	TSR-14099, MOC UTILITY SYSTEMS-2012-4-3	5/20/14	6/16/14	6/16/14	5/20/14	5/20/14	6/17/14
	REMOVE BELLOWS AT P8333 NEAR (T-30M-61)	H BASS	SJA	SJA	H BASS	H BASS	JDL
13	REVISED PER PROCESS SAFETY REVIEW	1/13/98	4/15/98		4/13/98	4/14/98	9/16/98
	TSR #8012	JWR	JMS		JWR	GFW	RLT
14	REVISED PER YS-04309Y TSR-7304	11/4/97	01/09/99	01/09/99	01/12/99	12/22/98	01/12/99
		JWT	AMG	AMG	JWR	GFW	RLT
15	ADDED 1/2" BALL VALVES TO CHECK NITROGEN	4/23/99	4/26/99	4/26/99	4/26/99	4/26/99	4/26/99
	DEMAND PER TSR-9068 & YS #04328Y	RR	AMG	AMG	JWR	GFW	RLT

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WASTE FUEL SYSTEM
T8333 (T-30M-61)
P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
7468	0BH25F004	17

SCALE: NONE | OPERATING AREA: – | BUILDING NO: –

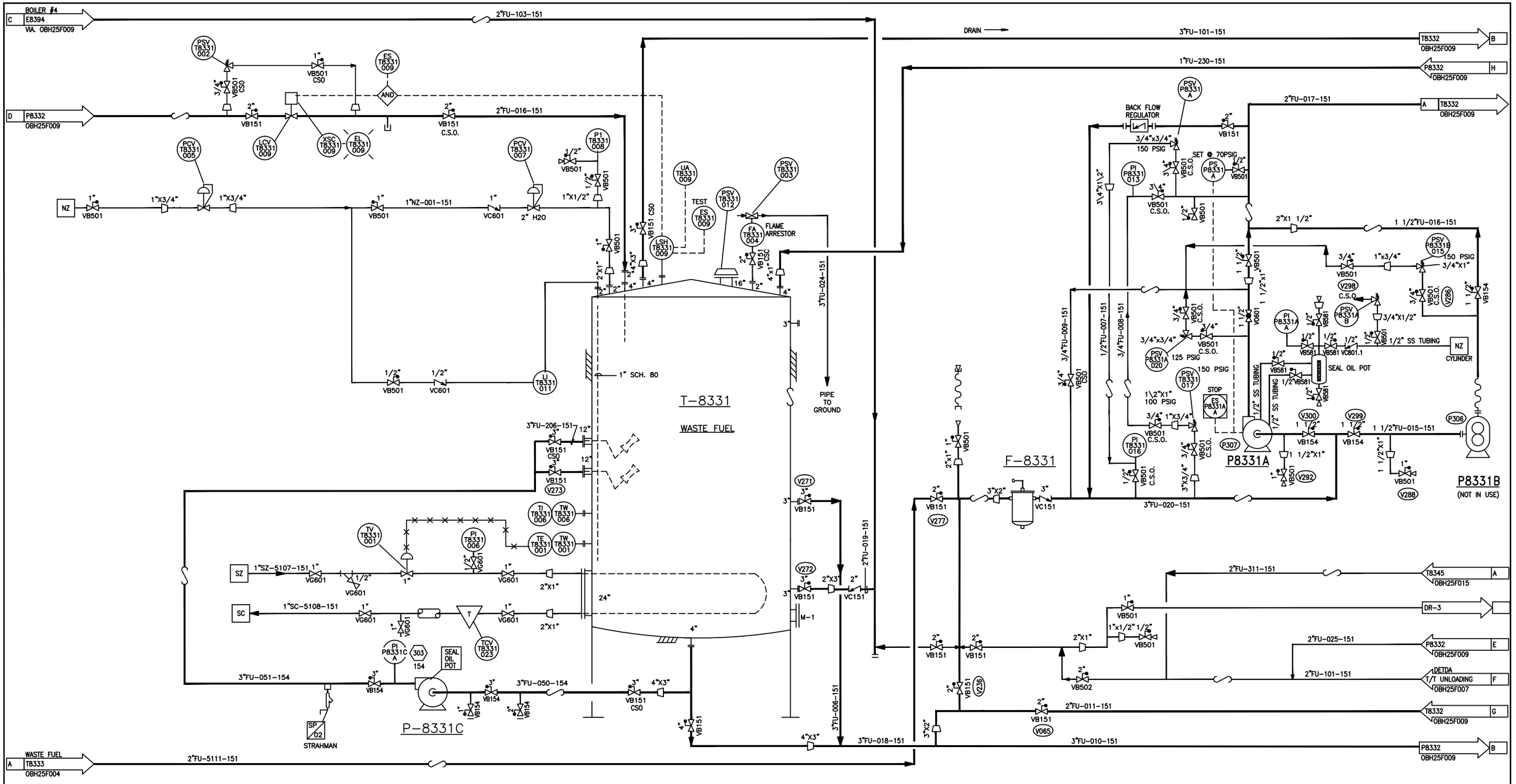

FIGURE D.2-4

F-8331

HAYWARD

P-8331A

1 x 1 1/2 - 8
3 GPM @ 290 TDH
10 HP; 3505 RPM
316 SS

P-8331B

MOTOR 3/4 H.P.
1 1/2" X 1 1/2" FNPT

P-8331C

(46474)
T8331 CIRCULATION PUMP
200 GPM @ 80' TDH
2X3-10
7.5 HP @ 1800 RPM
D.I.

T-8331

(T-30M-66)
30'000 GALS. SKIRT MT'D
12'-0" O.D. X 36'-0" S.S.
PRES. 13" H2O
TEMP. AMB.

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
5	AS-BUILT PER PROJECT #06821	4/8/94 RDS	4/8/94 RLT	4/18/94 DRH	4/18/94 JWR	4/18/94 RLT	4/18/94 RRS
21	TSR-8099, MOC-No. 4 BOILER-2008-3-369 LOW PRESS. SHUTOFF #4 BIR FEED PUMP	6/27/08 JWR	1/10/08 AMG	11/10/08 AMG	6/27/08 JWR	6/27/08 JWR	11/14/08 RLT
17	INSTALLED 1/2" BALL VALVE TO CHECK NITROGEN DEMAND PER TSR-9068 & YS #04328Y	4/23/99 RR	4/26/99 AMG	4/26/99 AMG	4/27/99 JWR	4/26/99 GFW	4/27/99 RLT
18	REVISED PER TSR# 2161 UPDATE EMERGENCY LP GAS BACK-UP	5/29/02 JWR	6/3/02 CF	6/3/02 CF	5/29/02 JWR	5/31/02 GFW	6/3/02 RLT
19	AS-BUILT PER PROJ.# 3380 BURN DETDA WASTE IN NO. 4 BOILER	12/17/02 JWR	12/18/02 ACB	12/18/02 JSS	12/18/02 JWR	12/18/02 JSS	12/18/02 RLT
20	AS-BUILT PER TSR# 3005 PHA UTILITIES	7/25/03 JWR	7/30/03 GTK		7/30/03 NLK	7/29/03 GFW	8/5/03 RAT

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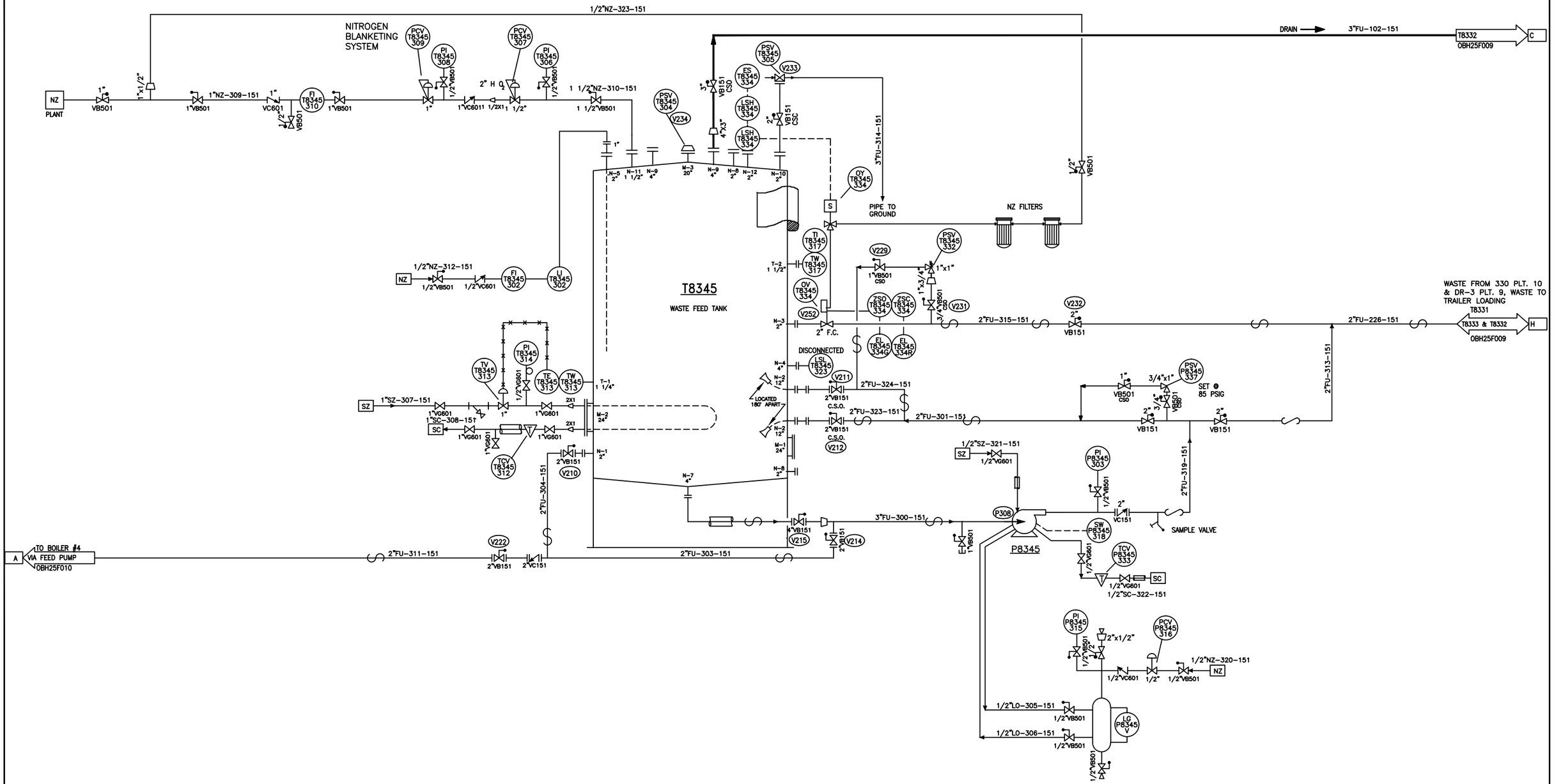
WASTE FUEL STORAGE T8331 (T-30M-66) P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F010	21

SCALE: NONE | OPERATING AREA: – | BUILDING NO: –



T8345
(T-10M-32)
WASTE FUEL TANK
9'-6" O.D. X 20'-0" T-T
DISHED BOTTOM
ATMOSPHERIC
CARBON STEEL

P8345
(PC-180-70-1)
2X3X8
150 GPM @ 60'
5 H.P. @ 1750 RPM
DUCTILE IRON
JACKETED BODY

FIGURE D.2-5

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ISSUED FOR CONSTRUCTION	3/24/92	1/26/93	1/30/93	1/27/93	1/26/93	1/27/93
	PER PROJ. 0682	JSJ	RLT	RCZ	JWR	RLT	RRS
6	REVISED PER PROCESS SAFETY REVIEW	1/14/98	4/15/98		4/13/98	4/14/98	9/16/98
	TSR #8012	JWR	JMS		JWR	GFW	RLT
7	REVISED PER TSR# 2231, YS-NO 4 BOILER-200	11/14/02	1/18/02	11/18/02	11/14/02	11/18/02	11/25/02
	DISCONNECT LSL-T8345-323	JWR	GTK	GTK	JWR	GFW	BBA
3	ADDED VALVE TAG'S PER POLLUTION CONTROL	4/22/94	4/27/94	4/26/94	4/26/94		4/27/94
		JWR	DEH	RCZ	JWR		RRS
4	AS-BUILT, VENT LINE & VALVE PER PROJ. # 22921	11/22/96	1/27/96	11/27/96	11/22/96	11/27/96	11/27/96
	VENT COLLECTION DRUM FOR HAZ. WASTE TANKS	JWR	DRH	RLT	JWR	RLT	RLT
5	AS-BUILT PER PROJ. #2715 VOC EMISSIONS	2/17/98	2/17/98	2/17/98	2/17/98	2/17/98	2/20/98
	REDUCTION WASTE FUEL TANKS	JWR	TEJ	SFC	JWR	SWB	RLT

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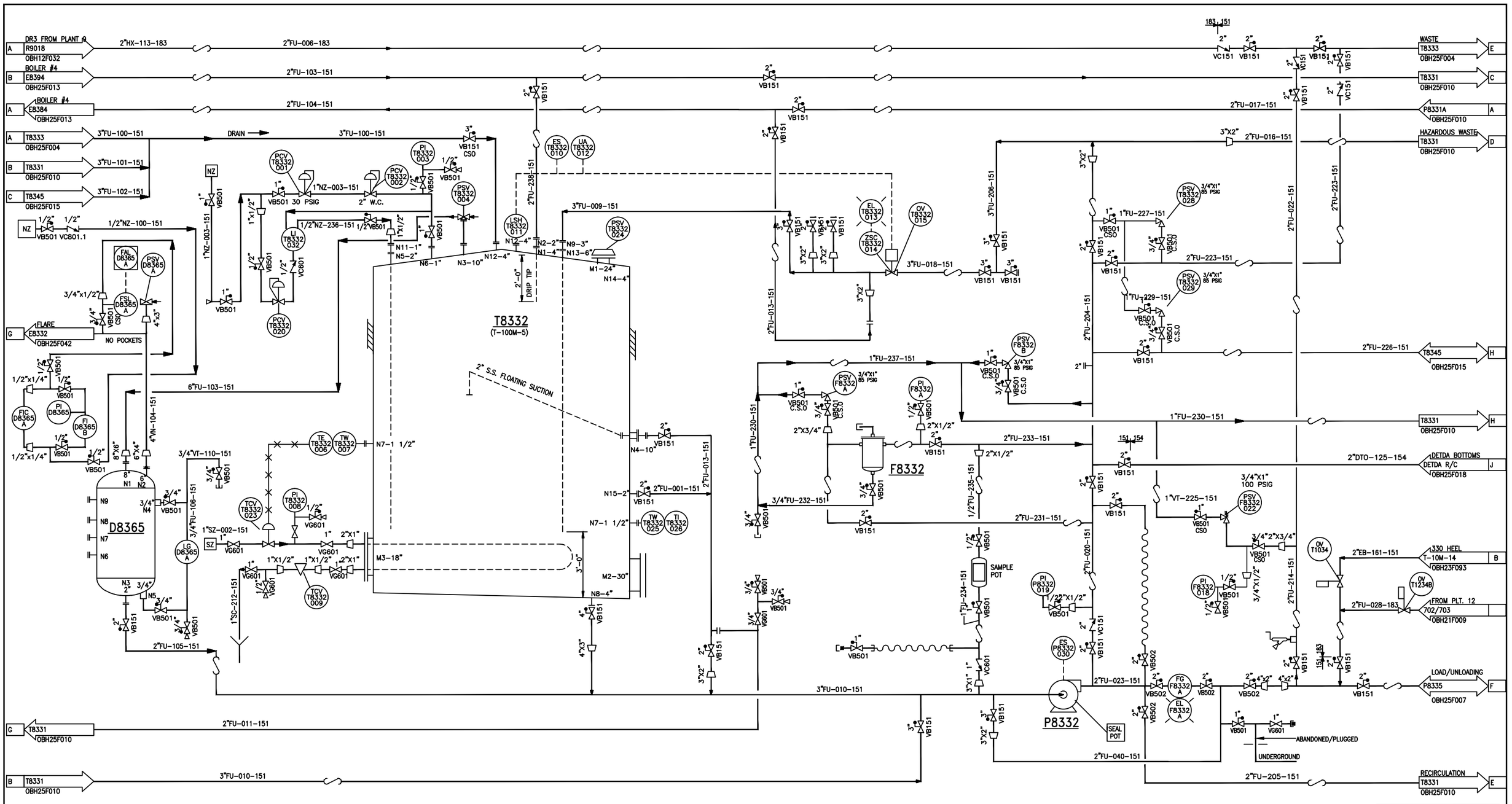
#4 BOILER IMPROVEMENT
T8345 (T-10M-32) FUEL BLEND SYSTEM
P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
0682	0BH25F015	7
SCALE: NONE	OPERATING AREA: –	BUILDING NO: –



D8365
(T-250-25)
VENT COLLECTION DRUM
250 GAL 3'-0" DIA.
MAWP 104 PSI @ 450°F
VAC. 15 PSI @ 450°F
C.S.

T8332
(T-100M-5)
HAZARDOUS WASTE
100,000 GALLONS
27'-0" I.D. X 24'-0" S.S.
PRESS. AMT.
TEMO. AMB.
CARBON STEEL

F8332
4" OD
2" SPIRAX
SPARCO FILTER
TYPE 2V RSHO

P8332
(PC-200-90-10)
200 GPM @ 90 FOT HEAD
MOTOR 7.5 H.P. @ 1750 RPM
3"X2"

FIGURE D.2-6

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ORANGEBURG

WASTE FUEL STORAGE
T-8332 (T-100M-5)
P&ID

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	AS-BUILT FOR UTILITIES	10/01/91	10/03/91			10/3/91	5/20/92
	PER PROCESS SAFETY REVIEW	RDS	RR			GFW	EG
26	REVISED PER TSR# 13046 FLARES, THERMAL OXIDE, VENT HEADERS PHA AS-BUILT WALKDOWNS	8/5/13	9/25/13	9/25/13	9/25/13	9/25/13	9/30/13
		JSJ	SA	SA	HAB	HAB	RLT
27	TSR-13290, MOC IBUPROFEN-2013-9-16	1/31/14	2/4/14	2/4/14	1/31/14	1/31/14	2/24/14
	CHANGE DR-3 HEEL LINE MATL. OF CONST. TO 183	H BASS	MDB	MDB	H BASS	H BASS	JDL
28	TSR-14211, MOC AN 330-2012-6-7	7/16/14	7/17/14	7/17/14	7/16/14	7/16/14	7/31/14
	MOVE 330 HEEL LINE	H BASS	ZGS	ZGS	H BASS	H BASS	JDL
24	TSR-9164, MOC-UTILITY SYSTEMS-2009-3-4	9/23/09	4/23/09	4/23/09	9/23/09	9/23/09	9/24/09
	SIGHT GLASS FOR T-100M-5 WATER CUTS	JWR	JSS	JSS	JWR	JWR	RLT
25	TSR-0027, MOC-AN-702/703-2009-4-1	2/24/10	2/25/10	2/25/10	2/24/10	2/24/10	3/2/10
	702 HEEL LINE TO 316 SS CONSTRUCTION	JWR	JM	JM	JWR	JWR	RLT

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F009	28
SCALE: NONE	OPERATING AREA: – BUILDING NO: –	

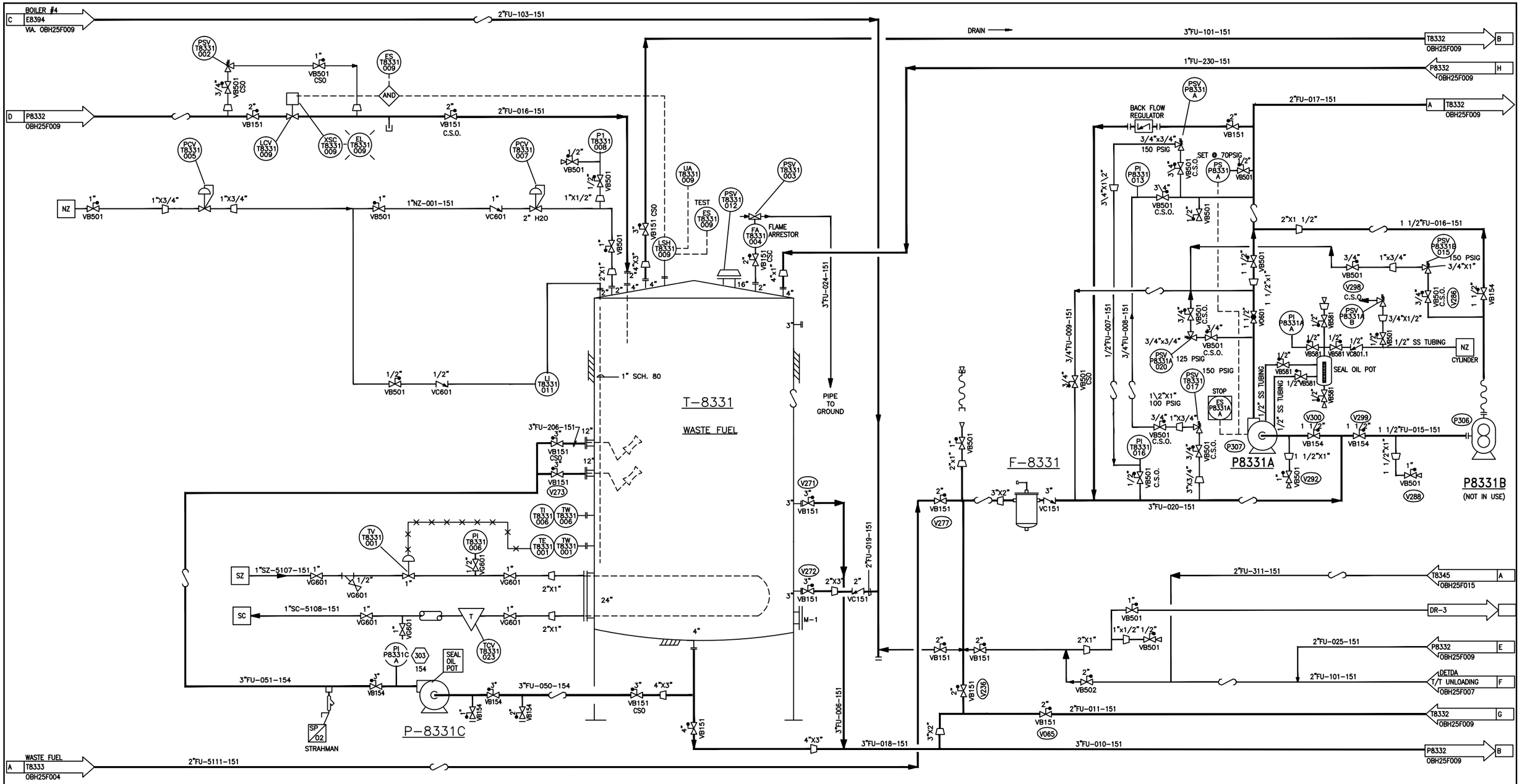

FIGURE D.2-7

F-8331

HAYWARD

P-8331A

1 x 1 1/2 - 8
3 GPM @ 290 TDH
10 HP; 3505 RPM
316 SS

P-8331B

MOTOR 3/4 H.P.
1 1/2" X 1 1/2" FNPT

P-8331C

(46474)
T8331 CIRCULATION PUMP
200 GPM @ 80' TDH
2X3-10
7.5 HP @ 1800 RPM
D.I.

T-8331

(T-30M-66)
30'000 GALS. SKIRT MT'D
12'-0" O.D. X 36'-0" S.S.
PRES. 13" H2O
TEMP. AMB.

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
5	AS-BUILT PER PROJECT #06821	4/8/94 RDS	4/8/94 RLT	4/18/94 DRH	4/18/94 JWR	4/18/94 RLT	4/18/94 RRS
21	TSR-8099, MOC-No. 4 BOILER-2008-3-369 LOW PRESS. SHUTOFF #4 BIR FEED PUMP	6/27/08 JWR	1/10/08 AMG	11/10/08 AMG	6/27/08 JWR	6/27/08 JWR	11/14/08 RLT
17	INSTALLED 1/2" BALL VALVE TO CHECK NITROGEN DEMAND PER TSR-9068 & YS #04328Y	4/23/99 RR	4/26/99 AMG	4/26/99 AMG	4/27/99 JWR	4/26/99 GFW	4/27/99 RLT
18	REVISED PER TSR# 2161 UPDATE EMERGENCY LP GAS BACK-UP	5/29/02 JWR	6/3/02 CF	6/3/02 CF	5/29/02 JWR	5/31/02 GFW	6/3/02 RLT
19	AS-BUILT PER PROJ.# 3380 BURN DETDA WASTE IN NO. 4 BOILER	12/17/02 JWR	12/18/02 ACB	12/18/02 JSS	12/18/02 JWR	12/18/02 JSS	12/18/02 RLT
20	AS-BUILT PER TSR# 3005 PHA UTILITIES	7/25/03 JWR	7/30/03 GTK		7/30/03 NLK	7/29/03 GFW	8/5/03 RAT

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WASTE FUEL STORAGE T8331 (T-30M-66) P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F010	21

SCALE: NONE | OPERATING AREA: – | BUILDING NO: –

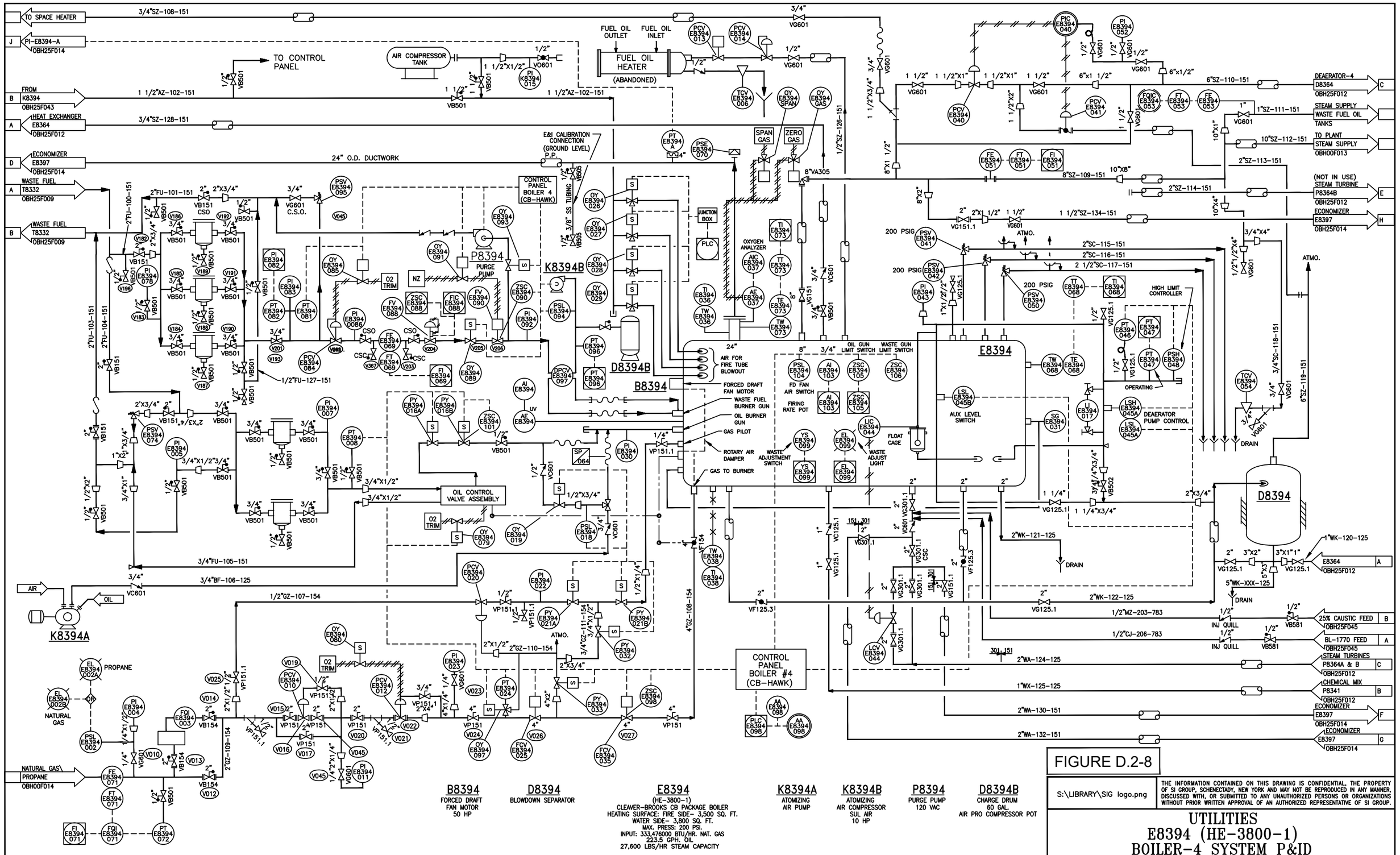

FIGURE D.2-8

S:\LIBRARY\SIG logo.png

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UTILITIES
E8394 (HE-3800-1)
BOILER-4 SYSTEM P&ID

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	AS-BUILT PER PSR	11/13/91	11/15/91			11/15/91	5/20/92
		RDS	RR			GFW	EG
16	TSR-11028, AS-BUILT PLANT-WIDE UTILITY DRAWINGS	9/28/11	9/28/11	9/28/11	9/29/11	9/29/11	10/6/11
	PER MARK-UPS ADDING LINE NUMBERS	JBQ	RAB	RAB	JBQ	JBQ	RLT
12	AS-BUILT PER TSR# 3005	7/25/03	7/30/03		7/30/03	7/29/03	8/5/03
	PHA UTILITIES	JWR	GTK		NLK	GFW	RAT
13	TSR-6084, MOC-No. 4 BOILER-2006-2-202	8/4/06	8/4/06	8/4/06	8/4/06	8/4/06	8/8/06
	REMOVED (PR-E8394-039) RECORDER #4 BOILER	JWR	AMG	AMG	JWR	JWR	RLT
14	AS-BUILT PER PROJECT #4194	2/15/07	2/19/07		2/19/07	2/19/07	2/19/07
	HAZARDS WASTE #4 BOILER IMPROVEMENT	RDS	RLT		JWR	RLT	RLT
15	TSR-0040, MOC UTILITY SYSTEMS-2009-11-1	7/20/10	8/4/11	8/4/11	8/14/11	8/14/11	8/6/11
	HEAT CHEMICAL FEED TO STEAM BOILERS	DLS	MDB	MDB	JWR	JWR	RLT

PROJECT NUMBER	PSRU	DRAWING NUMBER	0BH25F013
REV.	16		
SCALE: NONE	OPERATING AREA: –	BUILDING NO: –	

J PT-E8394-A OBH25F013

A K8395 OBH25F043

G BOILER #4 E8394 OBH25F013

H BOILER #4 E8394 OBH25F013

D BOILER #4 E8394 OBH25F013

F BOILER #4 E8394 OBH25F013

B INSTRUMENT AIR B9482 OBH15F009

1 1/2" VB501

2"WA-132-151

4"X2"

1 1/2"SZ-134-151

1 1/2" SS FLEX HOSE

2"X1 1/2"

1 1/2"X1"

24" O.D. DUCT

2"WA-130-151

3/4"WA-131-151

1"WA-131-151

1 1/2"AI-103-151

1 1/2"AI-104-151

1 1/2"-TL-137-151

1"AI-103-151

1"SC-135-151

1/2"WA-133-151

3/4"X1/2"

1"X1/2"

1 1/2"X1 1/4"

3/4"X1/4"

2"X3" @ 90 PSIG ATMO.

3"VT-134-151

1 1/2" Q.C.

1 1/2" -100-151

1" -100-151

1"VB151.3

1 1/2" Q.C.

1"AI-103-151

6"DUST-101-151

24" O.D. DUCT

24" O.D. DUCTWORK

1"WA-131-151

2"X1"

1"X3/4"

3"X2"

2"

8"

24"

3"

N1

N2

N3

N4A/B

N5A

N5B

N6A/B/C/D 4"

N7A/B/C/D 2"

N8A/B/C/D 1" CPLG.

MH-A 18"

MH-B 18"

P.P.

ATM

MINIMUM ELEVATION 60'-0" ABOVE GRADE

CEMS

LCP-E8397-1

TI E8397 G

TE E8397 G

TW E8397 G

TI E8397 H

TW E8397 H

PCV E8397 A

PSV E8397 B

PSV E8397 A

ES E8397 C

OV E8397 C

PI E8397 A

342

151

HV E8397 B

HS E8397 B

FC

GRADE

SP 001

SP 002

SP 003

E8397

TCV E8397 A

TW E8397 F

TI E8397 F

TW E8397 E

TE E8397 E

TI E8397 E

TI E8397 B

TE E8397 B

TW E8397 B

TI E8397 A

TW E8397 A

HS E8397 A

HV E8397 A

TW E8397 D

TE E8397 D

TIC E8397 D

TW E8397 C

TI E8397 C

TI E8397 D

PT B8397 A

E.R.

BLOWDOWN AIR CONTROLS BY BAGHOUSE VENDOR

XV S8397 1

1 OF 16

S8397

BAG HOUSE

20" ACCESS DOOR FOR BAG REMOVAL

PSE S8397 A

24" O.D. DUCT

VF CSO

DPT S8397 A

DPI S8397 A

DPAH S8397 A

DPAL S8397 A

T.I.

PI E8394 A

PAH E8394 A

PAL E8394 A

PIC E8394 A

PY E8394 A

VFD B8397 A

BROKEN BAG DETECTOR

AI S8397 A

AT S8397 A

AE S8397 A

ELA B8397 A

ES B8397 A

B8397

EXHAUST STACK F8397

AE S8394 A

AT S8394 A

CEMS

RV8397

ES RV8397 A

6" HAND HOLE

55 GAL DRUM

VB501

VB502

VB503

VB505

VO601

NOTE:
ECONOMIZER CONTROLLER MONITORS FEED WATER AND STACK GAS INLET / OUTLET TEMPERATURE AND CONTROLS OUTLET STACK GAS TEMPERATURE WITH DAMPER BYPASS VALVE.

FIGURE D.2-9

RV8397
( )
ROTARY AIRLOCK VALVE
6"X6"
1/4 HP

E8397
(97508)
CAIN ECONOMIZER
MODEL RTR 248G26CSS
S.S. INTERNALS
10 GA C.S. EXTERIOR
DESIGN PSIG 400 DESIGN TEMP. 650 °F

B8397
(46468)
BACK PRESSURE BLOWER
10,500 ACFM
50 HP @ 1800 RPM
C.S.

F8397
(70434)
24" DIA. SCH 20 X 60'-0" TALL
WITH 42" DIA X 44'-9" OUTSIDE SHELL
ATMOS. PRESSURE
CARBON STEEL

S8397
(46467)
BAG HOUSE DUST COLLECTOR
3183 SQ. FT. FILTER AREA
40" WC DESIGN: PRESS.
C.S.

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	AS BUILT	4/28/92				4/28/92	
		DAP				RLT	
16	TSR-9064, MOC-UTILITY SYSTEMS-2009-3-2	4/28/09	7/8/10	7/8/10	4/28/10	4/28/10	7/15/10
	PIPING CHANGES TO #4 BOILER	JWR	JEM	JEM	JWR	JWR	RLT
17	TSR-11016, MOC IBUPROFEN-2010-12-15	2/28/11	3/14/11	3/14/11	2/28/11	2/28/11	3/21/11
	TIE-IN INSTRUMENT AIR TO INCINERATOR LINES	H BASS	JDB	JDB	H BASS	H BASS	RLT
18	TSR-14154, MOC UTILITY SYSTEMS-2014-5-3	5/29/14	7/7/14	7/7/14	5/29/14	5/29/14	7/7/14
	MODIFY CONN. FOR PREKOTE & OPTICKOTE TESTING	H BASS	JAR	JAR	H BASS	H BASS	JDL
14	AS-BUILT PER PROJECT #4194	2/15/07	2/19/07		2/19/07	2/19/07	2/19/07
	HAIARDS WASTE #4 BOILER IMPROVEMENT	RDS	RLT		JWR	RLT	RLT
15	REVISED PER PROJECT # 4194	2/28/07	2/28/07		2/28/07	2/28/07	2/28/07
	ADD STRAINER AND OV	RDS	RLT		JWR	RLT	RLT

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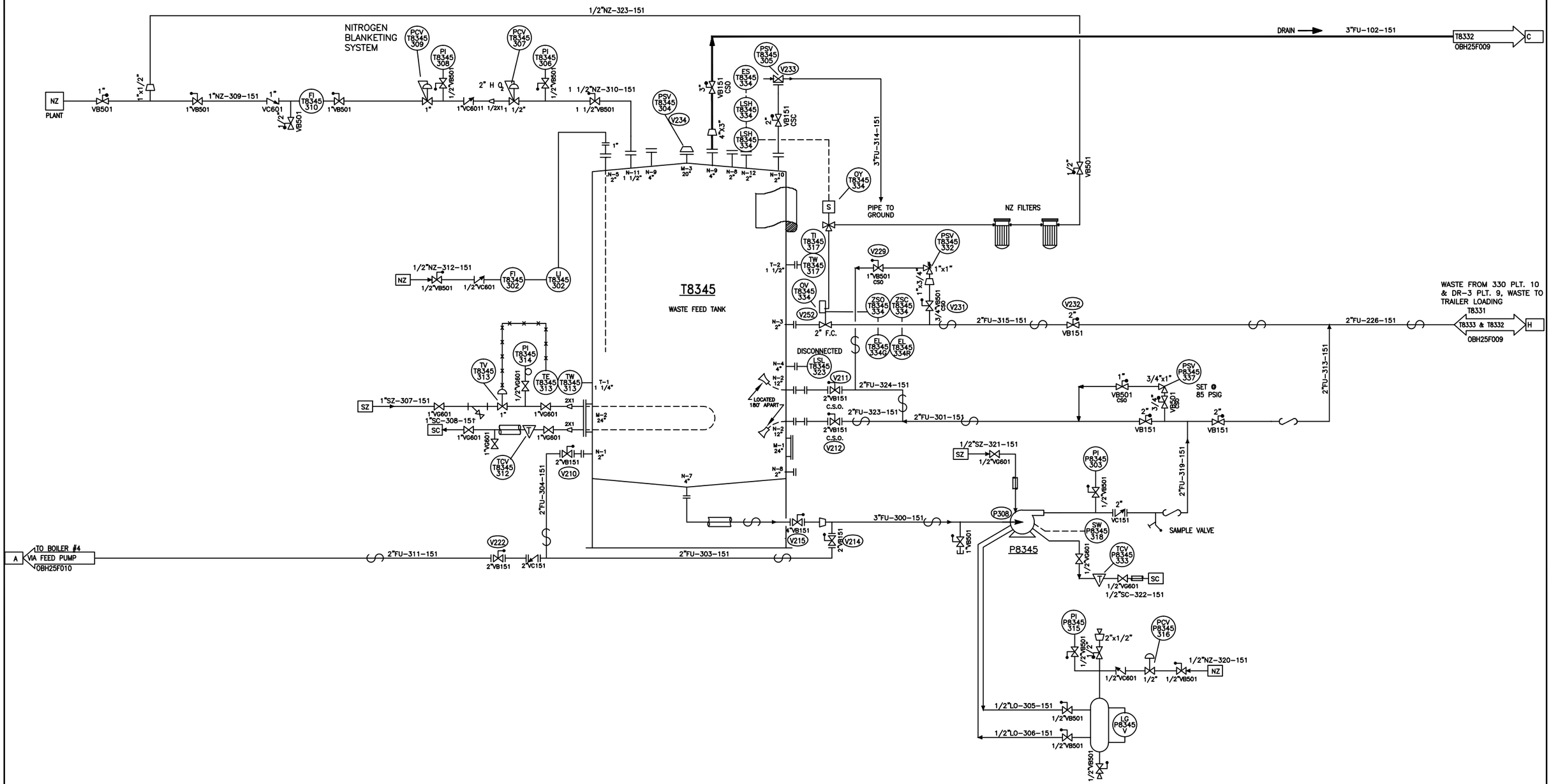
BOILER # 4 BAGHOUSE S8394 P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
0682	0BH25F014	18

SCALE: NONE | OPERATING AREA: | BUILDING NO: –



T8345
(T-10M-32)
WASTE FUEL TANK
9'-6" O.D. X 20'-0" T-T
DISHED BOTTOM
ATMOSPHERIC
CARBON STEEL

P8345
(PC-180-70-1)
2X3X8
150 GPM @ 60'
5 H.P. @ 1750 RPM
DUCTILE IRON
JACKETED BODY

FIGURE D.2-10

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ISSUED FOR CONSTRUCTION	3/24/92	1/26/93	1/30/93	1/27/93	1/26/93	1/27/93
	PER PROJ. 0682	JSJ	RLT	RCZ	JWR	RLT	RRS
6	REVISED PER PROCESS SAFETY REVIEW	1/14/98	4/15/98		4/13/98	4/14/98	9/16/98
	TSR #8012	JWR	JMS		JWR	GFW	RLT

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
7	REVISED PER TSR# 2231, YS-NO 4 BOILER-200	11/14/02	1/18/02	11/18/02	11/14/02	11/18/02	11/25/02
	DISCONNECT LSL-T8345-323	JWR	GTK	GTK	JWR	GFW	BBA
3	ADDED VALVE TAG'S PER POLLUTION CONTROL	4/22/94	4/27/94	4/26/94	4/26/94		4/27/94
		JWR	DEH	RCZ	JWR		RRS

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
4	AS-BUILT, VENT LINE & VALVE PER PROJ. # 22921	11/22/96	1/27/96	11/27/96	11/22/96	11/27/96	11/27/96
	VENT COLLECTION DRUM FOR HAZ. WASTE TANKS	JWR	DRH	RLT	JWR	RLT	RLT
5	AS-BUILT PER PROJ. #2715 VOC EMISSIONS	2/17/98	2/17/98	2/17/98	2/17/98	2/17/98	2/20/98
	REDUCTION WASTE FUEL TANKS	JWR	TEJ	SFC	JWR	SWB	RLT

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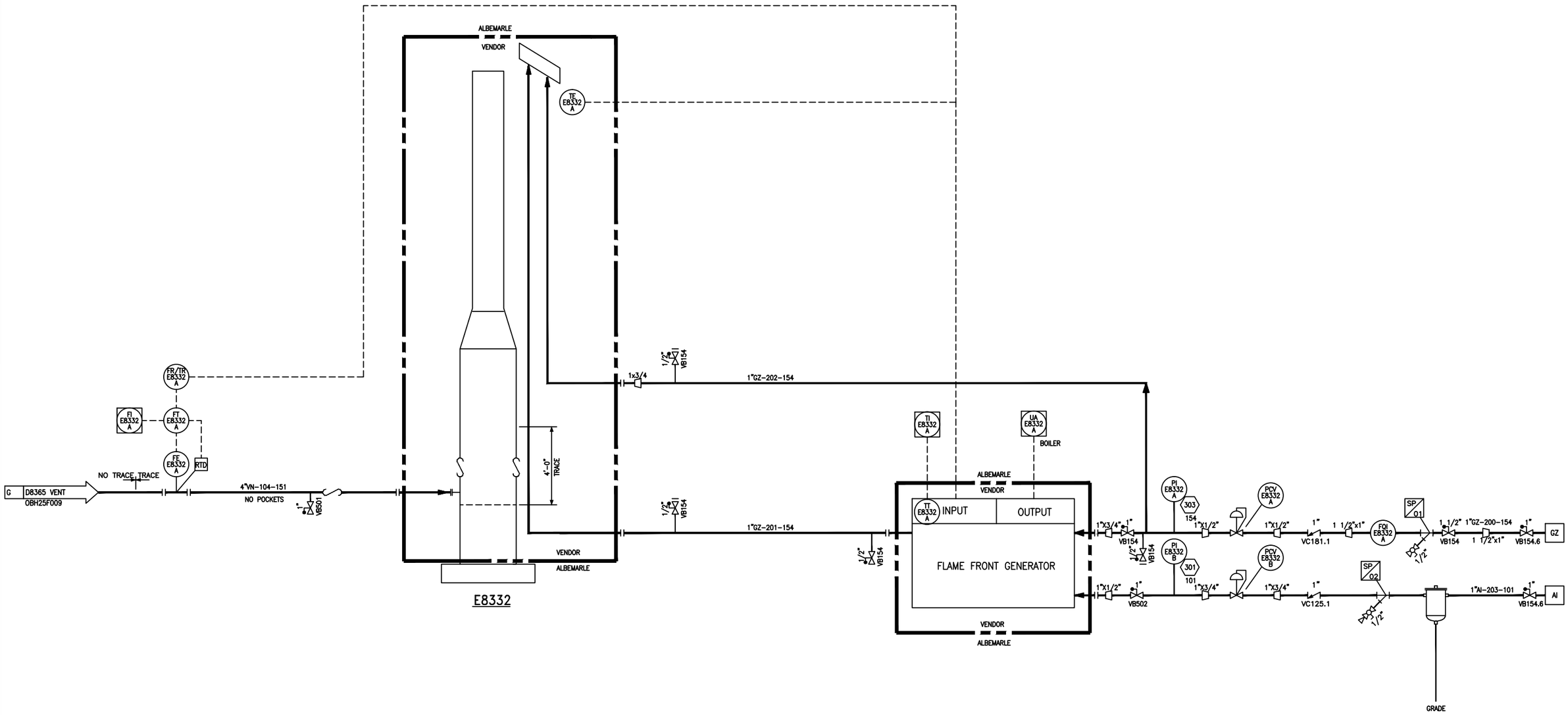
#4 BOILER IMPROVEMENT
T8345 (T-10M-32) FUEL BLEND SYSTEM
P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
0682	0BH25F015	7

SCALE: NONE | OPERATING AREA: – | BUILDING NO: –



E8332

WASTE FUEL VOC EMISSIONS
FLARE STACK

FIGURE D.2-11

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE FOR PROJECT #2715 VOC EMISSIONS	3/4/97	5/7/97	5/6/97	5/7/97	5/7/97	5/7/97
	REDUCTION FOR WASTE FUEL TANKS	JWR	DRH	SFC	JWR	SWB	RLT
1	AS-BUILT PER TSR# 3005	7/25/03	7/30/03		7/30/03	7/29/03	8/5/03
	PHA UTILITIES	JWR	GTK		NLK	GFW	RAT
2	TSR-9202, MOC-UTILITY SYSTEMS-2009-11-13	12/3/09	7/19/10	7/19/10	12/3/09	13/3/09	7/26/10
	REMOVE AIR ASSIST FROM #4 BOILER FLARE	JWR	JEM	JEM	JWR	JWR	RLT
3	TSR-12206, MOC-AREA 1-CRITICAL INST-2012-9-2	9/19/12	9/19/12	9/19/12	9/19/12	9/19/12	9/19/12
	TT-T8332-A TRANSMITTER	JWR	RAS	RAS	JWR	JWR	RLT
4	TSR-13007,MOC-UTILITY SYSTEMS-2012-9-4, BRING	1/15/13	1/15/13	1/15/13	1/15/13	1/15/13	1/15/13
	BOILER 4 FLARE FLOW & TEMP INTO DELTAV/PI	JWR	JBP	JBP	JWR	JWR	RLT
5	REVISED PER TSR# 13046 FLARES, THERMAL OXIDE,	8/1/13	9/25/13	9/25/13	9/25/13	9/25/13	9/30/13
	VENT HEADERS PHA AS-BUILT WALKDOWNS	JSJ	SA	SA	HAB	HAB	RLT

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ORANGEBURG

WASTE FUEL FLARE
E8332
P&I D

PROJECT NUMBER	DRAWING NUMBER	REV.
2715	0BH25F042	5
SCALE: NONE	OPERATING AREA: –	BUILDING NO: –

GATE VALVE / V_GATE
BALL VALVE / V_BALL
PLUG VALVE / V_PLUG
CHECK VALVE / V_CHECK
GLOBE VALVE / V_GLOBE
NEEDLE VALVE / V_NEEDLE
BUTTERFLY VALVE / V_BFLY
DAMPER VALVE / V_DAMPER
DIAPHRAGM VALVE / V_DIAFRM
PINCH VALVE MANUAL / V_PINCH
SLIDING GATE VALVE / V_SLGATE
ANGLE VALVE / V_ANG1
ANGLE VALVE MANUAL / V_ANG2
3 WAY VALVE / V_3WAY
4 WAY VALVE / V_4WAY

THROUGH VALVES

SAFETY VALVE IV_ANGPSV
GATE CONTROL VALVE IV_GT
GLOBE CONTROL VALVE IV_GL
BUTTERFLY CONTROL VALVE IV_BFY
GATE SOLENOID VALVE IV_GTSOL
GLOBE SOLENOID VALVE IV_GLSOL
BUTTERFLY SOLENOID VALVE IV_BFYSOL
PNEUMATIC GATE VALVE IV_GTPNM
PNEUMATIC GLOBE VALVE IV_GLPNM
PNEUMATIC BUTTERFLY VALVE IV_BFYPNM
GATE PRESSURE REG IV_GTPR
GLOBE PRESSURE REG IV_GLPR
BUTTERFLY PRESSURE REG IV_BFYPR
GATE SPRING ACTUATOR IV_GTSPG
GATE DOUBLE SPRING ACTUATOR IV_GTDSPG
BUTTERFLY SPRING ACTUATOR IV_SPRGBFY
CONSERVATION VENT IV_CONVENT
CONTROL ACTUATOR IV_CTR
SOLENOID ACTUATOR IV_SOL
SPRING ACTUATOR IV_SPRING
GATE SPRING VALVE W/ SOLENOID LIMIT SWITCHES IV_SPGGTAA
GLOBE SPRING VALVE W/ SOLENOID LIMIT SWITCHES IV_SPGGLA
BUTTERFLY SPRING VALVE W/ SOLENOID LIMIT SWITCHES IV_SPGBFYA

ALL INST. VALVES INSERTED WITH BALLOON IB_3B

INSTRUMENT VALVES

SLIP BLIND W/1 FLANGE FB_SLPB1C
SLIP BLIND W/ 2 FLANGES FB_SLPB2C
SPEC BLIND W/1 FLANGE NORM. OPEN FB_SPKB1C
SPEC BLIND W/1 FLANGE NORM. CLOSED FB_SPKB1O
SPEC BLIND W/2 FLANGES NORM. OPEN FB_SPKB2C
SPEC BLIND W/2 FLANGES NORM. CLOSED FB_SPKB2O
BLIND FLANGE FF_1VALFLG
BREAKOUT FLANGES FF_2FLG
FLANGES FOR VALVES FF_2VALFLG
EXPANSION JOINT FF_EXPJT
ORIFICE FLANGE FF_ORFIC
UNION FF_UNION
FLOW ORIFICE W/ O/P INSTRUMENT FF_ORF_DP

FITTINGS > FLANGES & BLINDS

CONCENTRIC REDUCER FR_CRED
ECCENTRIC REDUCER FR_ERED
STRAINER FR_WYE
STRAINER W/ BALL VALVE FR_WYEVB
STRAINER W/ GATE VALVE FR_WYEVG
STRAINER W/ GLOBE VALVE FR_WYEVO
STRAINER W/ PLUG VALVE FR_WYEVP
STRAINER W/ CHECK VALVE FR_WYEVC

FITTINGS > REDUCERS & STRAINERS

DRAIN HUB FM_DRAIN
FLEX HOSE FM_FLEXHZ
FLEX HOSE W/CONNECTIONS FM_FLXHC
HOSE CONNECTION FM_HC
LINE BREAK FM_LBRK
PIPE CAP FM_PCAP
PIPE BREAK FM_PEND
PLUG FM_PLUG
PIPE PLUG FM_PPLUG
STRAHMAN FM_SMPVAL
STEAM TRAP FM_STMTRP
SWIVEL JOINT FM_SWVJT
TRAP FM_TRAP
VENT TO AIR FM_VNT2AIR
SPRINKLER HEAD FM_SPRNKLR

FITTINGS > MISCELLANEOUS

1 LINE FIELD INSTRUMENT BALLOON IB_1B
2 LINE FIELD INSTRUMENT BALLOON IB_2B
BEHIND MAIN PANEL OR I/O MOUNTED IB_2BBM
IB_2BDBM
IB_2BDHM
IB_2BHM
LIGHTING IB_2BLL
LIGHTING IB_2BLM
IB_3B IB_3B
IB_3BBM IB_3BBM
PROGRAM LOGIC CONTROL FUNCTION IB_3B
LOCAL PANEL IB_3B
MAIN PANEL IB_3B
DETAIL TAG IB_DETTAG

INSTRUMENTATION > BALLOONS

INTERLOCK CONNECTION OR PURGE SYSTEM IM_DIAM
DIAPHRAGM SEAL IM_DIAPH
CONTROL TAG IM_IPTAG
RUPTURE DISK IM_RDISK
SMALL CIRCLE IM_SMCIR
WEIGHT SCALE IM_WSCALE
FLOW ORIFICE W/ O/P INSTRUMENT FF_ORF_DP

INSTRUMENTATION > MISCELLANEOUS

LEFT SIDE OFF PAGE CONNECTOR FLOW BOTH WAYS GA_CARDBL
RIGHT SIDE OFF PAGE CONNECTOR FLOW BOTH WAYS GA_CARDBR
LEFT SIDE OFF PAGE CONNECTOR FLOW ENTERING GA_CARFL
RIGHT SIDE OFF PAGE CONNECTOR FLOW ENTERING GA_CARFR
LEFT SIDE OFF PAGE CONNECTOR FLOW EXITING GA_CARTL
RIGHT SIDE OFF PAGE CONNECTOR FLOW EXITING GA_CARTR
LEADER ARROW GA_DIMARR
LEADER CIRCLE GA_DIMCIR
LEADER DOT GA_DIMDOT
LARGE FLOW ARROW GA_FLOARL
MEDIUM FLOW ARROW GA_FLOARM
SMALL FLOW ARROW GA_FLOARS
TIE-IN TAG LEFT GA_TIEINL
TIE-IN TAG RIGHT GA_TIEINR

GRAPHICS > ARROWS

HORN GM_HORN
NITROGEN BOTTLE GM_N2BOT
REVISION TRIANGLE GM_REVTRI
SECTION ARROW GM_SECTARR
SPEC BREAK RIGHT AND UP GM_SPECBKL
SPEC BREAK LEFT AND DOWN GM_SPECBKR
SPECIALTY ITEM TAG GM_SPITM
UTILITY CONTINUATION BOX GM_UTILBOX
UTILITY CONTINUATION TAG GM_UTILTAG

GRAPHICS > MISCELLANEOUS

COLD INSULATION GP_INSLC
HOT INSULATION GP_INSLH
PERSONAL PROTECTION GP_INSLPP
ELECTRIC TRACE GP_TRCE
STEAM TRACE W/O HEAT TRANSFER CEMENT GP_TRCS
STEAM TRACE DOUBLE W/ HEAT TRANSFER CEMENT GP_TRCSD
STEAM TRACE SINGLE W/ HEAT TRANSFER CEMENT GP_TRCSS
STEAM TRACED W/ HEAT TRANSFER CEMENT & TFK CHANNEL GP_TRCSH
STEAM TRACE W/SOCK GP_TRCSSK

GRAPHICS > PIPING

PS_B1
PS_B2
PS_B3
PS_B4
PRESSURE PS_CIR
VACUUM PS_CIRSQ
INTERLOCK PS_DIAM
PS_OVAL
FLOW RATE PS_OVPT
TEMPERATURE PS_RECT
SUMMATION PS_M01
PLUS PS_M02
NEGATIVE PS_M03
DELTA PS_M04
PLUS OR MINIS PS_M05
SQUARE ROOT PS_M07
DIVISION PS_M08
GREATER THAN PS_M09
LESS THAN PS_M10
MULTIPLIER PS_M11

PROCESS SYMBOLS

MAJOR
MINOR
PROCESS
ELECTRICAL
INSTRUMENT
AIR/PNEUMATIC
CAPILLARY
HYDRAULIC
SONIC
DCS/SOFTWARE
NUCLEAR

LINES

UNIT ABBRE□IATIONS

EL	ELECTRONIC LIGHT
ES	ELECTRONIC SWITCH
FA	FLAME ARRESTOR
FAL	FLOW ALARM - LOW
FIC	FLOW INDICATING CONTROLLER
LG	LE□EL GAGE GLASS
LI	LE□EL INDICATOR
LC□	LE□EL CONTROL □AL□E
PC□	PRESSURE CONTROL □AL□E
PI	PRESSURE INDICATOR
PS□	PRESSURE SAFETY □AL□E
TC□	TEMPERATURE CONTROL □AL□E
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
O□	OPERATOR □AL□E

FIGURE D.2-12

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	P&ID PROGRAM DEVELOPMENT	9-25-00 WAM					
1	GENERAL REVSION AND UPDATE TO SI GROUP BORDER & TITLE BLOCK	9/21/15 H BASS			9/21/15 H BASS		

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P&ID
BLOCK LEGEND
SHEET 1 OF 2

DWGCHART01

PROJECT NUMBER | DRAWING NUMBER | REV. 1

SCALE: NONE | OPERATING AREA: | BUILDING NO:

EQP #

EQUIP_NO
NAME
SIZE
DESIGN: XXXX PSIG @ XXXX F
MATERIALS_OF_CONSTRUCTION
INSULATION: THK_&_TYPE
DRUM DESCRIPTION
E_DRUM

EQUIP_NO
NAME
SIZE
DESIGN: XXXX PSIG @ XXXX F
MATERIALS_OF_CONSTRUCTION
PACKING/TRAYS: TYPE_MAT'L_QTY
INSULATION: THK_&_TYPE
COLUMNS DESCRIPTION
E_COLOUMNS

EQUIP_NO
NAME
TYPE_DRIVE
SIZE
XXXX GPM @XXXX TDH
MATERIALS_OF_CONSTRUCTION
INSULATION: THK_&_TYPE
PUMP DESCRIPTION
E_PUMP

EQUIPMENT TAG
E_EQPTAG

EQUIP_NO
NAME
TYPE_DRIVE
XXXXCFM @ XXXX PSIG
XXXX HP; XXXX RPM
MATERIALS_OF_CONSTRUCTION
NO_OF_STAGES
INSULATION: THK_&_TYPE
COMPRESSOR DESCRIPTION
E_COMP

EQUIP_NO
NAME
TYPE_DRIVE
XXXX CFM @ XXXX PSIG
XXXX HP; XXXX PRM
MATERIALS_OF_CONSTRUCTION
INSULATION: THK_&_TYPE
VACUUM PUMP DESCRIPTION
E_VACPUMP

EQUIP_NO
NAME
SIZE_CAPACITY
DESIGN: XXXX @ XXXX F
MATERIALS_OF_CONSTRUCTION
INSULATION: THK_&_TYPE
TANK DESCRIPTION
E_TANK

EQUIP_NO
NAME
SIZE
TEMA_TYPE
SHELL DESIGN: XXXX PSIG@ XXXX F
TUBE DESIGN: XXXX PSIG@ XXXX F
MATERIALS_OF_CONSTRUCTION
INSULATION: THK_&_TYPE
EXCHANGER DESCRIPTION
E_EXCHGR

EQUIP_NO
NAME
SIZE_CAPACITY
SHELL DESIGN: XXXX PSIG@ XXXX F
JACKET DESIGN: XXXX PSIG@ XXXX F
MATERIALS_OF_CONSTRUCTION
INSULATION: THK_&_TYPE
REACTOR & AUTOCLAVES DESCRIPTION
E_REACTOR

EQUIP_NO
NAME
MOTOR: XXXX HP; XXXX RPM
IMP: XXXX XXXX RPM
IMPELLER_TYPE
MATERIALS_OF_CONSTRUCTION
AGITATOR DESCRIPTION
E_AGITATOR

EQUIP_NO
NAME
RATING
POWER_SOURCE
MOTOR_HP
BRIDGE CRANE DESCRIPTION
E_BRDGCRAN

EQUIP_NO
NAME
DESIGN: XXXX PSIG@ XXXX F
XXXX GPM@ XXXX PSI
TYPE_EFFICIENCY
MATERIALS_OF_CONSTRUCTION
INSULATION_THK_TYPE
FILTER DESCRIPTION
E_FILTER

EQUIP_NO
NAME
FLOW_RATE
CAPACITY
MOTOR: XXXX HP; XXXX RPM/CELL
MATERIALS_OF_CONSTRUCTION
NO_OF_CELLS
COOLING TOWERS DESCRIPTION
E_CTOWERS

EQUIP_NO
NAME
HEAT_REJECTION @ XXXXF
REFRIGERANT/ CONDENSING_FLUID
MOTOR: XXXX @ XXXX RPM
INSULATION_THK_TYPE
REFRIGERATION MACHINE DESCRIPTION
E_REFRIG

EQUIP_NO
NAME
CONVEYOR_TYPE
FLOW_RATE
MOTOR: XXXX HP; XXXX RPM
MATERIALS_OF_CONSTRUCTION
CONVEYOR DESCRIPTION
E_CONVEYOR

EQUIP_NO
NAME
XXXXCFM@ XXXX WC@ XXXX RPM
MOTOR: XXXXHP@ XXXX RPM
DRIVE_MECHANISM
MATERIALS_OF_CONSTRUCTION
INSULATION_THK_TYPE
BLOWER & FAN DESCRIPTION
E_BLOWER

EQUIP_NO
NAME
SIZE
CAPACITY
MAX_RATE
SPEED
MOTOR: XXXX HP@XXXX RPM
MATERIALS_OF_CONSTRUCTION
ROTARY AIR LOCK DESCRIPTION
E_ROTYAIRL

EQUIPMENT > TAGS

PROPELLER AGITATOR OR MIXER
EV_AGPROP

TURBINE AGITATOR OR MIXER
EV_AGTURB

BIN ACTIVATOR
EV_BINACT

API TANK
EV_APITNK

PACKED COLUMN
EV_COLPAK

TRAYED COLUMN
EV_COLTRAY

KNOCKOUT POT
EV_KOPOT

PRESSURE VESSEL
EV_PRSVES

SAMPLE POT
EV_SAMPOT

SEAL OIL POT
EV_SLOILPT

SILO BIN OR HOPPER
EV_SILHOP

SPHERE
EV_SPHR

EQUIPMENT > VESSELS

BLIND FLANGE
EE_BF

FLANGED NOZZLE
EE_SN1

FLANGED NOZZLE W/ BLIND FLANGE
EE_SN2

FLANGED NOZZLE W/ BLIND FLANGE
EE_DN1

INSULATION
EE_INSUL1

PP INSULATION
EE_INSUL2

SPRAY NOZZLE
EE_SPRYNZ

EJECTOR
EE_EJECTOR

1/2 COUPLING
EE_COUP

FRONT VIEW FLANGE
EE_FN

MANWAY
EE_MANWAY

INSULATION
EE_INSUL

FILTER
EE_FILTER

PACKING FILTER
EE_FILTER2

VENT HEAD
EE_VNTHEAD

VENT TUBE
EE_VNTUBE

EQUIPMENT > ELEMENTS

AIR SLIDE
EM_AIRSLD

BLENDER DOUBLE CONE
EM_BLNDRDC

AT GRADE

BLOW DOWN
EM_BLOWDWN

BELT CONVEYOR
EM_BLTCNV

JET ENDUCTOR
EM_EJECTOR

EXTRUDER
EM_EXTRDR

STATIC MIXER OR IN-LINE MIXER
EM_ILMIXR

ROTARY DRYER
EM_RTDRYR

ROTARY VALVE
EM_RTVALV

SCREW CONVEYOR
EM_SCWCNV

SCREENER
EM_SCRNR

SPRAY DRYER
EM_SPYDRY

SIZE REDUCING EQUIPMENT
EM_SZRED

THICKENER
EM_THKNR

VIBRATING CONVEYOR
EM_VIBCNV

EQUIPMENT > MISCELLANEOUS

55GAL DRUM
ET_55DRUM

BAG
ET_BAG

BAGGER
ET_BAGR

DUMP TRUCK
ET_DUMPTRK

FORK LIFT
ET_FRKLFT

HOIST
ET_HOIST

ISO TANK
ET_ISOTNK

SCALE
ET_SCALE

TANK TRUCK
ET_TRAILR

RAIL CAR
ET_TRNCAR

EQUIPMENT > TRANSPORTATION

AIR INTAKE FILTER
EF_AIRIN

FILTER BAG
EF_BAG

BAG HOUSE (BOTTOM REMOVAL)
EF_BAGHBR

BAG HOUSE (TOP REMOVAL)
EF_BAGHTR

CARTRIDGE OR BAG FILTER
EF_CART

BATCH CENTRIFUGE
EF_CENBAT

CONTINUOUS CENTRIFUGE
EF_CENCON

CYCLONE
EF_CYCLONE

DUST FILTER
EF_DUST

IN-LINE CONE FILTER
EF_ILCONE

PACKED FILTER
EF_PACKED

PLATE FILTER
EF_PLATE

CENTRIFUGAL ENTRAINMENT SEPARATORS
EF_SEPCENT

WIRE MESH ENTRAINMENT SEPARATORS
EF_SEPWM

IN-LINE SINGLE FILTER
EF_SINGLE

EQUIPMENT > FILTERS

BLOWER OR FAN
EP_BLOWER

CENTRIFUGAL COMPRESSOR
EP_CENCOMP

DIAPHRAGM PUMP
EP_DIAPH

HORIZONTAL CENTRIFUGAL PUMP
EP_HORCENT

LIQUID RING VACUUM PUMP
EP_LIQRG

POSITIVE DISPLACEMENT PUMP
EP_POSDIS

DUPLEX RECIPROCATING PUMP OR COMPRESSOR
EP_RECOMPD

SIMPLEX RECIPROCATING PUMP OR COMPRESSOR
EP_RECOMPS

ROTARY COMPRESSOR OR VACUUM PUMP
EP_RTCOMP

ROTARY OR GEAR PUMP
EP_RTORGR

ROTARY VANE VACUUM PUMP
EP_RTVAC

SCREW TYPE
EP_SCREW

VERTICAL IN-LINE PUMP
EP_VERIL

IN-LINE PUMP PIPE MOUNTED
EP_VERILPM

VERTICAL CENTRIFUGAL PUMP OR VERTICAL SUMP PUMP
EP_VERSUMP

ENGINE
EP_GMOTOR

TURBINE
EP_TURBINE

MOTOR
EP_MOTOR

EQUIPMENT > PUMPS

AIR COOLED EXCHANGER
EH_AIRCLD

BOILER
EH_BOILER

COOLING TOWER
EH_CLDTRW

DOUBLE PIPE EXCHANGER
EH_DBPIPEX

HORIZONTAL SHELL & TUBE EXCHANGER
EH_HSH-TM

HORIZONTAL SHELL & TUBE EXCHANGER
EH_HSH-TS

INTERNAL COIL EXCHANGER
EH_ICOIL

KETTLE TYPE EXCHANGER
EH_KETTLE

PLATE & FRAME EXCHANGER
EH_PL-FRM

PROCESS SHELL & TUBE
EH_STPRC

VERTICAL SHELL & TUBE EXCHANGER
EH_VSH-TM

VERTICAL TUBE CIRCULAR HEATER
EH_VTHEATR

EQUIPMENT > HEAT EXCHANGERS

NOTES:
1.) SEE DWGCHART01.DWG FOR BLOCKS & LINETYPES.

Figure D.2-13

SI Group The Substance Inside

THE INFORMATION CONTAINED ON THIS DRAWING IS CONFIDENTIAL, THE PROPERTY OF SI GROUP, SCHENECTADY, NEW YORK AND MAY NOT BE REPRODUCED IN ANY MANNER, DISCUSSED WITH, OR SUBMITTED TO ANY UNAUTHORIZED PERSONS OR ORGANIZATIONS WITHOUT PRIOR WRITTEN APPROVAL OF AN AUTHORIZED REPRESENTATIVE OF SI GROUP.

P&ID
BLOCK LEGEND
SHEET 2 OF 2

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	P&ID PROGRAM DEVELOPMENT	9-25-00 WAM					
1	GENERAL REVSION AND UPDATE TO SI GROUP BORDER & TITLE BLOCK	9/21/15 H BASS			9/21/15 H BASS		

PROJECT NUMBER	DWGCHART02
SCALE: NONE	DRAWING NUMBER: 1
OPERATING AREA:	BUILDING NO: 0284
	REV.

C:\Users\jernigje\AppData\Local\Microsoft\Windows\INetCache\IE\1B5OJOJ6\DWGCHART02.dwg, 7/11/2019 1:37:58 PM

Appendix D-2.1
Professional Engineering Certifications
For Tanks T-100M-5, T-30M-61, T-30M-66 and T-10M-32

FILE COPY

ENGINEERING DESIGN & TESTING Corp.
ENGINEERS / CONSULTANTS / LABORATORIES

CORPORATE OFFICES:
COLUMBIA DISTRICT OFFICE:
Post Office Box 8027
Columbia, South Carolina 29202

(803) 791-8800
Facsimile Transmission:
(803) 791-0427

September 30, 1994

REPORT TO: Robert L. Thomas
Albemarle Corporation
Post Office Box 1028
Orangeburg, South Carolina 29116

FROM: R. Dean Harris, M.E., P.E.
Engineering Design & Testing Corp.

SUBJECT: Certification of Hazardous Waste Tank
Albemarle Equipment Number: T-100M-5
Albemarle Purchase Order Number: CERL-T 55763
ED&T File Number: COL4427-29780

The subject tank is a vertical, flat bottomed, carbon steel storage tank used in storing hazardous, flammable waste materials. The materials are to be used as fuel in a waste fired boiler.

The purpose of this investigation has been to examine the design, fabrication, and installation of the tank for compliance with appropriate federal regulations, codes and standards, and good engineering practice.

The conclusions and opinions stated herein are based on information available to the investigator as of this writing. It is conceivable that additional information may be forthcoming which bears on these conclusions and opinions. The right is reserved, therefore, to review all conclusions and opinions at any future point should, in fact, additional information become available.

This report is divided into sections as follows:

A. Summary Statement
B. Engineering Specifications and Standards
C. Field Inspections
D. Piping and Ancillary Equipment

FILE COPY

REPORT

Certification of Hazardous Waste Tank
ED&T File Number: COL4427-29780

September 30, 1994

Report To: Albemarle Corporation
Orangeburg, South Carolina

Attention: Mr. Robert L. Thomas

Engineer-in-Charge: R. Dean Harris, M.E., P.E.

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER No. 8457 ROGER DEAN HARRIS

ENGINEERING DESIGN & TESTING Corp.
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Charlotte, North Carolina/Jacksonville, Florida

ENGINEERING DESIGN & TESTING Corp.
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Facsimile Transmission:
(803) 791-0427

October 29, 1993

REPORT TO: Robert L. Thomas
Ethyl Corporation
Post Office Box 1028
Orangeburg, South Carolina 29116

FROM: R. Dean Harris, M.E., P.E.
Engineering Design & Testing Corp.

SUBJECT: Certification of Hazardous Waste Tank
Ethyl Equipment Number: T-30M-61
Ethyl Purchase Order Number: CERLT 55763
ED&T File Number: 4427-29780

The subject tank is a vertical, skirt mounted, carbon steel storage tank used in storing hazardous, flammable waste materials. The materials are to be used as fuel in a waste fired boiler.

The purpose of this investigation has been to examine the design, fabrication, and installation of the tank for compliance with appropriate federal regulations, codes and standards, and good engineering practice.

The conclusions and opinions stated herein are based on information available to the investigator as of this writing. It is conceivable that additional information may be forthcoming which bears on these conclusions and opinions. The right is reserved, therefore, to review all conclusions and opinions at any future point should, in fact, additional information become available.

ENGINEERING DESIGN & TESTING Corp.

ENGINEERS / CONSULTANTS / LABORATORIES

REPORT: Certification of Hazardous Waste Tank

Ethyl Corporation
Orangeburg, South Carolina

ATTN: Robert L. Thomas

ED&T File Number: 4427-29780
Engineer-in-Charge: R. Dean Harris, M.E., P.E.

October 29, 1993

COLUMBIA DISTRICT OFFICE:

Post Office Box 8027
Columbia, SC 29202
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ENGINEERING DESIGN & TESTING Corp.
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August 31, 1993

REPORT TO: J. William Jones, Jr.
Ethyl Corporation
Post Office Box 1028
Orangeburg, South Carolina 29116

FROM: R. Dean Harris, M.E., P.E.
Engineering Design & Testing Corp.

REFERENCE: Certification of Hazardous Waste Tank
Ethyl Equipment Number: T-30M-66
Ethyl Project Number: O-6641
Ethyl Purchase Order Number: C EJWJ 55649
ED&T File Number: 4012-29780

The subject tank is a vertical, skirt mounted, carbon steel storage tank for use in storing hazardous, flammable waste materials. The materials are to be used as fuel in a waste fired boiler.

The purpose of this investigation has been to examine the design, fabrication, and installation of the tank for compliance with appropriate federal regulations, codes and standards, and good engineering practice.

The conclusions and opinions stated herein are based on information available to the investigator as of this writing. It is conceivable that additional information may be forthcoming which bears on these conclusions and opinions. The right is reserved, therefore, to review all conclusions and opinions at any future point should, in fact, additional information become available.

ENGINEERING DESIGN & TESTING Corp.
ENGINEERS / CONSULTANTS / LABORATORIES

REPORT: Certification of Hazardous Waste Tank

Ethyl Corporation
Orangeburg, South Carolina

ATTN: J. William Jones, Jr.

ED&T File Number: 4012-29780
Engineer-in-Charge: R. Dean Harris, M.E., P.E.

August 31, 1993

COLUMBIA DISTRICT OFFICE:

Post Office Box 8027
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ENGINEERING DESIGN & TESTING Corp.
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August 30, 1993

REPORT TO: Robert L. Thomas
Ethyl Corporation
Post Office Box 1028
Orangeburg, South Carolina 29116

FROM: R. Dean Harris, M.E., P.E.
Engineering Design & Testing Corp.

REFERENCE: Certification of Hazardous Waste Tank
Ethyl Equipment Number: T-10M-32 (T8345)
Ethyl Purchase Order Number: CERLT55712
ED&T File Number: 4154-29780

The subject tank is a vertical, skirt mounted, carbon steel storage tank for use in storing hazardous, flammable waste materials. The materials are to be used as fuel in a waste fired boiler.

The purpose of this investigation has been to examine the design, fabrication, and installation of the tank for compliance with appropriate federal regulations, codes and standards, and good engineering practice.

The conclusions and opinions stated herein are based on information available to the investigator as of this writing. It is conceivable that additional information may be forthcoming which bears on these conclusions and opinions. The right is reserved, therefore, to review all conclusions and opinions at any future point should, in fact, additional information become available.

ENGINEERING DESIGN & TESTING Corp.

ENGINEERS / CONSULTANTS / LABORATORIES

REPORT: Certification of Hazardous Waste Tank

Ethyl Corporation
Orangeburg, South Carolina

ATTN: Robert Thomas

ED&T File Number: 4154-29780
Engineer-in-Charge: R. Dean Harris, M.E., P.E.

August 30, 1993

COLUMBIA DISTRICT OFFICE:

Post Office Box 8027
Columbia, SC 29202
(803) 791-8800

Appendix D-2.2

SI Group Plantwide Procedures:

Pressure Vessel & Storage Tank Inspection Procedure and Vessel, Piping, and Process Equipment Inspection Intervals

Approved by Bill Shelton on 05/08/2015
Accepted by Arthur Sweatman on 05/08/2015

Section: **Plant Services**

Name:	Number:	Issue Date:	Reissue Date:
PRESSURE VESSEL & STORAGE TANK INSPECTION PROCEDURE	**PS-PP-007**	**07/25/2002**	**05/08/2015**

NOTE: This procedure was formerly PT-PP-002 and was located in the Technology Resources section of the Orangeburg Plantwide Procedures. It has been renumbered and transferred to the Plant Services section. PT-PP-002 is to be retired.

1.0 SCOPE

This procedure establishes the guidelines to be used to inspect pressure vessels and storage tanks in accordance with recognized industry codes, SI Group's internal inspection programs and safety policies, or applicable governmental regulations.

2.0 RESPONSIBILITY

The administration of this procedure is the responsibility of the Manager, Plant Services. Departmental managers are responsible for the effective implementation of this procedure in their areas.

3.0 DOCUMENTATION CONTROL

This procedure must be reviewed and accepted by the Operations Manager, **Superintendent of Inspection and Construction, **Safety** Manager; and Plant Manager. It must be approved by the Plant Services Manager. It must be approved by the Manager, Plant Services.

4.0 REFERENCE DOCUMENTS

2.1 Orangeburg Plant Process Safety Management Manual, Section PSM 10.02, PSM 9.01, 9.02

2.2 National Board Inspection Code NB-23 — Pressure Vessel Inspection and Repair

2.3 OSHA 29 CFR 1910.119 — Process Safety Management

2.4 SI Group's Orangeburg Plantwide Procedures Database PS-PP-009

5.0 DEFINING THE EQUIPMENT

5.1 Internal Inspection

No confined space can be entered for inspection and or repair until all Albemarle Safety Procedures have been successfully implemented and verified by the Area Production Supervision and the Inspector. These policies and procedures are found in SI Group's Plantwide Procedures Database. Internal inspections of the subject equipment shall be accomplished by visual inspection of all exposed surfaces of the internals, including but not limited to:

- Entry preparation and cleanliness
- Effects of corrosion, if applicable, to all internal surfaces of the pressure retaining component.
- Condition of mechanical equipment, agitator parts, diplegs, etc.
- Condition of internal attachments, brackets, clips, supports, etc.

- Overall condition of internal appurtenances
- Mechanical damage, gouges, abrasions, dents, etc.
- Inspect up the relieve valve pipe to inspect the rupture disk if visible.
- **Check all Baffles for damage and tightness, There should be no movement of the Baffle when applying force from any direction. If any movement is noticed this condition should be addressed immediately.**
- Ensure all dip legs have the proper support as per the manufacturer's drawings. If a dip leg has missing supports or there are questions about the adequacy of the supports, contact the Area Engineer to assess. If supports are missing, they should be installed immediately.**
- The Inspector will compare the piping and instrument diagram (P&ID) with the internals of the vessel or tank to ensure that all the "dip legs", "spargers", "mixing nozzles", "coils", etc. are installed. If there is a discrepancy between the P&ID and vessel or tank the Inspection Supervisor, Maintenance Manager and the Area Superintendent are to be notified of the discrepancy. The Area Superintendent will then make the decision to modify the vessel or tank or correct the P&ID.

5.1.1. LIQUID PRESSURE TESTS

- All liquid pressure tests "Hydro" shall be done in accordance with the National Board Inspection Code (NBIC)
    I. A pressure test as required by the original code of construction shall be conducted. The pressure test shall not exceed 150% of the ~~MAWP~~maximum allowable operating pressure.
    II. The metal temperature for the pressure test shall be in accordance with the original code of construction but not less than 60 degrees Fahrenheit~~deg f~~
    III. Hold time for the pressure test be a minimum of 20 minutes prior to the examination by the inspector
    IV. The below form shall be printed filled out and attached to the work order and put in the equipment file.
    V. If for any reason the pressure test fails it shall be escalated to Maintenance Manager, and Area Superintendent
    VI. The vessel should be isolated from all piping for pressure tests. When it is unavoidable to isolate all piping from the equipment the Inspection Group shall approve the piping that is to remain in the pressure test.

PRESSURE TEST RECORD.doc

5.2 External Inspection

On stream external inspections, when applicable, shall be performed following the guidelines of the NBIC and shall include verification of the following points as a minimum:

- Operating pressure of the unit
- Maximum allowable operating pressure~~MAWP~~ as rated initially
- Safety/Relief Valve setting. **This includes the nozzle and piping below the RV.**
- Condition of the insulation or other coverings. **This includes Ultrasonic Thickness Gauging (UT) ports properly sealed.**
- Any evidence of leakage from the pressure retaining item including all connections
- External inspection for corrosion to the unit including UT thickness tests
- Condition of structural attachments
- Physical condition of vessel connections, flanges, couplings, etc.

External/UT Inspection of subject equipment shall be accomplished by ~~Ultrasonic Thickness Gauging (~~UT~~)~~ using calibrated instruments. The equipment used shall be encountered for each application. Calibration of the UT Gauge shall be verified prior to each test or series of tests performed. (Ref. current revision of CPMT-1)

Proper size, frequency, and temperature rated transducers shall be selected based on the equipment to be inspected. High-Temp couplants shall be used for readings taken on surfaces about 150 degrees Fahrenheit.

Inspection Steps typically employed:

1. Locate and positively identify the equipment(s) to be inspected.
2. Insure that proper thickness measurement locations (TMLs) are established and access to inspection surface has been made. Insulated items require ports be provided to facilitate the inspection. Notify Plant Services if ports in insulation are not provided in advance.
3. Visually inspect test surface to determine the cleaning method needed to assure that transducer can be properly coupled to the surface.
4. Clean surface, if needed, by approved methods such as brushing, scraping, sandblasting, or grinding.
5. Perform thickness testing on all TMLs logging in the thickness readings on the inspection report(s).
6. Make external visual inspection of the remainder of the item to assess the need for any other maintenance or repair that may be required. Areas to view specifically include, but are not limited to leaks, external corrosion, condition of paint, insulation supports, clips and brackets.
7. Ensure no steam hoses are placed under insulation or directed at vessel nozzles or shells.
8. Ensure that the bottom of any API tanks have sufficient drainage under the bottom plate.

5.2.1 ASSIGNING THICKNESS MEASUREMENT LOCATIONS ~~(TML)~~

The inspector shall establish the quantity of TMLs required to adequately represent the mechanical integrity of each piece of process equipment taking into consideration corrosion patterns that have been displayed by inspection history of equipment in similar service. On all API tanks there will be a minimum of 4 UT ports in the bottom 18 ~~"~~inch of any insulation to ensure there is no wet insulation allowing CUI of the bottom 18~~"~~ inch of the shell plate.

6.0 Reporting

At the completion of the required inspection(s), an SI Group's Inspection Report shall be filled out for each piece of equipment inspected. The report shall represent the findings of the inspection offering an assessment of the overall condition of the item, as well as any information relevant to any engineering analysis required if the equipment is found to be marginal or insufficient for its present service.

The A, B, C~~,~~ rating shall be reviewed at the time of the report and rated as per ~~-~~PSM-10.3 Notes Link

All reports shall be entered into the SAP electronic filing system.

SAP PM Notifications will be generated for repairs and other maintenance if anomalies are noted.

For repairs required that effect the mechanical integrity conditions of the equipment, i.e., code status, operating parameters, the follow actions will be executed.

1.) The Inspector will generate a repair notification reflecting an "A" priority to indicate that immediate attention and repairs are required are required before restoring equipment to achieve service.

2.) The Inspector will physically / verbally contact the area Operations Superintendent (Owner) of the equipment to discuss the findings and a path forward for repairs.

3.) A joint decision will be made between Operation and Maintenance as to execution of repair work and the timing there of (<24 hours) to restore mechanical integrity of the affected equipment.

4.) If immediate repairs, < 24 hours, cannot be performed as deemed necessary, by the Inspection Group to restore mechanical integrity, then the equipment will be "condemned" for continued service by the Inspection Group.

5.) For equipment "condemned" for service Operations must generate a "MOC", and receive approval prior to returning the equipment back to active service.

7.0 PROGRAM MAINTENANCE

As new equipment information is received from Plant Services, the equipment item is added to the Equipment Inspection Program. Changes to the equipment priority and inspection interval must be addressed as outlined in Plantwide Procedure Database PS-PP-009. Items will be added on an ongoing basis to accommodate the introduction and inspections of new equipment.

Approved by Kim Krisle on 05/08/2015
Accepted by Zach Steele on 02/11/2014
Accepted by Tyler Windsor on 02/11/2014
Accepted by Richard Bulas on 02/11/2014
Accepted by Kim Krisle on 02/11/2014

Section: **Plant Services**

Name:	Number:	Issue Date:	Reissue Date:
VESSEL, PIPING, & PROCESS EQUIPMENT INSPECTION INTERVALS	**PS-PP-009**	**01/24/2008**	**05/08/2015**

SCOPE

This procedure establishes the guidelines to be used to determine and define inspection requirements assigned to process equipment and piping systems in accordance with recognized industry codes, ****SI Group's**** internal inspection programs and safety policies, or applicable governmental regulations.

RESPONSIBILITY

The administration of this procedure is the responsibility of the ****Senior Manager, Maintenance & Engineering**.** Departmental managers are responsible for the effective implementation of this procedure in their areas.

DOCUMENTATION CONTROL

This procedure must be reviewed and accepted by the ****Manager, EHSS and Supervisor, Maintenance.** It must be approved by the ****Senior Manager, Maintenance & Engineering or designee**.** The ****Senior Manager, Maintenance & Engineering**** is the Master Copy Holder.

1.0 REFERENCE DOCUMENTS

1.1 Orangeburg Plant Process Safety Management Manual, Sections ~~PSM~~ Process Safety Management (PSM) 10.01, 10.02, 10.04.

1.2 ****SI Group**** — Orangeburg Plantwide Procedures Database PS-PP-007, PS-PP-008, and PS-PP-010.

1.3 ~~OSHA~~ Occupational Safety and Health Administration 29 ~~CFR~~ Code of Federal Regulations 1910-119 — Process Safety Management.

1.4 National Board Inspection Code NB-23 — Pressure Vessel Inspection and Repair.

1.5 American Petroleum Institute (API) — Piping Inspection Code, API Standard 570.

1.6 American Petroleum Institute — Tank Inspection, Repair, Alteration, and Reconstruction, API Standard 653.

2.0 DEFINING THE EQUIPMENT

Piping systems and process equipment shall have a unique number that can be cross-referenced to the process flow diagrams and or the ~~P&ID~~piping and instrument diagrams. Piping systems and process equipment will be categorized as defined in PSM-10.03.

Process Safety Management Manual, **Chemical Hazard Designation (ABC)**

Derating the critical safety classification of a piece of equipment to a lower class priority will require the approval of the Plant Manager.

In addition, piping, and equipment can be classified as "Class D"

Class D (No PM Required)

a. Used to denote idle equipment that no longer requires an inspection or calibration at a set PM interval

If a designation does not exist, then Area Supervision along with Inspection shall assign rating. Priority ratings shall be reviewed periodically by means of Process Hazard Analyses (PHAs). Additionally, the piping systems that are required to have preventive inspection programs and all process equipment shall be assigned an ****Maintenance Connect**** equipment number and an ****Maintenance Connect**** functional location for tracking inspection activity.

3.0 DEFINING INSPECTION INTERVALS

New process equipment shall be given a baseline inspection to establish the condition of the item "new and cold" prior to placing it in service. This shall be accomplished by means of an inspection at the fabricator's shop and/or at the time it is received on the property.

Initial inspection intervals for new equipment shall be based on the following:

- Previous inspection history if equipment is a replacement in kind.
- Inspection history of similar equipment in similar service, if such exists.
- If the two criteria above are not applicable, then a one year inspection interval will be set to establish baseline corrosion data.

3.1 Pressure Vessels and Storage Tanks

The API Standard 653 along with national Board Inspection Code NB-23 shall be used in conjunction with inspection history, ~~it if~~if it exists, to establish inspection minimums for each piece of process equipment categorized priority A, B or C. The inspection intervals, inspection types and/or the placement and number of Thickness Measurement Locations ~~TMLs (Thickness Measurement Locations)~~ is subject to review and revision after baseline data is collected and ample inspection history can be evaluated. Refer to Table ~~2~~1 (located at the end of the report) for recommended maximum intervals according to category. These maximums may be exceeded only if adequate corrosion data is available. Inspections of pressure vessels and storage tanks shall be conducted as described in Plantwide Procedures Database PS-PP-007.

Non-corrosive service equipment may forego internal inspection provided onstream external inspections are performed periodically, including thickness measurements, and all of the following conditions are met:

a. The non-corrosive character of the content, including the effect of trace elements, has been established by at least five years comparable service experience with the fluid being handled.
b. No questionable condition is disclosed by the external inspection. If such condition exists, an internal inspection is required immediately.
c. The operating temperature of the pressure-retaining item does not exceed the lower limits for the creep range of the vessel metal per ~~table below~~Table 2.

Table ~~1~~2

1 Material	2 Temperature
Carbon Steel and C-1/2 Mo and Ferritic Stainless Steel	750ºF (400ºC)
Low Alloy Steels (Cr-Mo)	850ºF (455ºC)
Austenitic Stainless Steels	950ºF (510ºC)
Aluminum Alloys	200ºF (93ºC)

d. The pressure-retaining item is protected against inadvertent contamination.

3.2 Pipe Systems

The API Standard 570 shall be used in conjunction with available inspection history to establish inspection intervals for each piping system categorized as Class A by PSM-10.03 in the Process Safety Management Manual. Other piping systems are not subject to routine preventive inspection programs unless specific problems associated with a highly corrosive environment are identified. The inspection intervals and/or the placement and number of Thickness Measurement Locations~~TMLs~~ are subject to review and revision after baseline data is collected and sufficient inspection history can be collected and evaluated. Refer to Table ~~2~~ 1 for recommended maximum intervals according to category. These maximums may be exceeded only if adequate corrosion data is available. Inspections of piping systems shall be conducted as described in Plantwide Procedures Database PS-PP-008.

3.2.1 External Risks of Pipe Racks:

The areas around the pipe racks shall be evaluated and ranked according to the following list

- **Severe Corrosive Atmosphere**
- **Mild Corrosive Atmosphere**
- **Non Corrosive Atmosphere**

All piping that is exposed to a severe Corrosive Atmosphere shall:

- **Have a yearly PM set up for a visual inspection**
- **The PM shall have a drawing or suitable visual graphic which clearly depicts the battery limits of the inspection area.**
- **The piping in the highly corrosive area shall be inspected by the methodology called out in section 7.0 of policy PS-PP-08.**

The plant shall have a systemic corrosion control program to visually observe all rack piping on the plant.

- **This inspection shall:**
- **Cover the entire plant in 2 years**
- **Remove all flange shields to inspect the flanges and look for any evidence of leakage, and look for any signs of CUI**
- **Any damaged insulation shall be removed, the pipe observed for any signs of CUI or deficient painting system. The pipe shall then be re-painted and re-insulated to bring into compliance with appropriate SI Group specifications.**
- **Un-insulated pipe painting system shall be evaluated and cleaned and painted as needed**
- **Any questionable pipe the vender shall contact the Inspection Group to evaluate the condition further.**

3.2.2 Flexhoses: See Orangeburg Safety Policy Manual procedure SPP-041

Orangeburg Safety Policy Manual, Flexible Hose Policy

****3.3 Idle Equipment**

Often, equipment is campaigned for use. In these cases, it may be desirable to leave the PM intervals in place such that they do not have to be recreated when a new campaign approaches. To manage the PM's for this equipment, the ABC Indicator should be changed to 'D' showing that no PM is required. The Work Orders remain live and in the backlog for execution when the equipment is recommissioned. At that point in time, the ABC Indicator should be changed to match the new service. ~~An~~ A Management of Change request (MOC) must document the change in ABC indicator to 'D'.

Equipment cannot be designated as idle (D) unless the following criteria is met:

- The equipment is isolated at all inlets from any new chemical addition
- Take note that blanks and blinds may be necessary for long idle periods of time or for situations where only single valves seal against live flow.
- Wherever applicable, nitrogen should be isolated to avoid pressure build up or bleeding. .
- The equipment is empty of chemical contents. This means that there is no heel and only deminimus residual solvents remain.

- Energy for steam tracing, jacket heating, or coil heating is isolated with valves.
- All isolations (blanks and valves) are locked and tagged per the site Lock Tag & Try (LTT) Procedure.

If the equipment is not used for more than one year it becomes idled equipment and procedure OP-PP-31 applies as stated below:

IDLED STATE:

If a process is down for six months and there are no plans to restart the process within the next six months then the process should be placed into an idled state. The following shall apply to idled equipment:

- The Equipment will need to be emptied and cleaned such that all residual chemicals are removed from the equipment but the equipment does not have to be blanked from other processes.

- The Equipment will need to be locked out from other equipment per the LTT procedures

- The equipment should be labeled with a tag in the field as "Idled Equipment" and the idle state of the equipment should be documented with an MOC

- PM's for this idled equipment can be delayed until just prior to restarting the equipment using a temporary MOC with the end date of the MOC specified as one year

- Equipment that remains in an idled state for more than one year would need an area management review to determine why the equipment should not be placed "removed from service" and approval would be needed from an MOC to continue to classify the equipment as "idled"

- Prior to returning idled equipment to active service, a safety review must be conducted to ensure that the equipment, procedures and safety systems are adequate for safe operation. In addition the regular PM plans for the equipment must be re-evaluated for the service. If the equipment is changing service then inspections must be performed on the equipment prior to putting the equipment into service. When the equipment is to be put back into service, a pre startup safety review and walk through is to be conducted to ensure the overall integrity of the equipment and instrumentation.**

4.0 ALTERATIONS TO INSPECTION INTERVALS

Inspection intervals must be reviewed and adjusted as necessary after a significant change of service or if inspection reveals an appreciable acceleration of corrosion beyond the initially established rate. The inspection group shall be notified of changes in service that may affect the expected life of the equipment.

Alterations to inspection intervals can be initiated by, but not limited to, the following:

a. Once baseline inspections are complete and corrosion rates are established, the initial inspection interval for new equipment can be extended. Area supervision and the inspection group still use the turnaround planning process to evaluate the appropriate frequency for future inspections.

b. Periodic process safety reviews for PSM processes are conducted in the form of ~~Process Hazard Analyses (~~PHAs~~)~~. Any corrective actions from these reviews concerning the addition of routine inspections or changes to inspection frequencies of process equipment and pressure retaining systems will be forwarded to and evaluated by area supervision and the inspection group.

c. The mechanical excellence group has responsibility for analyzing premature equipment failure. Investigation results may prompt a change to the inspection frequency for a piece of process equipment or pressure retaining system.

d. Inspection results, both internal and external, may dictate the need to alter inspection frequencies.

e. Quality related events and analysis.

Any change to an inspection interval for fixed equipment (vessels, exchangers, pipelines, etc.) must be documented by submitting an MOC in the Management of Change database located in Lotus Notes. The requirements for MOC documentation are as follows:

1. At minimum, the **Supervisor, Maintenance** and Area **Production Manager** must be listed as approvers on the MOC.
2. List the existing and proposed inspection intervals.
3. Description must include justification for changing interval. Justification should be comprised of past inspection history, risk/severity of failure, calculated corrosion rates and estimated remaining life.
4. Tasks shall be assigned to the Area Maintenance Planner or **Supervisor, Maintenance** to update the **Maintenance Connect** preventive maintenance plan with the new interval.

5.0 OVERDUE INSPECTIONS

This section describes **SI Group's** Orangeburg site method for assuring categorized equipment (as described in Section 2) that are past due for inspection are addressed per the Management of Change policy.

Past Due Definition
Any inspection work order occurring within 30 days of the **Maintenance Connect** due date will be considered on time. An inspection work order is considered "past due" if it is not completed within 30 days of the **Maintenance Connect** due date.

5.1 Procedure for all pressure relief systems, all pressure vessels, and Category A equipment/piping

When inspections of pressure relief systems, pressure vessels, or Category A equipment/piping cannot be completed prior to the **past due** date, the responsible area shall initiate a temporary ~~Management of Change request (~~MOC~~)~~ request in the Management of Change database located on Lotus Notes. The MOC form must be approved by Area **Production Manager** and the **Supervisor, Maintenance**.

5.1.1 In the "Return to Original State" field enter the date inspection is expected to be completed. If inspection is not completed by the "return to Original State", a new MOC request will have to be submitted and approved until the work is performed.

5.1.2 In the "Technical Basis for Change" field, give explanation why inspection cannot be performed by due date. A risk assessment shall be performed on equipment that is requested for extension and documented in the MOC. At minimum, the risk assessment shall include inspection history of the equipment, and may include hazards of the service and/or status of the equipment (i.e., out of service).

5.1.3 Inspections of Category A equipment that do not occur within 90 days of the **past due** date (or 120 days from the **Maintenance Connect** due date) require Plant Manager approval on the MOC. If the original MOC did not include Plant Manager as an approver, a second MOC must be submitted.

5.2 Procedure for Category B equipment and piping

When inspections of Category B equipment/piping cannot be completed within 90 days of the **past due** date (or 120 days from the **Maintenance Connect** due date), the responsible area shall initiate a temporary ~~Management of Change request (~~MOC~~)~~ request in the Management of Change database located on Lotus Notes.

5.2.1 Requirements of ~~sections~~ Sections 5.1.1 and 5.1.2 above must be completed.

5.2.2 Area **Production Manager** and Inspection Supervisor approval is required for continued operation of Category B equipment MOC submittals.

5.2.3 Inspections of ~~category~~ Category B equipment that does not occur withing 90 days of the past due date (or 120 days from the ****Maintenance Connect**** due date) require Plant Manager approval on the MOC. If the original MOC did not include Plant Manager as an approver, a second MOC must be submitted.

5.3 Procedure for Category C equipment and piping

Management of Change requests are not required for Category C equipment/piping. Approval must be attained through Area ****Production Manager**** for continued operation.

6.0 WORKFLOW PROCESS

6.1 The Area Maintenance Planner shall provide the Area ****Production Manager**** and Process Engineers a list of all inspection work orders that are currently overdue, and coming due within the subsequent month, during the weekly planning meetings.

6.2 Operations schedules the equipment for availability for inspection work orders, making all feasible attempts to complete prior to the **past due** date.

6.3 If inspection cannot be completed prior to the **past due** date, the appropriate Unit Leader shall initiate a temporary MOC **to extend the due date for the inspection of the equipment.** The MOC shall be left in draft status with comment in "Technical Basis for Change" that MOC is ready for inspection review.

****6.4** In order to encourage completion of the inspection prior to the due date, each piece of equipment that requires an extention of the inspection date must have a separate MOC. The exception to this would be the extention of the inspection date due to a business reason. For example if the business team has requested the delay of a TAR then all the associated equipment that requires an inspection extention may be done on a single MOC. Also, if an extention of the inspection due date is required to sync up equipment inspection dates to minimize the number of required TARs for a process then the associated equipment could be done under a single MOC.**

6.5 The ****Supervisor, Maintenance**** shall monitor the MOC system on a weekly basis for draft MOC's awaiting inspection review. The inspection department shall review all equipment history and provide documentation to support or contest temporary extension of inspection. This documentation is provided back to the ****Production Supervisors**** in electronic format to be attached to the MOC.

6.6 ****Production Supervisors**** shall review appropriate inspection documentation and remove any equipment that is not supported for extension by the inspection department from the MOC request. ****Production Supervisors**** shall attach documentation to MOC request and submit for approval.

7.0 SIGNIFICANT CHANGE OF SERVICE

The condition of process equipment which is intended for a significant change of service shall be determined by the Inspection Department. Standard best practice shall be to perform an internal inspection prior to placing equipment in a new service to assess the current condition and provide baseline data for new service corrosion mechanisms. If accurate corrosion data for new service and current condition of equipment is known, internal inspection requirements may be waived via MOC request approved by Plant Manager and ****Supervisor, Maintenance****

8.0 PROGRAM MAINTENANCE

As new equipment information is received from Plant Services or Engineering, the equipment is added to the equipment inspection program. Items will be added on an ongoing basis to accommodate the introduction and inspections of new equipment. The inspection group shall audit the past due list and the Management of Change Database on a weekly basis to insure past due inspections have been documented and approved according to this procedure.

Table ~~2~~1

Recommended Maximum Inspection Intervals in Months

	Hot Oil (Therminol or Dowtherm) Heaters		Vessels, Tanks, Exchangers		Pipe	CV's/EV's		PSV's Including Inspection of Rupture Disks Below	Rupture Disks Alone	Steam Boilers		Flex Hoses	
	Internal	External Infrared	Internal	External	External Ultrasonic	Shop Test	External	Shop Test	Internal	Internal	External Infrared	Pressure Test	External
HIGHLY HAZARDOUS (A)	24*	12	36*	36	60	If recommended by external or with vessel internal	36	36*	36*	12**	6	Upon Removal for Change in Service	12**
HAZARDOUS (B)	N/A	N/A	60	60	120	If recommended by external or with vessel internal	60	60	60	N/A	N/A	Upon Removal for Change in Service	12**
NON-HAZARDOUS / NON-CORROSIVE [C]	N/A	N/A	120	60	N/A	If recommended by external or with vessel internal	60	120	120	N/A	N/A	N/A	N/A

* 12 month default interval for new equipment unless similar service indicates otherwise.

** Cannot be longer interval by Site/Corporate Policy

Inspection Intervals.xls

Appendix D-2.3
Copies of SI Group's Certificate of Accreditation from the National Board of Boiler and Pressure Vessel Inspectors

THE NATIONAL BOARD
OF
BOILER & PRESSURE VESSEL INSPECTORS

Certificate of Accreditation

This is to certify that

SI Group, Inc
725 Cannon Bridge Road
Orangeburg, South Carolina 29115
United States
Acceptable Abbreviation: SI Group

is accredited as an Owner-User Inspection Organization in accordance with the provisions of NB-371, Accreditation of Owner-User Inspection Organizations (OUIO).

The scope of this accreditation is limited to:

Inservice Inspections for Jurisdictional Compliance and Repair/Alteration Inspections for National Board Inspection Code (NBIC) Compliance

Certification Number: 51

Issue Date: June 13, 2018

Expiration Date: August 1, 2021

Executive Director

0307

THE NATIONAL BOARD
OF
BOILER & PRESSURE VESSEL INSPECTORS

Certificate of Authorization

This is to certify that

SI Group, Inc
725 Cannon Bridge Road
Orangeburg, South Carolina 29115
United States
Acceptable Abbreviation: SI Group

is authorized to use the R Symbol in accordance with the provisions of the National Board Inspection Code and NB-415, Accreditation of "R" Repair Organizations.

All activities within the scope of this Authorization shall be controlled by the above location.

The scope of this Authorization is limited to:

Metallic
Repairs and Alterations
At The
Shop Location

Certification Number: 4860

Issue Date: June 13, 2018

Expiration Date: August 1, 2021

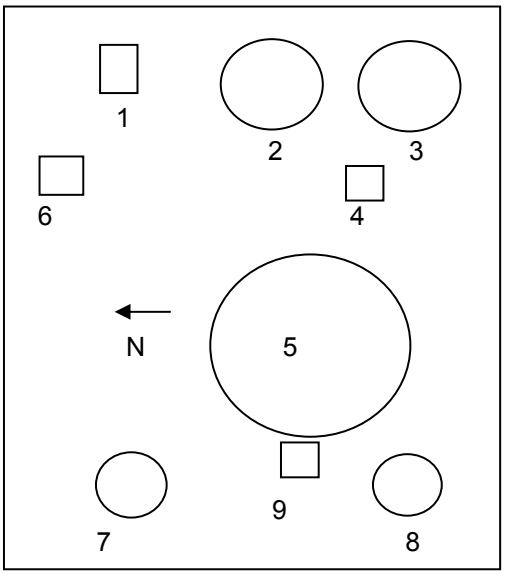
Executive Director

0308

Appendix D-2.4
Secondary Containment Volume Calculations

Hazardous Waste Containment Structure Volume Calculations

1 Elevated concrete pad
2 Tank T-30M-66
3 Tank T-30M-61
4 Elevated concrete pad
5 Tank T-100M-5
6 Elevated concrete pad
7 Tank T-30M-32
8 Elevated concrete pad
9 Concrete Foundation



Containment Area Volume

L =	80	ft
W =	60	ft
H =	4.5	ft

Gross
Volume = 21,600 cu ft
= 161,579 gallons

Rainfall Volume

25 yr, 24 hr rainfall = 6.71 in
Volume = Containment area L * W * 25y rain depth
= 2,684 cu ft
20,078 gallons

Less Volume

Unit	Dia	Width	Length	Net Displacement Height	Displacement Volume		Tank Volume	
1	-	5	8	0.21	8	cu ft		gallons
2	12	-	-	2.7	305	cu ft	30,000	gallons
3	12	-	-	2.7	305	cu ft	30,000	gallons
4	-	2.5	2.5	0.16	1	cu ft		gallons
5	27	-	-	4.5	2,576	cu ft	100,000	gallons
6	-	5	6	0.5	15	cu ft		gallons
7	9.5	-	-	4.5	319	cu ft	10,000	gallons
8	9	-	-	2.15	137	cu ft		gallons
9	-	2.5	2.5	0.35	2	cu ft		gallons
				Sum =	3,670	cu ft	170,000	gallons
					27,450	gallons		

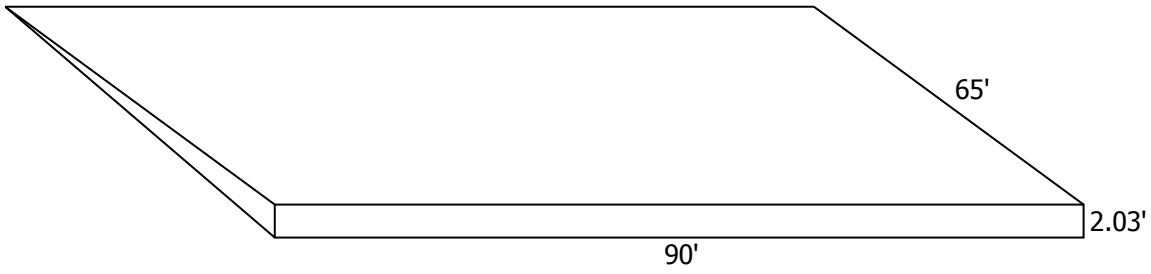
Containment Capacity

Net capacity = Gross Containment Volume - Sum of Displacement Vol
= 134,129 gallons

Max Vol. to Contain = 25y Rain Vol + Largest Tank Vol
= 120,078 gallons

Remaining Volume = Net Capacity - Max Volume to Contain
= 14,051

Truck Unloading Area Containment Volume Calculations



Cross Sectional Area	= 0.5*b*h = 0.5 * 65 ft * 2.03 ft = 65.98 sq ft
Containment Volume	= Cross Sectional Area * Width = (65.98 sq ft) * 90 ft = 5938 cu ft
	= 44,421 gallons
Rainfall Volume	
25 yr, 24 hr rainfall depth	= 6.71 inches
Rainfall Volume	= Containment area L * W * 25y rainfall depth = 65 ft * 90 ft * (7/12) ft = 3271 cu ft
	= 24,469 gallons
Net Containment	= Containment Volume - Rainfall Volume =19,952 gallons

330 Heel Tank Containment Volume Calculations

Cross Sectional Area	= b*h = 37 ft * 43 ft = 1,591 sq ft
Containment Volume	= Cross Sectional Area * Height = 1,591 sq ft * 4 ft = 6,364 cu ft = 47,602 gallons
Rainfall Volume	
25 yr, 24 hr rainfall depth	= 6.71 inches
Rainfall Volume	= Containment area L * W * 25y rainfall depth = 37 ft * 43 ft * (7/12) ft = 928 cu ft = 6,941 gallons
Net Containment	= Containment Volume - Rainfall Volume = 40,661 gallons

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SECTION D.9
BOILER AND WASTE HANDLING DESCRIPTION
[40 CFR Parts 266, 270.22 and 270.66]

The SI Group plant operates a firetube boiler (No. 4) (HE-3800-1) at its Orangeburg, South Carolina plant. The boiler burns process wastes to generate steam for plant operations. This section of the application discusses the boiler system and waste unloading system. The major components of the boiler system are as follows:

- Waste Fuel Feed System

- Boiler and Its Control System
  - HE-3800-1
  - Computerized Boiler Management Controller (CBMC)
  - Boiler Oxygen Trim System

- Hazardous Waste Monitoring System
  - System Controller with Data Acquisition System
  - Combustion Chamber Temperature Monitor
  - Combustion Gas Stack Temperature Monitor
  - Waste Fuel Feed Firing Rate Monitor
  - Natural Gas Flow Rate Monitor
  - Steam Production Rate Monitor
  - Baghouse Pressure Drop Monitor
  - Baghouse Break Detector

- Automatic Waste Feed Cut-off System

- Air Pollution Control Devices
  - Baghouse
  - Stack

- Continuous Emissions Monitoring System (CEMS)

D.9.1 Waste Fuel Feed System

Plant wastes for burning in HE-3800-1 are transferred from the various processing areas throughout the plant to the boiler via pipeline or tank trucks. During transfers, the tank trucks are spotted in a curbed area adjacent to the boiler; which also serves as a less than 90-day storage area. All wastes are off-loaded into waste fuel tanks T-100M-5, T-30M-61, T-30M-66, and T-10M-32 that are located in the diked area adjacent to the boiler. Secondary containment is provided for the waste collection tanks. A schematic of the waste collection and feed system is provided in Figure D.9-1 (Appendix D-9). Direct burning no longer occurs at the facility.

Wastes are segregated in the trailers and collection tanks to ensure that incompatible wastes are not combined. The remaining wastes are transferred into the collection tank, T-100M-5. This 100,000-gallon flat bottom carbon steel tank collects the majority of the plant's primary waste streams and is referred to as the Primary Waste Fuel Collection Tank. Although waste can be fed to the boiler from any tank, typically tanks T-30M-61 and T-30M-66 are used as the feed tanks to the boiler.

Waste fuels collected and blended in the waste fuel collection tank are transferred to one of the boiler feed tanks where the waste is fed to the boiler. The waste from T-100M-5 is transferred to boiler feed tanks via a floating suction whereby the waste fuel from the top of the tank is siphoned off. This siphoning minimizes any sediments and free water in the waste fuel that may be transferred to the burn tanks. Solids removed from the tank during periodic cleaning and inspection are shipped offsite as hazardous waste for disposal. Water periodically collects in the bottom of tank T-100M-5 and is phase cut from the tank for disposal as hazardous waste.

Once a boiler feed tank is filled, the waste is sampled (waste fed to the boiler directly is also sampled and analyzed prior to burning). The waste is then fed to the boiler from the approved waste tanks via pump P-8331A. The boiler feed waste is filtered again just before the boiler controls to ensure removal of any remaining solids that might plug or interfere with the burn nozzle proper atomization. Other than the liquid waste, natural gas and fuel oil No. 2 are used as boiler fuels. The total feed rate of liquid waste fuel to the boiler can vary between 1.5 and 3.5 gallons per minute (gpm). The boiler begins to "flame out" if the feed rate drops below ~1.5 gpm. Due to boiler inefficiencies, the maximum firing rate for waste fuel is expected to be 3.5 gpm.

Typically, the fuel data is as follows:

Fuel Type and Grade	Heat Content	Consumption (~) Rated Capacity
Natural Gas	1,040 BTU/CF	32,200 CF/hr
Fuel Oil No. 2 (low sulfur)	20,000 BTU/lb	1,675 lb/hr
Liquid Waste	17,000 BTU/lb	1,970 lb/hr[1]

D.9.2 Boiler and Its Control System

D.9.2.1 Cleaver Brooks Boiler

The boiler, HE-3800-1 is a Cleaver-Brooks 800 HP packaged firetube boiler of welded steel construction and consists of a pressure vessel, burner, burner controls, forced draft fan, damper, and air pump. With the passage of the MACT regulations, SI Group has installed a CBMC and an oxygen trim system to ensure that the burning of hazardous wastes meets regulatory standards.

The boiler is designed with fuel and air introduced at the head of the boiler. Combustion takes place in the cylindrical furnace chamber that runs along the length of the boiler. The combustion gases then make three more passes through the tubes of the boiler prior to being exhausted to the air pollution control device. Steam is produced as the hot combustion gases heat water surrounding the tubes.

A forced draft fan located in the boiler head furnishes air for the combustion of the waste fuel. In operation, air is forced through a diffuser plate in the boiler to thoroughly mix with waste fuel for proper combustion. Compressed air atomizes the waste fuel in the burner gun nozzle. Combustion is optimized through an oxygen trim system on the boiler. The oxygen trim system manipulates the waste fuel flow to achieve the optimal firing conditions.

The boiler is also capable of firing separately, natural gas or fuel oil in place of waste fuel. The boiler is equipped with separate fuel trains to burn waste fuel, fuel oil, and natural gas. As part of the automatic waste feed cutoff system, the boiler can be switched from burning waste fuel to natural gas automatically. To burn fuel oil, the burner nozzle utilized to burn waste fuel is changed manually to a nozzle specifically designed to burn No. 2 fuel oil.

D.9.2.2 Computerized Boiler Management Controller

The CBMC is the Cleaver-Brooks CB-Hawk. The CB-Hawk is a microprocessor-based integrated control system for gas, waste fuel, or combination fuel burner application. The system can manage up to three fuel streams and permit simultaneous burning of the fuels. SI Group utilizes the system

[1] Actual limit is based on MACT performance test.

to manage the burning of natural gas, fuel oil, and waste fuels separately and does not utilize the simultaneous burning option. The CBMC consists of a boiler controller (chassis, program module, and keyboard display module), flame amplifier, solid state sensors (waste fuel/fuel oil and water temperature, steam, gas, and waste fuel/fuel oil pressure), and damper motor. Functions provided by the CBMC include automatic burner sequencing, flame supervision, system status indication, and system and self-diagnostics. All pertinent boiler operating parameters are monitored and controlled by this system. The CBMC has a remote display and interface system to allow monitoring and modifying operating parameters. The CBMC is equipped with digital input to initiate the change over from waste fuel to natural gas in the event of an automatic waste feed cutoff. The CBMC automatically controls the change-over of fuels.

D.9.2.3 Boiler Oxygen Trim System

The boiler is also equipped with an oxygen (O_2) trim system. The trim system is a Cleaver-Brooks microprocessor-based control system with oxygen analyzer designed to maintain the proper fuel-to-air ratio so that optimal combustion conditions can be obtained. The complete system is comprised of oxygen sensors, firing rate sensors, a control panel which houses an oxygen analyzer and controller, and an actuator system that trims either the fuel or air flow. The system is designed to compensate for any minor changes in conditions such as temperature, barometric pressure, fuel characteristics, and normal system hysteresis.

The system analyzes flue gas oxygen content and based on the firing rate and type of fuel being fired, determines the proper oxygen set-point. The actual oxygen input is compared with the oxygen set-point and the controller determines an output to correct and maintain oxygen at the desired set-point.

D.9.3 Hazardous Waste Monitoring System

D.9.3.1 System Controller and Data Acquisition System

The Babcock-Wilcox NetDAHS CEMS provides data acquisition, calibration, and automatic feed shutoff interlocks for the boiler. The system consists of a supervisory Windows-based PC and a GE Fanuc programmable logic controller (PLC). The Fanuc PLC interfaces with field devices, executes control code, receives instructions from the NetDAHS PC, and passes data to the NetDAHS PC. NetDAHS provides computation, data logging, reporting, and visualization functions. The NetDAHS PC is equipped with an uninterruptible power supply to reduce the risk of data loss.

The NetDAHS CEMS acquires six readings of each variable every minute and logs the average to a disc file. The NetDAHS CEMS also computes 60-minute rolling averages for each variable, also logged to a disc file.

The NetDAHS CEMS monitors all required operating parameters while the boiler is in operation. Any parameter excursion outside of regulator limits will initiate an automatic waste feed cutoff (AWFCO). The AWFCO is implemented in a fail-safe fashion, whereby a signal is required to be present to permit feeding waste to the boiler. Absence of the signal, whether due to parameter excursion, wiring fault, or equipment failure, will result in automatic shutoff of the waste feed and switchover to natural gas.

The NetDAHS CEMS also initiates the daily calibration of the stack O_2 and carbon monoxide (CO) analyzer. The NetDAHS CEMS generates daily reports as follows:

- **Instrument Operating Report** — Reports any outages including period of daily calibration for the CEMS, generated daily with quarterly results.

- **Data Acquisition System Operating Report** — Reports all downtime of the data acquisition system, generated daily with quarterly results.

- **Daily Calibration Drift Report** — Reports the results of the daily calibration drift test, generated daily with quarterly results.

- **Daily Operating Report** — Reports actual operating data every minute.

- **Waste Feed Report** — Tracks when boiler controls are in the waste position and totals waste fed to the boiler, generated daily and quarterly.

- **Waste Feed Shutdown Report** — Reports all automatic waste feed shutdowns by any operating variable (including weekly test), the reason for shutdown, and operator entered corrective action, generated on a quarterly basis.

- **System Downtime Report** — Reports downtime of CEMS and NetDAHS, generated quarterly.

A schematic of the NetDAHS CEMS is provided in Figure D.9-2 (Appendix D-9).

D.9.3.2 Continuous Emissions Monitoring System

SI Group continuously monitors the CO and O_2 levels in the combustion stack gases and routinely meets the 100 parts per million by volume (ppmv) CO corrected to 7% O_2 limit when burning waste. The NetDAHS CEMS in set to switch the boiler from burning hazardous waste to burning natural gas when the rolling, one-hour CO concentration is greater than 65 ppmv.

Emissions data collected during February 2017 was evaluated to confirm that the NetDAHS CEMS was functioning in this capacity. During the month of February 2017, there were three, one-hour periods when the CO concentration from the boiler exhaust exceeded the 65 ppmv. During each of these one-hour periods, the boiler switched from burning hazardous waste to burning natural gas, as intended. Records of the emissions data from February 2017 is included as Appendix D-9.1.

The CEMS utilized by SI Group is the sniffer system by Enertec. The system consists of three parts: a sample probe/primary filter installed directly on the stack, an analyzer system mounted in the instrument house, and a heated sample line connecting the two parts. The primary sample conditioning system is mounted in the same rack as the analyzers.

By mounting all but the primary filter for the sampling conditioning in the analyzer cabinet, easier maintenance is assured. The primary filter mounted at the sample probe collects most of the dust from the baghouse exhaust. In order to prevent condensation of moisture, the primary filter and the sample line are traced with electrical heating tape to maintain a temperature of 220-325 degrees Fahrenheit (°F). Along with the sampling line is a separate line to carry calibration gases to the probe. In the primary sample conditioning system, the sample gas passes through a drain separator, a mist catcher, a particulate filter, a flow selector valve, a pump, and a dehumidifier.

The CO and O_2 analyzer is a Rosemount XStream stack gas analyzer. This dual analyzer has the following characteristics:

Principle of Operation:	Non-Dispersive Infrared
Range CO:	0-200 and 0-3000 parts per million (ppm)
Range O_2:	0-21%
Response Time:	1 minute for 90% response at inlet
Repeatability:	± 0.5% of full scale
Drift:	± 1% full scale per day
Span:	$\pm$ 2% full scale per day

D.9.3.3 Combustion Chamber Temperature

A thermocouple is installed in the rear end of the boiler at the end of the firing chamber prior to the combustion gases entering the tubes for heat transfer. The thermocouple, a type R in a thermowell, has a local indicator and transmits a signal to the PC via PLC.

The typical combustion chamber temperature is 1980 ^{0}F. Appendix D-9.2 presents the results combustion chamber temperatures recorded during the 2003 trial burn, 2009 CPT, and the 2014 CPT. The combustion chamber average temperatures ranged between 1,294 ^{0}F (2003 trial burn minimum combustion temperature test) — 2,252 ^{0}F (2014 CPT) which were all greater than the 1,284 ^{0}F permit condition.

D.9.3.4 Combustion Stack Gas Temperature

The combustion stack temperature is continuously monitored via a thermocouple located between the exhaust of the boiler and the inlet to the baghouse. The thermocouple, a type J in a 316 stainless-steel thermowell, is equipped with a local indicator and transmits a proportional 4-20 milliAmp (mA) signal to the PC via PLC. Combustion gases exiting the boiler are typically 300-400 ^{0}F.

In the March 2005 *Final Preliminary Hazardous Waste Combustion Risk Assessment,* a stack gas temperature of 362 ^{0}F was used in the air dispersion modeling; based on stack testing results from November 2003. During the 2003 Test Burns, average stack gas temperatures were measured between 257 — 373 ^{0}F, with an average temperature of 346.5 ^{0}F. Comprehensive performance test data collected in 2009 and 2014 measured stack gas temperatures between 320 — 325 ^{0}F (average 323 ^{0}F) and 231 — 331 ^{0}F (average 295 ^{0}F), respectively. The lower temperature tests were intentional to capture worst case conditions for the formation of dioxins and furans. Data from the 2003 Test Burns and the 2009 and 2014 comprehensive performance tests are provided in Appendix D-9.3.

D.9.3.5 Waste Fuel Firing Rate

The waste fuel fed to the boiler passes through a Micro-Motion mass flow meter prior to entering the boiler. The flow meter is located between the boiler controls and the burner gas to account for all waste fuel burned in the boiler. The meter continuously transmits a 4-20 mA signal via PLC to the PC. Typical operational waste feed rates are 600-1,500 pounds per hour.

D.9.3.6 Natural Gas Flow Rate

Natural gas is utilized as an alternative fuel to the boiler. The natural gas feed rate to the boiler is measured by a Johnson Yokogawa Vortex meter with transmitter. The unit transmits a 4-20 mA signal to the PC via PLC. When firing natural gas, rates ranging from 10-15 pounds per minute are typical. The unit also calculates the natural gas fed to the boiler.

D.9.3.7 Steam Production Rate

The boiler feed water is measured by a Badger Meter with a local readout. The steam production for the boiler is measured by the steam flow meter. The unit transmits a 4-20 mA signal to the PC via PLC. Steam production rates are typically 10,000-20,000 pounds per hour.

D.9.3.8 Baghouse Pressure Drop

Pressure drop across the baghouse is continuously measured by a differential pressure cell. The differential pressure transmitter sends a signal proportional to 0-15 inches of water to the PC via PLC. The baghouse has a minimum set point of 0.5 inches of water for burning waste. Similarly, the baghouse has a maximum set point of 20 inches of water; above which, the boiler will switch to gas. The baghouse typically operates with a pressure drop of 2-5 inches of water.

The #4 boiler baghouse opacity sensor, AI-S8397-A, is an Auburn Systems Trioflow model 3400-11 and monitors for breakthrough in the bags. The principle of operation for this device is electrostatic: when particulates collide with the probe, or pass nearby, the detector transmits a proportional 4-20 mA signal to the PLC, which elevates the opacity reading above its baseline.

D.9.4 Automatic Waste Feed Cutoff System

The PC monitors the operation variables and initiates an automatic waste feed cutoff when one or more of the following conditions are met (some values are based on performance test results):

High CO: The hourly rolling average of CO corrected to 7% O_2 is greater than 65 ppm (note that this limit is well below the 100 ppm permit requirement).

Low Baghouse: The instantaneous baghouse pressure is below 0.5 inches of water Pressure. One minute block averages are stored. Each 1-minute block average consists of 60 samples taken at 1 second intervals.

High Waste
Feed Rate: The hourly rolling average of the waste feed rate exceeds 23.1 pounds per minute.

High Stream
Feed Rate: The hourly rolling average of the steam feed rate exceeds 20.3 thousand pounds per minute.

Baghouse
Particulate Measurement: 0.63 milligrams per dry standard cubic meter (equal to 0.0097 grains per dry standard cubic foot [dscf] *Boiler No. 4 Comprehensive Performance Test Report EPA I.D. NO. SCD 043 348 072* [Focus Environmental Inc. August 2014] [Appendix D-9.4]).

O_2/CO analyzer in Maintenance mode.
Waste flow hourly average value > 23.1 lb/min.
Baghouse pressure differential < 0.50 inch H_2O.
Steam flow hourly average value > 20.3 Mlb/hr.
Economizer exhaust temp leaving > 398 °F.
Boiler temp hourly average value > 2700°F.
Boiler temp hourly average value > 2500 °F.
Boiler temp hourly average value < 1393 °F.
CO analyzer data not valid.
Operator-initiated AWFCO test.
CO calibration failed.
O_2 calibration failed.
Baghouse particulate measurement > 0.08 grains per dscf.
Corrected CO hourly average value > 65 ppm.
Boiler firebox outlet pressure > -1 inch H_2O.

If one of these parameters is exceeded, the PC will send a signal to the CBMC via the two PLCs to switch from waste fuel to natural gas. In switching over from waste to natural gas, the waste fuel feed is ramped down to low fire over 30 seconds. The natural gas pilot is then ignited and confirmed. Then, the natural gas feed is ramped up to the desired firing rate over the next 40 seconds. The boiler will be up fully on natural gas within 90 seconds after the initiation of the cutoff by the PC. The CBMC will perform this operation automatically. The radiant heat in the boiler will not allow the

chamber temperature to drop significantly during the switch from waste fuel to natural gas. Therefore, any residual waste fuel in the boiler will be burned. SI Group tests the waste feed cutoff system every seven days during normal operation.

In order to minimize the number of waste feed cutoffs, the PC will alarm when any of the variables reach 50-80% of their limit. This early warning will permit the boiler operator to take some corrective action before emission limits are exceeded. The NetDAHS will report all automatic waste feed cutoffs, either tests or actual.

D.9.5 Pollution Control Devices

D.9.5.1 Baghouse

To ensure that particulate emissions will be below the MACT limit of 0.08 grains/dscf, SI Group has installed a baghouse to collect particulate in the stack gases. The baghouse, manufactured by Aeropulse, Inc. (Model PR-256-10-H-N), is guaranteed by the manufacturer to remove 90% of the particle in the stack gases. The baghouse has 256 10-foot long bags that are 10 feet long and 6 inches in diameter. The bags are constructed of a heat resistant polyamide. The baghouse is equipped with a photohelic pressure sensor to provide on demand reverse pulse cleaning and is designed with 40 inches of water pressure rating at 500 ^{0}F with a maximum air to cloth ratio of 3.5 cubic feet per minute per square-foot.

The *Results of November 2011 Particulate Matter Emissions Testing of Boiler No. 4* (GEL Engineering, January 2012, and included as Appendix D-9.5) determined that the particulate matter emission concentration from Boiler No. 4 was 0.0012 grains/dscf at 7% Oxygen; which is less than the emission limit of 0.08 grains/dscf at 7% Oxygen.

The 2014 performance test for Boiler No. 4 (*Boiler No. 4 Comprehensive Performance Test Report EPA I.D. NO. SCD 043 348 072* [Focus Environmental Inc. August 2014, and included as Appendix D-9.4]) determined that the particulate matter emissions from Boiler No. 4 averaged 0.63 milligrams per dry standard cubic meter (equal to 0.0097 grains/dscf); which is less than the HWC MACT Standard of 0.08 grains per dscf. Future performance tests will be performed on the Boiler No. 4 to comply with Boiler MACT requirements.

When the baghouse is operating normally, the flow of exhaust gas across the filter elements is expected to produce a differential pressure of 3 — 5 inches of H2O. A higher differential pressure would indicate the elements are more highly saturated with particulates. A lower differential pressure would indicate a lower loading of particulates on the elements. An abnormally-low differential

pressure could indicate a broken filter element or bypassing of exhaust gas around the baghouse. Therefore, a trigger pressure of < 0.5 inch H2O is used to signal that the baghouse may have a broken or missing bag. The differential pressure at the baghouse is continuously monitored by SI Group's NetDAHS CEMS on one-minute intervals.

The value of -1 inch H_2O is maintained as the outlet pressure of the firebox to ensure that no leaks to the atmosphere occur. Any pressure greater than -1 inch H_2O is a signal that a leak to the atmosphere has occurred and that ambient air is entering the firebox.

There is are two vent lines on the line from the boiler exhaust to the baghouse (one on the inlet line to the baghouse and one on the outlet line from the baghouse); making it impossible to bypass the baghouse. This vent lines each contain a manually-operated; however, the butterfly valves are left open at all times. In the event that the baghouse would need to be locked out for maintenance; the boiler and the induction fans are lockout out, not the butterfly valves before and after the baghouse. Closing the butterfly valve would result in a shutdown of the boiler due to the pressure increase in the vent line.

The baghouse is equipped with a hopper. Particulate collected on the bags is dislodged by the pulsating cleaners and falls into the hopper. The bottom of the hopper is equipped with a rotary air lock valve that discharges the particulate into 55-gallon drums. The drums are sent offsite as hazardous waste for proper disposal.

D.9.5.2 Boiler Stack

To aid dispersion of the stack gases, the boiler is equipped with a 60-foot high by 24-inch diameter stack. This stack at maximum firing rates produces a dilution factor of 0.73 micrograms per cubic meter per second for the maximum offsite annual average concentration based on atmospheric data and air dispersion modeling.

D.9.6 Trailer Loading/Unloading Area

Hazardous wastes are regularly collected from temporary (<90-day) storage tanks located throughout the plant property by steel tank-trailers operated onsite by SI Group. Other vehicles may occasionally be used to make deliveries to the HWMUs. The collected waste is transferred from the tank-trailers to the storage tanks at the facility.

Tank-trailers delivering hazardous waste to the HWMUs are unloaded within a coated concrete containment area that is located immediately adjacent to and east of the storage tank containment structure (see Figure D.9-2-1, Appendix D-9). This containment area measures approximately

65 feet by 90 feet, is paved with 6 inches of reinforced concrete, and also serves as a less than 90-day storage area. Containment walls along three sides of the structure are constructed of 8-inch reinforced concrete. The fourth side of the structure is open to allow vehicular access. The south wall of the loading area is approximately 5 feet high and the sidewalls maintain a consistent top elevation. The floor of the area slopes up at 3/8 inches per foot to the vehicle entrance on the north side where a 4-inch roll curb prevents storm water from flowing into the area. This structure can contain approximately 44,421 gallons, which is greater than 100% of the capacity of the largest tank-trailer that would expected to be present at the loading/unloading area (typically, 7,500 gallons) plus precipitation from a 25-year, 24-hour rainfall event (approximately 24,470 gallons). Calculations supporting this containment volume can be found in Appendix D-2.3.

The contained loading/unloading area slopes to a trench drain along the south side of the area. Any waste releases or accumulated liquids are contained within the area and collected in a sump that is located in the southwest corner of the loading area. An installed pump, for removal of storm water, pumps from this sump to a nearby sump which is pumped to Area 3 Wastewater Storage tank (T-0134). This pump is automatic and activated by a level indicator. The sump contents are visually inspected for signs of contamination such as an oily sheen or discoloration. If contamination is suspected or a spill of hazardous material has occurred, the sump contents will be pumped into a tanker or other appropriate container within 24 hours and properly disposed. Tank T-0134 is not subject to RCRA regulations because it does not receive, store, or treat hazardous waste. The secondary containment area, the sump, and all transfer equipment and piping are inspected daily for evidence of a release, presence of debris, and structural deterioration (see Section I, Inspection Schedule and Procedures).

Tank-trailers are loaded or unloaded, one at a time, with a pump through flexible hose connection ports located within the contained loading/unloading area. A platform with two self-leveling gangways and safety gates is used to allow safe access to tank-trailer loading/unloading operations. The piping diagram for the tank-trailer loading/unloading facility and transfer operations is shown in Figure D.9-1 (Appendix D-9).

For spills, blowing out the lines between transfers and buckets are used to minimize small leaks. The transfer pump is gravity fed from the tank trucks.

As shown in Figure D.2-1 (Appendix D-2), a metal stairway provides access between the two containment areas and a metal ladder located on the east wall of the structure provides a second means of escape in an emergency. Safety equipment located in the tank-trailer loading/unloading

containment area consists of an emergency shower with an eyewash station and one ANSUL 30-pound dry chemical fire extinguisher. Additional equipment located in the adjacent storage tank containment area is easily accessible. A fire protection turret nozzle is located 50 feet north of the facility just across 10th Street. Safety equipment locations are shown on Figure D.2-1 (Appendix D-2). All safety equipment is inspected monthly, as discussed in Section H, Inspection Schedule and Procedures).

D.9.7 Satellite Accumulation Areas

Hazardous wastes are also managed at a number of Satellite Accumulation Areas throughout the plant property. Section J of this Permit Application includes more information regarding the Satellite Accumulation Areas utilized at the facility.

Appendix D-9
Figures

HAZARDOUS WASTE TO OFF-SITE FUEL BLENDING VIA TANK TRUCK

TO FLARE

AN-330 HEEL VIA PIPE LINE

T8333
(T-30M-61)
WASTE FUEL
COLLECTION TANK

T8345
(T-10M-32)
WASTE FUEL
BURN TANK

P8333

P8345

#2 FUEL OIL OR PLANT WASTE VIA TANK TRAILERS

TO FLARE

PLANT WASTE VIA PIPE LINE

T8332
(T-100M-5)
WASTE FUEL
COLLECTION TANK

T8331
(T-30M-66)
WASTE FUEL
BURN TANK

AQUEOUS CUT VIA TANK TRUCK TO TREATMENT SYSTEM

F8332
SELF CLEANING
FILTER

P8332

F8331
FEED
FILTER

P8331A

P8331B

BOILER FILTER

TO ATM. AT
60' ABOVE GRADE

CO AND O_2 ANALYZERS

AE AE

24" I.D.

DPT

FILTER-3050-1
BAG HOUSE
3050 ft^2
252 BAGS

TT

TT

FT

PLANT NATURAL GAS

E8304
(HE-3800-1)
BOILER #4

150 PSIG STEAM TO PLANT
27,000 LB/HR MAX

FT

BOILER FEED WATER

FIGURE D.9-1

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ISSUED FOR APPROVAL	2/11/93	2/11/93		2/17/93	2/17/93	2/17/93
	PER PROJECT 0682	RDS	RLT		JWR	RLT	RRS
1	GENERAL REVISION	01/17/00	1/17/00		1/17/00	1/17/00	1/18/00
		RR	GFW		JWR	GFW	RLT
2	GENERAL REVISION	8/30/04	8/31/04	8/31/04	8/31/04	8/31/04	8/31/04
		RDS	MGC	RDS	JWR	MGC	RAT

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D

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BOILER #4 ENVIRONMENTAL SCHEMATIC PFD

PROJECT NUMBER	DRAWING NUMBER	REV.
0682	0BH25F008	2
SCALE: NONE	OPERATING AREA: – BUILDING NO: –	

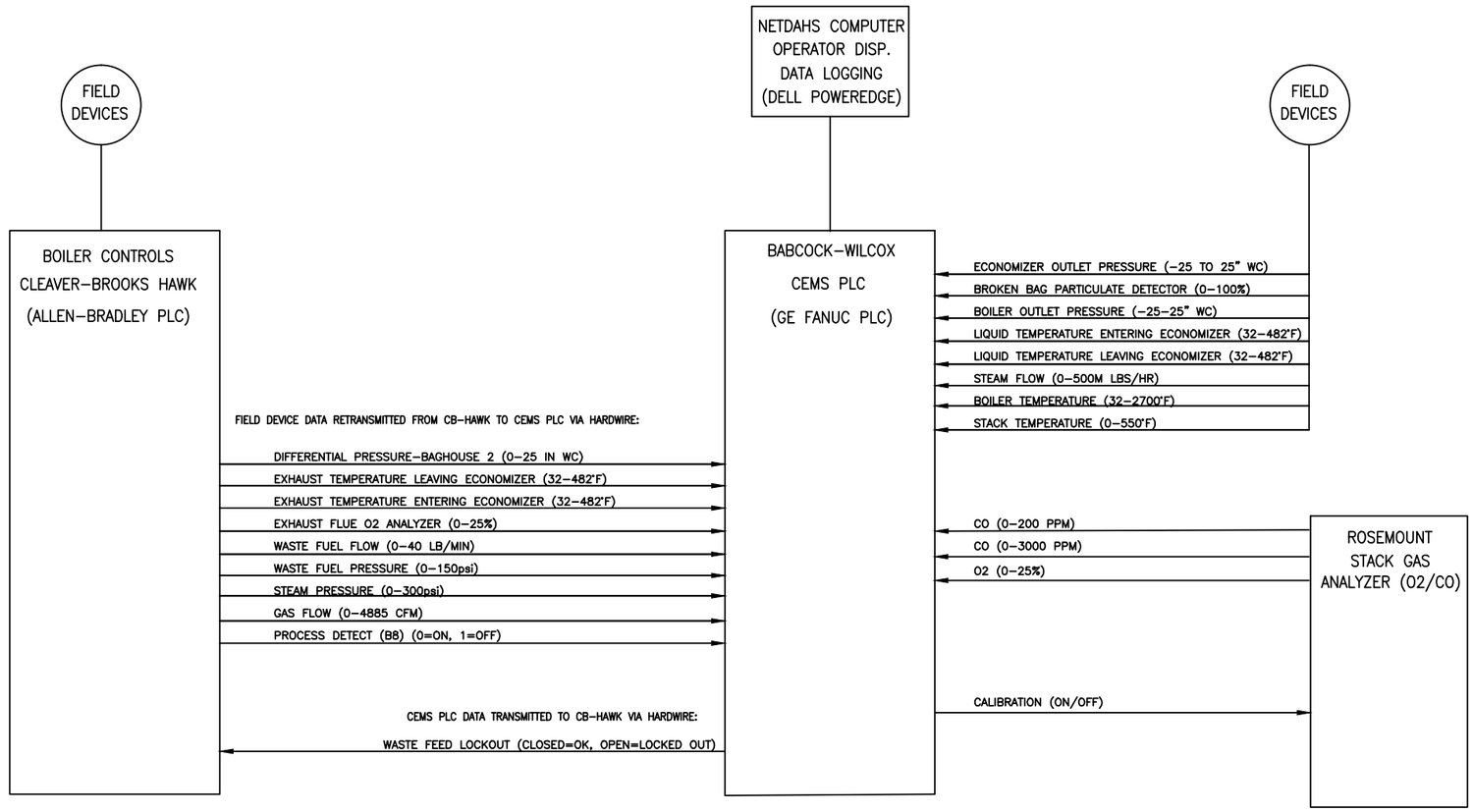

FIGURE D.9-2

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
3	AS–BUILT PER PROJECT #4194 HAZARDOUS WASTE #4 BOILER IMPROVEMENT	3/14/07 RDS					
2	GENERAL REVISION	4/2/06					

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
4	AS–BUILT PER 2008 PROJECT TO UPGRADE CLEAVER–BROOKS HAWK ICS BOILER CONTROLS	9/10/15 JPG	9/10/15				

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D

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BOILER #4
CONTROL AND DATA LOGGING SYSTEM SCHEMATIC

PROJECT NUMBER	DRAWING NUMBER	REV.
4194	0BH25I076	4

SCALE: NONE | OPERATING AREA: – | BUILDING NO: –

Appendix D-9.1
Emissions Data from February 2017

Average Values Report
Generated: 4/13/2017 07:59

Company: SI Group
Plant: 725 Cannon Bridge Rd.
City/St: Orangeburg, SC 29115
Source: BOILER

Period Start: 2/1/2017 00:00
Period End: 2/28/2017 23:59
Validation Type: 60/60 min
Averaging Period: 1/1 hr
Type: Rolling Avg

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/01/2017 00:00	311.9	0.0	1738.9	12.54	18	-8.05
02/01/2017 01:00	307.8	0.0	1691.4	11.69	21	-7.98
02/01/2017 02:00	313.1	0.0	1776.7	14.43	19	-7.93
02/01/2017 03:00	304.9	0.0	1657.5	9.93	16	-8.15
02/01/2017 04:00	297.9	0.0	1612.1	9.41	14	-8.02
02/01/2017 05:00	304.8	0.0	1677.5	10.74	14	-8.05
02/01/2017 06:00	298.1	0.0	1587.6	8.45	13	-8.04
02/01/2017 07:00	303.4	0.0	1667.4	11.19	15	-7.96
02/01/2017 08:00	298.3	0.0	1602.2	8.76	13	-8.09
02/01/2017 09:00	301.0	0.0	1658.7	10.87	N/A	-7.99
02/01/2017 10:00	301.1	0.0	1616.1	9.07	15	-8.07
02/01/2017 11:00	298.9	0.0	1583.1	8.63	14	-8.04
02/01/2017 12:00	298.9	0.0	1579.4	8.65	14	-8.03
02/01/2017 13:00	299.6	3.1	1578.7	8.67	13	-8.03
02/01/2017 14:00	314.8	17.4	1690.7	12.01	16	-7.96
02/01/2017 15:00	321.2	18.2	1737.1	12.97	16	-8.02
02/01/2017 16:00	321.6	18.3	1748.8	13.35	16	-8.01
02/01/2017 17:00	321.9	18.0	1742.5	12.94	16	-8.01
02/01/2017 18:00	322.4	17.7	1737.3	12.87	15	-8.02
02/01/2017 19:00	322.7	17.6	1732.5	12.69	16	-8.05
02/01/2017 20:00	322.4	17.5	1727.8	12.62	17	-8.00
02/01/2017 21:00	322.2	17.4	1725.4	12.51	16	-8.03
02/01/2017 22:00	322.1	17.3	1721.6	12.40	16	-8.05
02/01/2017 23:00	321.9	17.9	1741.2	12.87	16	-8.01
02/02/2017 00:00	322.5	17.9	1744.9	12.64	15	-8.03
02/02/2017 01:00	322.5	17.9	1744.3	12.75	16	-8.04
02/02/2017 02:00	322.3	17.9	1747.6	12.89	16	-8.00
02/02/2017 03:00	321.6	17.9	1748.9	13.07	16	-8.02
02/02/2017 04:00	319.2	18.0	1747.5	13.43	16	-8.03
02/02/2017 05:00	321.0	17.9	1745.6	12.82	16	-8.05
02/02/2017 06:00	319.6	18.0	1748.8	13.80	16	-8.01
02/02/2017 07:00	319.2	17.8	1743.7	12.66	15	-8.03
02/02/2017 08:00	320.9	18.0	1754.0	13.01	15	-8.04
02/02/2017 09:00	321.8	18.1	1758.9	12.82	N/A	-8.01
02/02/2017 10:00	323.7	18.7	1786.7	13.37	17	-8.02
02/02/2017 11:00	322.5	18.5	1788.4	13.40	17	-8.04
02/02/2017 12:00	324.8	18.2	1785.6	13.15	17	-8.01
02/02/2017 13:00	319.7	18.1	1781.8	13.86	17	-8.04
02/02/2017 14:00	325.8	18.4	1797.1	13.28	17	-8.02
02/02/2017 15:00	327.2	18.3	1797.9	13.48	17	-8.04
02/02/2017 16:00	328.1	18.3	1800.3	13.33	17	-8.03
02/02/2017 17:00	328.0	18.3	1796.5	13.32	16	-8.02
02/02/2017 18:00	329.4	18.1	1790.0	12.94	16	-8.01
02/02/2017 19:00	329.4	17.8	1777.4	12.76	16	-8.02
02/02/2017 20:00	327.1	17.8	1770.0	13.03	15	-8.01
02/02/2017 21:00	327.2	17.7	1769.7	12.77	16	-8.08
02/02/2017 22:00	327.7	17.8	1771.2	12.83	16	-8.01
02/02/2017 23:00	324.9	17.8	1773.2	12.85	16	-8.01
02/03/2017 00:00	326.9	17.9	1774.6	12.72	16	-8.03
02/03/2017 01:00	325.5	17.7	1768.9	13.17	16	-8.04
02/03/2017 02:00	327.7	17.8	1772.5	12.55	16	-8.03
02/03/2017 03:00	327.5	17.9	1772.8	12.68	16	-8.02
02/03/2017 04:00	325.4	17.9	1772.9	12.87	16	-8.02
02/03/2017 05:00	325.8	18.0	1779.7	12.76	16	-8.04
02/03/2017 06:00	328.0	18.1	1785.9	12.58	16	-7.99
02/03/2017 07:00	325.6	18.1	1782.4	12.75	16	-8.02
02/03/2017 08:00	325.3	16.4	1789.3	12.87	24	-8.00
02/03/2017 09:00	321.2	3.6	1768.1	12.32	N/A	-7.91
02/03/2017 10:00	321.9	18.1	1744.7	12.69	20	-8.01
02/03/2017 11:00	322.1	17.9	1741.3	12.58	19	-8.02
02/03/2017 12:00	322.5	18.1	1743.9	12.56	19	-8.09
02/03/2017 13:00	322.5	18.2	1747.2	12.51	19	-7.99
02/03/2017 14:00	319.9	15.1	1730.4	12.01	37	-8.02
02/03/2017 15:00	321.8	17.9	1725.0	12.27	18	-8.03
02/03/2017 16:00	321.7	18.1	1735.7	12.41	18	-8.01
02/03/2017 17:00	322.4	17.9	1732.5	12.22	17	-8.05
02/03/2017 18:00	321.3	17.9	1733.3	12.14	17	-8.03
02/03/2017 19:00	323.7	18.2	1753.5	12.62	17	-8.04
02/03/2017 20:00	319.5	10.8	1701.0	11.15	19	-8.08
02/03/2017 21:00	314.6	0.0	1768.9	12.29	24	-8.03
02/03/2017 22:00	299.7	1.8	1565.7	7.87	16	-8.24
02/03/2017 23:00	294.5	0.0	1527.5	7.58	22	-8.11
02/04/2017 00:00	311.8	15.5	1692.1	12.10	17	-7.96

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/04/2017 01:00	317.9	17.8	1729.3	12.87	17	-8.01
02/04/2017 02:00	317.2	17.9	1734.1	12.95	17	-8.04
02/04/2017 03:00	317.6	17.7	1733.6	12.53	17	-8.04
02/04/2017 04:00	317.3	17.4	1722.4	12.30	16	-8.04
02/04/2017 05:00	317.0	17.0	1706.2	11.95	17	-8.01
02/04/2017 06:00	316.9	17.8	1734.1	13.03	16	-8.04
02/04/2017 07:00	316.4	17.5	1722.3	12.24	16	-8.07
02/04/2017 08:00	314.8	17.5	1722.1	13.24	16	-8.00
02/04/2017 09:00	314.8	17.5	1724.9	12.65	N/A	-8.05
02/04/2017 10:00	317.1	17.8	1739.2	12.60	21	-8.02
02/04/2017 11:00	317.0	17.8	1745.3	13.00	20	-8.02
02/04/2017 12:00	319.7	18.1	1762.3	13.04	19	-8.03
02/04/2017 13:00	321.1	18.3	1772.3	13.26	19	-8.03
02/04/2017 14:00	322.3	18.6	1785.6	13.28	19	-8.02
02/04/2017 15:00	322.8	18.3	1777.0	13.17	18	-8.04
02/04/2017 16:00	320.6	18.2	1776.9	13.96	17	-8.03
02/04/2017 17:00	320.2	17.9	1769.0	13.07	17	-8.04
02/04/2017 18:00	322.6	17.7	1764.7	12.70	17	-8.03
02/04/2017 19:00	322.3	18.3	1778.0	13.14	17	-8.03
02/04/2017 20:00	322.5	17.8	1762.2	12.78	16	-8.00
02/04/2017 21:00	321.3	17.4	1742.8	12.54	16	-8.04
02/04/2017 22:00	319.2	17.1	1727.1	12.47	15	-8.01
02/04/2017 23:00	320.3	17.1	1725.3	12.09	15	-8.02
02/05/2017 00:00	320.5	17.3	1731.1	12.46	15	-8.02
02/05/2017 01:00	317.4	17.3	1729.9	13.08	15	-8.01
02/05/2017 02:00	318.4	17.3	1728.2	12.51	15	-8.07
02/05/2017 03:00	311.5	17.4	1730.6	14.20	15	-7.99
02/05/2017 04:00	317.0	17.6	1738.6	12.80	15	-8.01
02/05/2017 05:00	320.7	18.2	1758.0	12.71	15	-8.00
02/05/2017 06:00	319.4	18.0	1753.8	12.71	16	-7.99
02/05/2017 07:00	315.9	17.8	1742.8	14.18	16	-8.06
02/05/2017 08:00	318.4	17.9	1744.7	12.56	16	-8.00
02/05/2017 09:00	320.9	18.3	1761.6	12.91	N/A	-7.98
02/05/2017 10:00	322.6	18.5	1768.2	12.93	18	-7.99
02/05/2017 11:00	315.4	1.2	1747.5	13.47	43	-7.71
02/05/2017 12:00	304.1	8.8	1547.9	9.79	17	-8.97
02/05/2017 13:00	309.6	9.3	1632.6	11.33	19	-8.44
02/05/2017 14:00	304.9	0.0	1704.5	11.52	19	-8.02
02/05/2017 15:00	312.0	16.2	1719.6	13.80	19	-7.97
02/05/2017 16:00	316.6	18.1	1705.7	12.50	16	-8.02
02/05/2017 17:00	318.7	17.7	1692.6	12.10	16	-8.02
02/05/2017 18:00	320.5	17.5	1680.8	11.82	16	-8.01
02/05/2017 19:00	311.8	12.3	1496.0	8.30	13	-9.76
02/05/2017 20:00	297.6	0.7	1491.2	8.09	25	-7.78
02/05/2017 21:00	305.6	8.8	1613.6	10.17	16	-7.95
02/05/2017 22:00	319.2	17.5	1663.5	11.82	17	-8.02
02/05/2017 23:00	302.4	6.2	1464.6	8.60	17	-9.47
02/06/2017 00:00	305.7	2.0	1619.4	10.70	23	-7.93
02/06/2017 01:00	290.6	1.6	1360.4	5.94	13	-9.03
02/06/2017 02:00	308.1	0.0	1676.4	12.73	21	-7.82
02/06/2017 03:00	301.9	0.0	1652.1	10.64	16	-8.05
02/06/2017 04:00	295.5	0.0	1585.6	8.97	13	-8.04
02/06/2017 05:00	295.3	0.0	1586.8	8.97	13	-8.03
02/06/2017 06:00	294.4	0.0	1565.5	8.53	12	-8.03
02/06/2017 07:00	301.6	10.1	1627.9	10.65	17	-7.97
02/06/2017 08:00	316.4	17.7	1705.5	12.91	16	-8.00
02/06/2017 09:00	317.8	18.2	1726.9	13.38	N/A	-8.01
02/06/2017 10:00	319.3	18.4	1746.3	13.48	19	-8.02
02/06/2017 11:00	321.5	18.6	1762.0	13.68	17	-7.93
02/06/2017 12:00	317.5	15.0	1661.6	11.59	21	-6.19
02/06/2017 13:00	274.4	0.0	1042.7	0.94	10	-1.10
02/06/2017 14:00	300.6	0.0	1538.4	9.08	20	-7.34
02/06/2017 15:00	320.4	16.5	1709.0	12.66	24	-7.97
02/06/2017 16:00	324.3	17.6	1722.1	12.65	23	-8.01
02/06/2017 17:00	325.1	17.8	1738.6	12.98	22	-7.98
02/06/2017 18:00	324.1	17.3	1725.7	12.66	23	-8.00
02/06/2017 19:00	323.8	16.6	1700.4	11.89	23	-7.99
02/06/2017 20:00	323.0	16.5	1693.8	11.83	22	-7.72
02/06/2017 21:00	322.2	16.4	1687.1	11.59	22	-7.89
02/06/2017 22:00	322.1	17.2	1710.1	12.29	21	-7.94
02/06/2017 23:00	322.4	17.2	1711.0	12.15	21	-7.79
02/07/2017 00:00	316.8	11.6	1624.7	10.04	29	-7.86
02/07/2017 01:00	298.6	1.0	1564.6	8.21	29	-7.98
02/07/2017 02:00	318.4	17.9	1690.8	12.16	21	-7.94
02/07/2017 03:00	308.8	7.7	1573.9	8.82	22	-8.07
02/07/2017 04:00	295.7	0.1	1534.0	7.75	29	-8.03
02/07/2017 05:00	296.9	0.0	1560.3	7.96	19	-8.04
02/07/2017 06:00	297.0	0.0	1561.4	7.99	19	-8.02
02/07/2017 07:00	296.3	0.0	1563.7	7.98	19	-8.03
02/07/2017 08:00	296.2	0.0	1564.4	8.02	19	-8.03
02/07/2017 09:00	296.0	0.0	1539.7	7.64	N/A	-8.02
02/07/2017 10:00	298.3	0.0	1554.4	7.92	21	-8.02

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/07/2017 11:00	300.4	0.0	1556.9	7.85	20	-8.03
02/07/2017 12:00	301.1	0.0	1556.7	7.96	20	-8.03
02/07/2017 13:00	302.3	0.0	1556.7	7.92	20	-8.03
02/07/2017 14:00	304.0	0.0	1556.6	7.95	20	-8.02
02/07/2017 15:00	303.1	0.0	1528.6	7.59	27	-8.06
02/07/2017 16:00	302.2	0.0	1546.7	7.88	20	-8.02
02/07/2017 17:00	302.0	0.0	1550.9	8.05	20	-8.02
02/07/2017 18:00	302.2	0.0	1551.8	8.24	20	-8.03
02/07/2017 19:00	301.9	0.0	1553.0	8.14	20	-8.03
02/07/2017 20:00	300.6	0.0	1559.1	8.29	20	-8.02
02/07/2017 21:00	301.7	0.0	1566.8	8.23	20	-8.03
02/07/2017 22:00	301.9	0.0	1575.5	8.69	20	-8.02
02/07/2017 23:00	301.7	0.0	1588.0	8.72	19	-8.04
02/08/2017 00:00	297.9	0.0	1571.8	8.55	19	-8.05
02/08/2017 01:00	298.5	0.0	1565.6	8.11	20	-8.01
02/08/2017 02:00	299.8	0.0	1549.9	7.94	34	-8.06
02/08/2017 03:00	298.9	0.0	1558.6	8.18	19	-8.03
02/08/2017 04:00	296.1	0.0	1555.8	8.18	19	-8.03
02/08/2017 05:00	298.7	0.0	1557.4	8.24	19	-8.02
02/08/2017 06:00	300.0	0.0	1558.1	8.18	19	-8.03
02/08/2017 07:00	299.8	0.0	1558.9	8.21	N/A	-8.02
02/08/2017 08:00	298.5	0.0	1559.0	8.37	N/A	-8.03
02/08/2017 09:00	298.0	0.0	1559.8	8.31	21	-8.04
02/08/2017 10:00	297.1	0.0	1560.9	8.29	20	-8.03
02/08/2017 11:00	298.5	0.0	1560.2	8.29	20	-8.04
02/08/2017 12:00	299.6	0.0	1558.2	8.24	20	-8.03
02/08/2017 13:00	300.5	0.0	1559.2	8.27	20	-8.02
02/08/2017 14:00	300.9	0.0	1560.0	8.17	20	-8.02
02/08/2017 15:00	301.3	0.0	1559.7	8.25	19	-8.02
02/08/2017 16:00	301.3	0.0	1559.6	8.34	19	-8.02
02/08/2017 17:00	302.2	0.0	1560.0	8.22	19	-8.02
02/08/2017 18:00	304.0	0.0	1610.4	9.61	19	-7.98
02/08/2017 19:00	310.0	0.0	1654.0	10.50	19	-8.03
02/08/2017 20:00	302.3	0.0	1549.9	8.33	19	-8.03
02/08/2017 21:00	301.3	0.0	1546.6	8.40	19	-8.03
02/08/2017 22:00	301.2	0.0	1546.3	8.29	19	-8.03
02/08/2017 23:00	301.2	0.0	1546.3	8.23	19	-8.03
02/09/2017 00:00	301.2	0.0	1546.0	8.24	19	-8.03
02/09/2017 01:00	301.2	0.0	1545.7	8.26	19	-8.03
02/09/2017 02:00	300.6	0.0	1526.9	8.02	26	-8.07
02/09/2017 03:00	299.8	0.0	1539.6	8.39	19	-8.04
02/09/2017 04:00	300.0	0.0	1565.0	8.93	19	-8.04
02/09/2017 05:00	298.0	0.0	1537.1	8.45	19	-8.02
02/09/2017 06:00	298.5	0.0	1555.0	8.59	19	-8.02
02/09/2017 07:00	293.9	0.0	1556.9	8.50	19	-8.03
02/09/2017 08:00	288.3	0.0	1549.5	8.56	19	-8.04
02/09/2017 09:00	286.5	0.0	1542.7	8.31	N/A	-8.03
02/09/2017 10:00	285.8	0.0	1546.1	8.52	21	-8.03
02/09/2017 11:00	291.5	0.0	1616.9	9.69	19	-8.01
02/09/2017 12:00	290.2	0.0	1567.3	8.67	19	-8.03
02/09/2017 13:00	290.2	0.0	1563.2	8.62	19	-8.03
02/09/2017 14:00	291.4	0.0	1589.9	9.09	19	-8.03
02/09/2017 15:00	292.0	0.0	1577.7	8.88	20	-8.03
02/09/2017 16:00	291.1	0.0	1549.0	8.25	21	-8.04
02/09/2017 17:00	289.2	0.0	1548.0	8.24	21	-8.03
02/09/2017 18:00	289.7	0.0	1547.6	8.13	20	-8.03
02/09/2017 19:00	290.7	0.0	1548.4	8.24	20	-8.02
02/09/2017 20:00	290.8	0.0	1548.5	8.23	20	-8.03
02/09/2017 21:00	290.0	0.0	1550.4	8.17	21	-8.03
02/09/2017 22:00	290.0	0.0	1551.8	8.29	21	-8.03
02/09/2017 23:00	296.4	0.0	1660.4	11.29	22	-7.95
02/10/2017 00:00	302.9	0.0	1654.7	11.12	25	-8.13
02/10/2017 01:00	297.6	0.0	1582.3	9.58	21	-8.15
02/10/2017 02:00	290.3	0.0	1551.6	8.49	20	-8.04
02/10/2017 03:00	288.9	0.0	1548.5	8.53	20	-8.03
02/10/2017 04:00	290.2	0.0	1557.4	8.44	20	-8.04
02/10/2017 05:00	290.3	0.0	1550.8	8.33	20	-8.03
02/10/2017 06:00	289.7	0.0	1551.4	8.34	20	-8.02
02/10/2017 07:00	288.6	0.0	1550.6	8.54	20	-8.03
02/10/2017 08:00	288.5	0.0	1551.1	8.51	19	-8.03
02/10/2017 09:00	290.0	0.0	1550.5	8.42	N/A	-8.03
02/10/2017 10:00	291.0	0.0	1548.8	8.42	N/A	-8.03
02/10/2017 11:00	292.4	0.0	1549.1	8.32	16	-8.04
02/10/2017 12:00	293.6	0.0	1546.2	8.29	16	-8.03
02/10/2017 13:00	293.6	0.0	1546.1	8.33	17	-8.04
02/10/2017 14:00	295.1	0.0	1546.9	8.40	17	-8.03
02/10/2017 15:00	295.7	0.0	1546.9	8.39	16	-8.04
02/10/2017 16:00	294.0	0.0	1546.3	8.35	16	-8.03
02/10/2017 17:00	292.9	0.0	1546.6	8.54	16	-8.04
02/10/2017 18:00	296.8	0.0	1579.9	9.06	16	-8.03
02/10/2017 19:00	296.0	0.0	1550.1	8.62	16	-8.03
02/10/2017 20:00	295.8	0.0	1557.6	8.49	16	-8.03

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/10/2017 21:00	295.0	0.0	1553.2	8.29	16	-8.04
02/10/2017 22:00	294.7	0.0	1552.1	8.47	16	-8.03
02/10/2017 23:00	293.3	0.0	1551.6	8.35	16	-8.03
02/11/2017 00:00	293.4	0.0	1551.7	8.43	15	-8.03
02/11/2017 01:00	292.5	0.0	1537.8	8.46	21	-8.12
02/11/2017 02:00	292.2	0.0	1560.6	8.81	15	-8.02
02/11/2017 03:00	296.7	0.0	1603.6	9.56	16	-8.04
02/11/2017 04:00	296.1	0.0	1600.0	9.70	16	-8.04
02/11/2017 05:00	293.3	0.0	1563.8	8.84	15	-8.03
02/11/2017 06:00	292.1	0.0	1548.4	8.51	15	-8.04
02/11/2017 07:00	292.4	0.0	1555.2	8.60	15	-8.03
02/11/2017 08:00	293.1	0.0	1555.1	8.67	15	-8.03
02/11/2017 09:00	293.8	0.0	1566.7	8.82	N/A	-8.03
02/11/2017 10:00	295.2	0.0	1562.5	8.68	17	-8.03
02/11/2017 11:00	296.4	0.0	1547.7	8.46	16	-8.03
02/11/2017 12:00	298.1	0.0	1546.0	8.23	16	-8.03
02/11/2017 13:00	299.0	0.0	1545.8	8.39	15	-8.03
02/11/2017 14:00	297.4	0.0	1543.7	8.49	15	-8.02
02/11/2017 15:00	298.4	0.0	1542.6	8.55	15	-8.03
02/11/2017 16:00	301.2	0.0	1551.2	8.59	15	-8.03
02/11/2017 17:00	302.5	0.0	1552.4	8.56	14	-8.02
02/11/2017 18:00	302.4	0.0	1584.6	9.47	14	-7.98
02/11/2017 19:00	304.0	0.0	1575.8	8.90	15	-8.06
02/11/2017 20:00	303.1	0.0	1600.7	9.82	15	-8.01
02/11/2017 21:00	303.1	0.0	1593.4	9.52	15	-8.04
02/11/2017 22:00	298.8	0.0	1576.5	8.98	14	-8.03
02/11/2017 23:00	300.9	0.0	1599.5	9.43	15	-8.02
02/12/2017 00:00	298.9	0.0	1561.5	8.69	14	-8.03
02/12/2017 01:00	299.7	0.0	1582.8	9.23	14	-8.03
02/12/2017 02:00	297.0	0.0	1522.4	7.83	16	-8.22
02/12/2017 03:00	296.4	0.0	1546.7	8.57	15	-8.03
02/12/2017 04:00	297.5	0.0	1542.9	8.31	15	-8.03
02/12/2017 05:00	298.0	0.0	1556.8	8.79	15	-8.02
02/12/2017 06:00	298.3	0.0	1545.1	8.34	15	-8.03
02/12/2017 07:00	299.2	0.0	1543.2	8.21	15	-8.02
02/12/2017 08:00	298.7	0.0	1543.1	8.39	15	-8.03
02/12/2017 09:00	298.8	0.0	1542.7	8.15	N/A	-8.03
02/12/2017 10:00	298.3	0.0	1541.4	8.49	15	-8.03
02/12/2017 11:00	298.2	0.0	1540.0	8.16	14	-8.02
02/12/2017 12:00	298.5	0.0	1539.4	8.27	14	-8.03
02/12/2017 13:00	299.8	0.0	1538.7	8.33	14	-8.02
02/12/2017 14:00	298.0	0.0	1538.5	8.29	14	-8.03
02/12/2017 15:00	297.8	0.0	1551.7	8.50	14	-8.02
02/12/2017 16:00	299.1	0.0	1542.8	8.31	14	-8.03
02/12/2017 17:00	300.8	0.0	1542.4	8.34	14	-8.03
02/12/2017 18:00	301.9	0.0	1543.3	8.41	14	-8.03
02/12/2017 19:00	301.1	0.0	1554.5	8.71	14	-8.03
02/12/2017 20:00	301.2	0.0	1550.8	8.33	14	-8.02
02/12/2017 21:00	300.7	0.0	1551.2	8.44	14	-8.02
02/12/2017 22:00	300.2	0.0	1551.2	8.36	14	-8.03
02/12/2017 23:00	299.4	0.0	1551.0	8.50	14	-8.02
02/13/2017 00:00	299.6	0.0	1548.4	8.24	13	-8.03
02/13/2017 01:00	297.4	0.0	1537.6	8.17	13	-8.03
02/13/2017 02:00	293.9	0.0	1510.2	7.84	16	-8.13
02/13/2017 03:00	292.3	0.0	1536.1	8.30	13	-8.04
02/13/2017 04:00	289.7	0.0	1542.0	8.25	14	-8.03
02/13/2017 05:00	290.7	0.0	1542.9	8.27	14	-8.03
02/13/2017 06:00	290.6	0.0	1552.8	8.47	14	-8.03
02/13/2017 07:00	291.7	0.0	1544.3	8.26	14	-8.03
02/13/2017 08:00	291.3	0.0	1544.8	8.22	15	-8.03
02/13/2017 09:00	290.9	0.0	1544.0	8.46	N/A	-8.03
02/13/2017 10:00	298.9	0.0	1633.2	10.85	16	-7.98
02/13/2017 11:00	296.6	0.0	1568.4	8.52	15	-8.07
02/13/2017 12:00	297.3	0.0	1559.5	8.54	15	-8.03
02/13/2017 13:00	296.0	0.0	1559.6	8.52	15	-8.03
02/13/2017 14:00	295.6	0.0	1560.3	8.75	15	-8.03
02/13/2017 15:00	296.5	0.0	1561.2	8.47	14	-8.03
02/13/2017 16:00	296.5	0.0	1545.1	8.43	15	-8.03
02/13/2017 17:00	296.0	0.0	1543.7	8.36	15	-8.03
02/13/2017 18:00	293.2	0.0	1543.9	8.27	15	-8.03
02/13/2017 19:00	294.4	0.0	1543.9	8.29	15	-8.03
02/13/2017 20:00	295.5	0.0	1543.8	8.27	15	-8.03
02/13/2017 21:00	309.0	14.2	1638.5	11.46	44	-7.95
02/13/2017 22:00	318.9	19.0	1689.5	12.52	18	-8.00
02/13/2017 23:00	318.2	19.1	1697.2	12.58	18	-8.01
02/14/2017 00:00	318.6	19.5	1718.0	12.87	18	-7.84
02/14/2017 01:00	318.1	19.4	1725.8	12.90	18	-7.75
02/14/2017 02:00	317.7	19.3	1723.5	12.71	18	-8.01
02/14/2017 03:00	318.2	19.5	1738.9	12.90	18	-7.82
02/14/2017 04:00	318.6	19.2	1733.2	12.66	18	-7.66
02/14/2017 05:00	319.2	19.4	1737.8	12.69	18	-8.01
02/14/2017 06:00	320.1	20.2	1773.5	13.36	18	-7.76

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/14/2017 07:00	319.9	20.1	1775.0	13.19	18	-7.76
02/14/2017 08:00	320.6	20.1	1776.3	13.12	18	-7.70
02/14/2017 09:00	320.5	20.2	1789.7	13.20	N/A	-7.43
02/14/2017 10:00	323.4	20.6	1809.1	13.57	19	-7.78
02/14/2017 11:00	325.8	20.7	1821.2	13.74	18	-7.32
02/14/2017 12:00	325.5	20.1	1808.0	13.39	18	-8.01
02/14/2017 13:00	326.1	20.0	1809.2	13.24	18	-7.99
02/14/2017 14:00	326.9	19.6	1801.3	13.09	18	-7.73
02/14/2017 15:00	327.3	19.6	1804.1	13.12	18	-7.65
02/14/2017 16:00	328.1	20.0	1816.2	13.39	18	-7.92
02/14/2017 17:00	328.3	20.0	1821.0	13.58	18	-7.73
02/14/2017 18:00	329.2	20.0	1821.1	13.41	18	-7.86
02/14/2017 19:00	328.7	20.0	1823.6	13.40	18	-7.50
02/14/2017 20:00	328.0	19.8	1810.0	13.17	18	-7.72
02/14/2017 21:00	327.3	19.8	1815.5	13.34	18	-7.23
02/14/2017 22:00	327.2	19.7	1812.2	13.03	18	-7.71
02/14/2017 23:00	327.1	19.7	1819.3	13.09	18	-7.24
02/15/2017 00:00	327.0	19.7	1815.8	13.06	16	-7.71
02/15/2017 01:00	326.9	19.6	1814.7	12.97	16	-7.46
02/15/2017 02:00	326.3	19.4	1800.0	12.90	16	-7.98
02/15/2017 03:00	326.3	19.5	1804.5	12.89	17	-7.84
02/15/2017 04:00	325.8	19.7	1820.2	13.18	18	-7.45
02/15/2017 05:00	326.3	19.7	1824.9	13.13	19	-7.28
02/15/2017 06:00	326.2	19.7	1820.0	13.30	18	-7.77
02/15/2017 07:00	326.5	19.7	1828.2	13.05	17	-7.29
02/15/2017 08:00	326.8	19.7	1828.5	13.15	17	-7.52
02/15/2017 09:00	326.3	19.7	1828.8	13.19	N/A	-7.67
02/15/2017 10:00	327.0	19.9	1836.5	13.37	17	-7.26
02/15/2017 11:00	324.8	19.8	1827.0	13.59	17	-7.90
02/15/2017 12:00	319.6	19.8	1826.0	14.89	17	-8.02
02/15/2017 13:00	324.5	19.9	1834.9	13.30	17	-7.49
02/15/2017 14:00	322.0	20.0	1837.5	13.52	17	-6.66
02/15/2017 15:00	322.9	20.0	1836.4	13.44	17	-6.63
02/15/2017 16:00	323.8	19.9	1839.0	13.34	17	-7.06
02/15/2017 17:00	326.9	19.9	1838.5	13.21	17	-6.31
02/15/2017 18:00	326.8	19.9	1835.5	13.56	17	-6.55
02/15/2017 19:00	327.3	19.8	1839.1	13.31	17	-6.74
02/15/2017 20:00	328.0	19.7	1837.3	13.42	17	-6.23
02/15/2017 21:00	327.1	19.7	1833.7	13.30	17	-6.25
02/15/2017 22:00	322.4	19.7	1832.4	13.76	16	-6.92
02/15/2017 23:00	322.7	19.6	1835.7	13.24	16	-6.48
02/16/2017 00:00	322.4	19.7	1830.3	13.23	17	-6.92
02/16/2017 01:00	323.9	19.6	1831.7	13.05	16	-6.51
02/16/2017 02:00	324.0	19.6	1818.5	13.12	16	-7.31
02/16/2017 03:00	326.4	19.5	1824.3	12.91	17	-6.71
02/16/2017 04:00	326.3	19.5	1820.7	12.87	17	-6.76
02/16/2017 05:00	326.0	19.6	1818.0	12.94	17	-6.89
02/16/2017 06:00	326.5	19.6	1824.7	12.86	17	-6.50
02/16/2017 07:00	325.5	19.5	1816.3	12.89	16	-7.01
02/16/2017 08:00	324.5	19.5	1818.1	12.88	17	-6.59
02/16/2017 09:00	321.1	19.8	1826.1	13.45	N/A	-6.92
02/16/2017 10:00	319.3	20.5	1843.7	13.87	18	-7.49
02/16/2017 11:00	324.3	20.8	1854.6	13.78	18	-7.69
02/16/2017 12:00	322.4	20.7	1855.6	14.35	18	-7.92
02/16/2017 13:00	327.1	20.7	1855.9	13.77	17	-7.81
02/16/2017 14:00	327.2	20.6	1856.1	13.76	17	-7.64
02/16/2017 15:00	326.1	20.5	1854.2	13.74	17	-7.88
02/16/2017 16:00	325.7	20.4	1854.7	14.01	17	-7.82
02/16/2017 17:00	326.6	20.3	1854.1	14.03	17	-7.79
02/16/2017 18:00	328.9	20.3	1853.5	13.58	17	-7.87
02/16/2017 19:00	327.9	20.1	1847.7	13.80	17	-7.75
02/16/2017 20:00	329.6	20.0	1841.0	13.52	17	-7.63
02/16/2017 21:00	329.2	19.9	1834.4	13.38	17	-7.80
02/16/2017 22:00	329.3	19.7	1831.0	13.09	17	-7.50
02/16/2017 23:00	328.6	19.6	1825.5	13.09	17	-7.70
02/17/2017 00:00	328.3	19.6	1826.1	13.23	17	-7.65
02/17/2017 01:00	328.5	19.6	1823.6	12.97	17	-7.61
02/17/2017 02:00	328.0	19.6	1823.8	13.20	17	-7.79
02/17/2017 03:00	327.8	19.5	1823.3	13.03	17	-7.51
02/17/2017 04:00	327.1	19.6	1820.4	13.15	17	-7.68
02/17/2017 05:00	327.3	19.5	1817.8	12.87	17	-7.66
02/17/2017 06:00	326.1	19.4	1813.0	13.12	17	-7.53
02/17/2017 07:00	324.3	19.4	1811.8	13.00	17	-7.59
02/17/2017 08:00	326.0	20.2	1838.6	13.52	17	-7.61
02/17/2017 09:00	324.5	20.5	1853.3	14.28	N/A	-7.59
02/17/2017 10:00	319.4	9.0	1795.7	12.47	26	-7.57
02/17/2017 11:00	310.9	16.7	1689.2	12.50	19	-7.82
02/17/2017 12:00	320.0	20.7	1795.9	14.16	18	-7.80
02/17/2017 13:00	322.1	20.6	1803.1	14.01	18	-7.89
02/17/2017 14:00	324.1	20.5	1808.0	13.85	18	-7.84
02/17/2017 15:00	323.6	20.5	1815.3	14.51	18	-7.73
02/17/2017 16:00	325.3	20.7	1823.4	14.33	18	-7.85

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/17/2017 17:00	327.5	20.9	1829.2	14.41	17	-7.66
02/17/2017 18:00	327.9	20.5	1825.5	13.89	17	-7.93
02/17/2017 19:00	326.5	20.3	1823.1	14.11	17	-7.71
02/17/2017 20:00	325.0	19.9	1812.2	13.39	17	-7.80
02/17/2017 21:00	324.2	19.7	1808.9	13.55	17	-7.80
02/17/2017 22:00	324.6	19.5	1801.2	13.08	17	-7.66
02/17/2017 23:00	323.4	19.4	1792.4	13.08	17	-7.78
02/18/2017 00:00	322.8	19.7	1806.2	13.42	17	-7.72
02/18/2017 01:00	323.6	19.2	1787.4	13.07	17	-7.61
02/18/2017 02:00	321.4	19.4	1789.2	13.39	17	-7.82
02/18/2017 03:00	323.6	19.6	1799.1	13.05	17	-7.81
02/18/2017 04:00	322.0	19.5	1794.7	13.51	17	-8.01
02/18/2017 05:00	323.1	19.6	1800.5	13.10	17	-8.01
02/18/2017 06:00	323.1	19.7	1805.8	13.24	17	-7.83
02/18/2017 07:00	322.9	19.8	1814.8	13.54	17	-7.57
02/18/2017 08:00	324.2	19.7	1811.1	13.20	17	-7.82
02/18/2017 09:00	323.4	19.7	1809.8	13.58	N/A	-7.92
02/18/2017 10:00	326.1	20.1	1830.7	13.40	19	-7.63
02/18/2017 11:00	327.2	20.3	1837.9	14.03	17	-7.69
02/18/2017 12:00	327.1	20.0	1830.2	13.40	16	-7.87
02/18/2017 13:00	327.6	19.4	1814.0	13.07	18	-7.59
02/18/2017 14:00	327.7	19.2	1809.4	12.94	18	-7.54
02/18/2017 15:00	329.2	19.4	1813.8	12.90	18	-8.00
02/18/2017 16:00	329.2	19.4	1815.0	13.05	18	-7.73
02/18/2017 17:00	329.4	19.5	1818.0	13.13	18	-7.93
02/18/2017 18:00	328.4	19.0	1801.0	12.93	17	-7.64
02/18/2017 19:00	327.0	18.8	1792.5	12.42	18	-7.34
02/18/2017 20:00	325.9	19.3	1803.9	12.98	18	-7.81
02/18/2017 21:00	327.7	19.2	1804.5	12.68	17	-7.61
02/18/2017 22:00	328.7	19.6	1817.9	13.02	17	-7.56
02/18/2017 23:00	328.6	19.6	1818.6	12.95	17	-7.61
02/19/2017 00:00	327.8	19.6	1817.8	13.08	17	-7.59
02/19/2017 01:00	325.5	19.6	1812.2	13.22	17	-7.97
02/19/2017 02:00	325.9	19.6	1817.5	12.99	17	-7.69
02/19/2017 03:00	327.5	19.7	1826.6	13.25	17	-7.37
02/19/2017 04:00	327.1	19.6	1820.2	13.37	17	-7.84
02/19/2017 05:00	324.5	19.3	1808.4	13.08	17	-7.42
02/19/2017 06:00	324.3	19.1	1801.2	12.87	17	-7.70
02/19/2017 07:00	325.6	19.1	1803.3	12.70	17	-7.58
02/19/2017 08:00	326.0	19.4	1814.4	13.44	17	-7.75
02/19/2017 09:00	325.0	19.2	1807.5	12.89	N/A	-7.84
02/19/2017 10:00	324.2	19.7	1826.5	13.46	16	-7.52
02/19/2017 11:00	324.5	20.1	1840.3	13.70	16	-7.79
02/19/2017 12:00	327.3	20.5	1847.5	14.01	16	-7.61
02/19/2017 13:00	326.5	20.5	1848.2	14.59	16	-7.66
02/19/2017 14:00	328.4	20.4	1851.1	13.83	17	-7.93
02/19/2017 15:00	327.3	20.4	1851.6	13.88	17	-7.41
02/19/2017 16:00	327.4	20.2	1848.0	13.68	17	-7.72
02/19/2017 17:00	326.8	20.3	1851.1	14.50	18	-7.63
02/19/2017 18:00	326.9	20.0	1845.9	13.83	18	-7.22
02/19/2017 19:00	326.3	19.9	1840.2	14.16	18	-7.93
02/19/2017 20:00	329.4	19.7	1838.4	13.14	18	-7.51
02/19/2017 21:00	330.5	19.3	1820.1	12.95	17	-7.74
02/19/2017 22:00	329.4	19.2	1812.9	12.85	17	-7.62
02/19/2017 23:00	329.4	19.2	1815.8	12.77	17	-7.32
02/20/2017 00:00	328.6	19.2	1811.0	13.00	17	-7.77
02/20/2017 01:00	327.7	19.2	1812.6	12.95	17	-7.39
02/20/2017 02:00	326.5	19.1	1807.4	13.19	16	-7.91
02/20/2017 03:00	328.1	19.4	1818.2	12.85	16	-7.45
02/20/2017 04:00	328.2	19.9	1831.2	13.47	17	-7.77
02/20/2017 05:00	327.7	19.5	1821.3	13.04	17	-7.47
02/20/2017 06:00	327.6	19.5	1818.9	13.11	17	-7.74
02/20/2017 07:00	327.9	19.5	1819.8	12.92	17	-7.54
02/20/2017 08:00	328.2	19.5	1819.3	12.97	17	-7.69
02/20/2017 09:00	328.6	20.0	1835.0	13.52	N/A	-7.62
02/20/2017 10:00	302.5	6.9	1381.8	5.79	12	-10.74
02/20/2017 11:00	298.8	0.0	1610.8	8.48	16	-8.02
02/20/2017 12:00	301.2	0.0	1596.9	8.43	16	-8.04
02/20/2017 13:00	302.2	0.0	1611.4	9.15	16	-7.98
02/20/2017 14:00	302.5	0.0	1596.4	8.55	16	-8.08
02/20/2017 15:00	310.5	10.8	1646.7	10.92	18	-7.97
02/20/2017 16:00	308.7	4.1	1571.6	9.69	20	-8.63
02/20/2017 17:00	317.4	17.2	1671.6	12.45	19	-7.97
02/20/2017 18:00	318.8	17.1	1684.8	12.56	19	-8.01
02/20/2017 19:00	320.2	17.1	1684.2	11.84	19	-8.01
02/20/2017 20:00	319.2	14.0	1668.6	12.05	31	-7.74
02/20/2017 21:00	307.4	6.5	1618.1	9.80	17	-8.02
02/20/2017 22:00	318.2	17.6	1660.9	11.98	17	-7.83
02/20/2017 23:00	317.2	17.4	1639.5	11.31	17	-7.61
02/21/2017 00:00	316.9	17.3	1634.1	11.31	17	-7.65
02/21/2017 01:00	314.0	17.5	1645.1	11.94	17	-7.62
02/21/2017 02:00	317.5	17.7	1653.9	11.36	17	-7.67

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/21/2017 03:00	317.0	17.9	1669.0	11.64	17	-7.55
02/21/2017 04:00	319.3	17.9	1673.3	11.39	17	-7.56
02/21/2017 05:00	319.1	18.0	1678.8	11.65	17	-7.60
02/21/2017 06:00	320.5	17.6	1668.3	10.87	17	-7.61
02/21/2017 07:00	321.1	17.7	1669.4	11.05	17	-7.73
02/21/2017 08:00	320.7	17.9	1675.6	10.99	17	-7.53
02/21/2017 09:00	322.9	18.0	1683.1	11.08	N/A	-7.50
02/21/2017 10:00	325.1	18.6	1704.2	11.39	17	-7.53
02/21/2017 11:00	327.2	18.9	1719.3	11.58	17	-7.63
02/21/2017 12:00	327.4	18.3	1701.4	11.09	17	-7.78
02/21/2017 13:00	328.0	18.4	1708.2	11.25	17	-7.61
02/21/2017 14:00	328.1	18.3	1709.1	11.29	17	-7.49
02/21/2017 15:00	328.2	17.8	1692.1	10.98	17	-7.43
02/21/2017 16:00	328.5	17.9	1692.7	10.94	17	-7.65
02/21/2017 17:00	329.5	18.0	1693.8	10.80	17	-7.35
02/21/2017 18:00	330.1	18.0	1696.3	10.98	17	-7.47
02/21/2017 19:00	329.7	17.5	1670.7	10.35	17	-7.41
02/21/2017 20:00	329.7	17.6	1687.8	10.96	17	-7.25
02/21/2017 21:00	317.7	6.1	1635.6	9.41	28	-7.70
02/21/2017 22:00	319.7	16.0	1607.8	10.60	20	-7.83
02/21/2017 23:00	311.7	4.7	1574.4	9.18	74	-7.71
02/22/2017 00:00	320.9	16.8	1597.0	10.34	17	-7.71
02/22/2017 01:00	321.2	17.1	1614.7	10.63	17	-7.62
02/22/2017 02:00	322.2	17.2	1626.1	10.40	17	-7.57
02/22/2017 03:00	321.6	17.2	1633.4	10.95	17	-7.58
02/22/2017 04:00	323.2	17.2	1642.3	10.41	17	-7.50
02/22/2017 05:00	323.6	17.3	1649.3	10.81	17	-7.47
02/22/2017 06:00	321.4	17.2	1647.4	10.93	17	-7.48
02/22/2017 07:00	323.6	17.3	1653.8	10.95	17	-7.31
02/22/2017 08:00	321.9	17.4	1657.0	10.98	17	-7.46
02/22/2017 09:00	325.5	17.7	1666.7	10.72	N/A	-7.42
02/22/2017 10:00	327.2	18.0	1679.0	10.80	17	-7.25
02/22/2017 11:00	328.1	18.1	1686.3	10.76	17	-7.28
02/22/2017 12:00	329.8	18.3	1695.9	10.90	16	-7.73
02/22/2017 13:00	330.7	18.3	1696.6	10.90	16	-7.13
02/22/2017 14:00	331.6	18.2	1695.6	10.75	16	-7.07
02/22/2017 15:00	332.1	17.8	1685.3	10.54	17	-7.10
02/22/2017 16:00	332.4	17.9	1699.6	10.80	16	-7.23
02/22/2017 17:00	331.2	17.5	1684.2	11.60	16	-7.15
02/22/2017 18:00	328.3	18.0	1673.8	10.94	16	-7.23
02/22/2017 19:00	314.9	3.6	1587.2	8.58	27	-7.58
02/22/2017 20:00	306.6	0.0	1624.8	9.57	14	-8.01
02/22/2017 21:00	313.1	0.0	1660.2	10.94	17	-7.79
02/22/2017 22:00	302.5	0.0	1573.8	8.84	14	-8.03
02/22/2017 23:00	301.8	0.0	1561.4	8.34	14	-8.05
02/23/2017 00:00	301.2	0.0	1554.5	8.33	14	-8.02
02/23/2017 01:00	307.8	0.0	1637.7	10.79	16	-7.93
02/23/2017 02:00	302.5	0.0	1583.6	8.91	14	-8.03
02/23/2017 03:00	308.3	0.0	1641.7	11.15	17	-7.75
02/23/2017 04:00	301.5	0.0	1563.1	8.52	14	-8.05
02/23/2017 05:00	299.3	0.0	1558.3	8.77	14	-8.01
02/23/2017 06:00	304.0	0.0	1600.5	9.47	17	-8.07
02/23/2017 07:00	296.7	0.0	1565.4	8.68	14	-8.03
02/23/2017 08:00	298.5	0.0	1564.1	8.63	14	-8.03
02/23/2017 09:00	298.6	0.0	1552.3	8.45	N/A	-8.04
02/23/2017 10:00	309.1	5.4	1581.2	10.50	54	-8.05
02/23/2017 11:00	313.8	10.7	1576.4	9.77	19	-8.48
02/23/2017 12:00	303.6	2.2	1498.9	9.46	19	-8.45
02/23/2017 13:00	315.1	18.8	1606.0	11.90	17	-7.78
02/23/2017 14:00	320.1	18.9	1626.4	11.37	17	-7.57
02/23/2017 15:00	320.2	19.1	1644.6	11.54	N/A	-7.46
02/23/2017 16:00	322.0	19.0	1647.0	11.23	N/A	-7.65
02/23/2017 17:00	323.3	18.9	1648.9	11.02	N/A	-7.34
02/23/2017 18:00	314.1	7.5	1628.1	9.79	39	-7.80
02/23/2017 19:00	322.3	18.5	1616.4	10.67	17	-7.32
02/23/2017 20:00	322.7	18.6	1634.0	10.80	17	-7.10
02/23/2017 21:00	324.9	18.6	1683.5	11.38	17	-7.17
02/23/2017 22:00	324.8	18.6	1706.4	12.10	18	-7.11
02/23/2017 23:00	325.3	18.6	1716.2	11.79	18	-7.46
02/24/2017 00:00	326.1	18.7	1731.8	12.12	18	-7.15
02/24/2017 01:00	325.6	18.6	1700.8	11.23	18	-7.12
02/24/2017 02:00	325.2	17.9	1654.8	10.25	18	-6.91
02/24/2017 03:00	325.0	17.4	1633.6	9.82	19	-6.99
02/24/2017 04:00	324.5	17.2	1625.2	9.86	19	-6.97
02/24/2017 05:00	319.7	17.4	1622.9	11.02	18	-7.15
02/24/2017 06:00	324.6	16.5	1611.9	9.37	27	-7.34
02/24/2017 07:00	310.4	6.9	1575.2	8.45	28	-7.72
02/24/2017 08:00	323.8	18.1	1608.1	9.94	19	-7.07
02/24/2017 09:00	325.0	17.6	1604.5	9.70	N/A	-7.18
02/24/2017 10:00	325.2	13.0	1610.0	9.61	31	-7.10
02/24/2017 11:00	310.7	0.8	1517.9	7.26	55	-9.13
02/24/2017 12:00	304.8	0.0	1460.6	8.54	19	-9.24

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/24/2017 13:00	321.8	14.6	1555.9	8.95	20	-7.47
02/24/2017 14:00	276.7	0.0	768.6	0.02	0	-13.19
02/24/2017 15:00	272.7	0.0	985.0	3.01	10	-12.01
02/24/2017 16:00	308.5	0.0	1569.3	8.89	15	-8.04
02/24/2017 17:00	311.4	8.0	1530.3	8.56	35	-7.85
02/24/2017 18:00	322.7	18.1	1576.1	10.25	17	-7.45
02/24/2017 19:00	320.8	18.2	1593.2	10.44	18	-7.35
02/24/2017 20:00	319.2	12.9	1550.5	8.56	18	-7.38
02/24/2017 21:00	307.6	0.3	1572.9	8.63	32	-7.79
02/24/2017 22:00	306.6	6.3	1528.5	8.38	27	-7.79
02/24/2017 23:00	319.8	17.6	1548.0	9.41	20	-7.10
02/25/2017 00:00	321.4	18.0	1576.8	9.49	20	-7.25
02/25/2017 01:00	312.3	8.5	1505.6	7.66	19	-7.65
02/25/2017 02:00	304.0	1.5	1573.5	8.12	26	-8.01
02/25/2017 03:00	294.9	0.0	1379.6	5.81	12	-9.35
02/25/2017 04:00	302.5	0.0	1582.3	8.39	15	-8.03
02/25/2017 05:00	302.7	0.0	1575.8	8.21	15	-8.04
02/25/2017 06:00	303.6	0.0	1603.6	9.06	14	-8.02
02/25/2017 07:00	302.5	0.0	1569.6	8.33	13	-8.04
02/25/2017 08:00	301.8	0.0	1567.6	8.34	14	-8.03
02/25/2017 09:00	301.1	0.0	1572.4	8.45	N/A	-8.03
02/25/2017 10:00	301.0	0.0	1577.6	8.89	16	-8.01
02/25/2017 11:00	313.3	16.8	1555.0	9.78	31	-7.51
02/25/2017 12:00	319.8	18.0	1585.5	9.89	18	-7.13
02/25/2017 13:00	299.5	3.9	1339.6	6.40	17	-9.71
02/25/2017 14:00	308.3	9.5	1537.5	9.08	23	-7.80
02/25/2017 15:00	307.3	7.8	1420.3	6.84	56	-8.83
02/25/2017 16:00	299.0	0.0	1483.1	8.50	15	-8.51
02/25/2017 17:00	312.7	0.0	1698.7	11.35	14	-8.02
02/25/2017 18:00	307.9	3.0	1595.5	9.43	22	-7.81
02/25/2017 19:00	317.6	17.7	1570.5	10.04	18	-7.23
02/25/2017 20:00	314.0	17.7	1553.7	9.70	18	-7.22
02/25/2017 21:00	313.7	17.9	1567.6	9.56	19	-7.31
02/25/2017 22:00	293.2	3.4	1400.6	6.18	15	-8.72
02/25/2017 23:00	306.0	13.2	1528.2	8.51	27	-7.58
02/26/2017 00:00	303.0	11.4	1545.1	9.21	23	-7.55
02/26/2017 01:00	300.8	4.8	1561.2	8.56	32	-7.96
02/26/2017 02:00	294.0	0.0	1579.4	8.90	15	-8.04
02/26/2017 03:00	301.3	3.1	1600.6	9.52	106	-7.92
02/26/2017 04:00	295.7	0.4	1558.0	8.34	112	-8.07
02/26/2017 05:00	303.2	12.2	1524.8	9.25	94	-7.78
02/26/2017 06:00	310.7	10.9	1487.2	8.30	219	-7.06
02/26/2017 07:00	295.9	0.0	1556.5	8.32	16	-8.05
02/26/2017 08:00	293.9	0.0	1563.6	8.34	15	-8.03
02/26/2017 09:00	293.8	0.0	1566.0	8.49	N/A	-8.03
02/26/2017 10:00	295.8	0.0	1588.0	8.78	18	-8.02
02/26/2017 11:00	299.4	4.2	1568.7	8.63	20	-7.93
02/26/2017 12:00	301.3	3.6	1468.2	7.26	33	-7.92
02/26/2017 13:00	297.2	1.6	1475.3	7.32	44	-7.82
02/26/2017 14:00	296.4	0.0	1547.9	8.04	15	-8.04
02/26/2017 15:00	303.5	7.2	1529.2	8.14	53	-7.85
02/26/2017 16:00	301.5	5.2	1526.8	8.10	44	-7.73
02/26/2017 17:00	303.6	2.4	1508.3	7.49	41	-7.84
02/26/2017 18:00	300.2	0.0	1566.7	8.04	15	-8.04
02/26/2017 19:00	300.2	0.0	1570.2	8.16	15	-8.02
02/26/2017 20:00	299.3	0.0	1572.4	8.08	15	-8.03
02/26/2017 21:00	298.7	0.0	1575.6	8.12	15	-8.03
02/26/2017 22:00	298.1	0.0	1578.7	8.05	15	-8.03
02/26/2017 23:00	297.8	0.0	1580.5	8.10	15	-8.04
02/27/2017 00:00	297.1	0.0	1582.0	8.06	15	-8.04
02/27/2017 01:00	296.9	0.0	1583.1	8.02	15	-8.03
02/27/2017 02:00	296.7	0.0	1560.3	7.79	18	-8.02
02/27/2017 03:00	296.9	0.0	1573.4	8.17	15	-8.03
02/27/2017 04:00	296.5	0.0	1573.8	8.20	15	-8.03
02/27/2017 05:00	296.0	0.0	1574.5	8.16	15	-8.02
02/27/2017 06:00	296.1	0.0	1575.9	8.17	15	-8.03
02/27/2017 07:00	296.1	0.0	1576.9	8.14	15	-8.04
02/27/2017 08:00	296.2	0.0	1577.0	8.18	15	-8.03
02/27/2017 09:00	297.5	0.0	1577.2	8.09	N/A	-8.03
02/27/2017 10:00	299.3	0.0	1578.3	8.14	16	-8.03
02/27/2017 11:00	301.1	0.0	1576.3	8.12	15	-8.03
02/27/2017 12:00	302.2	0.0	1578.0	8.09	15	-8.03
02/27/2017 13:00	302.0	0.0	1578.6	8.13	15	-8.03
02/27/2017 14:00	303.1	0.0	1577.9	8.16	15	-8.03
02/27/2017 15:00	303.7	0.0	1577.2	8.12	15	-8.03
02/27/2017 16:00	303.9	0.0	1577.9	8.10	15	-8.03
02/27/2017 17:00	304.1	0.0	1579.1	8.11	15	-8.01
02/27/2017 18:00	304.1	0.0	1580.3	8.19	15	-8.04
02/27/2017 19:00	303.8	0.0	1581.0	8.17	15	-8.03
02/27/2017 20:00	303.2	0.0	1582.1	8.12	15	-8.03
02/27/2017 21:00	302.9	0.0	1582.8	8.06	15	-8.03
02/27/2017 22:00	300.7	0.0	1582.8	8.15	15	-8.03

Period Start:	Average EXHTEMPENT degF	Average WASTE FUEL # / min	Average BLR TEMP Deg F	Average STM FLOW M# / hr	Average CCO ppm	Average BLR PRESS in Wc
02/27/2017 23:00	298.6	0.0	1580.3	8.28	15	-8.03
02/28/2017 00:00	301.3	0.0	1579.4	8.09	15	-8.02
02/28/2017 01:00	302.3	0.0	1580.1	8.14	14	-8.03
02/28/2017 02:00	302.6	0.0	1579.5	8.23	21	-8.05
02/28/2017 03:00	302.3	0.0	1578.8	8.17	14	-8.03
02/28/2017 04:00	303.1	0.0	1578.7	8.24	14	-8.03
02/28/2017 05:00	302.8	0.0	1579.0	8.28	14	-8.03
02/28/2017 06:00	302.4	0.0	1579.8	8.19	14	-8.03
02/28/2017 07:00	302.2	0.0	1581.2	8.35	14	-8.03
02/28/2017 08:00	302.2	0.0	1581.6	8.23	14	-8.04
02/28/2017 09:00	302.3	0.0	1581.9	8.30	N/A	-8.03
02/28/2017 10:00	303.1	0.0	1579.9	8.22	16	-8.03
02/28/2017 11:00	302.1	0.0	1568.9	8.10	16	-8.04
02/28/2017 12:00	302.0	0.0	1573.9	8.22	16	-8.03
02/28/2017 13:00	303.3	0.0	1572.7	8.33	16	-8.03
02/28/2017 14:00	304.3	0.0	1573.0	8.10	16	-8.03
02/28/2017 15:00	304.4	0.0	1573.7	8.16	16	-8.03
02/28/2017 16:00	304.1	0.0	1574.0	8.13	15	-8.03
02/28/2017 17:00	303.8	0.0	1574.2	8.13	16	-8.02
02/28/2017 18:00	304.4	0.0	1574.9	8.19	16	-8.03
02/28/2017 19:00	305.2	0.0	1575.5	8.19	15	-8.03
02/28/2017 20:00	305.3	0.0	1576.7	8.17	15	-8.02
02/28/2017 21:00	304.6	0.0	1577.4	8.16	15	-8.03
02/28/2017 22:00	304.2	0.0	1577.6	8.16	14	-8.03
02/28/2017 23:00	303.5	0.0	1577.9	8.10	14	-8.03
Final Average*	**311.9**	**9.9**	**1660.1**	**10.62**	**19**	**-7.86**
Maximum*	**332.4**	**20.9**	**1856.1**	**14.89**	**219**	**0.00**
	02/22/2017 16:00	02/17/2017 17:00	02/16/2017 14:00	02/15/2017 12:00	02/26/2017 6:00	
Minimum*	**272.7**	**0.0**	**768.6**	**0.02**	**0**	**-13.19**
	02/24/2017 15:00	02/28/2017 23:00	02/24/2017 14:00	02/24/2017 14:00	02/24/2017 14:00	02/24/2017 14:00

* Does not include Invalid Averaging Periods ("N/A")

Appendix D-9.2
Combustion Chamber Temperatures

Appendix D-11

Combustion Chamber Temperatures

Temperature Results (F)						
Test Date	**Test Description [1,2]**	**Run 1**	**Run 2**	**Run 3**	**Average**	**Notes**
November 2003	RCRA Trial Burn - Maximum Waste Feed Rate Test	1838	1879	1990	1902	
November 2003	RCRA Trial Burn - Minimum Combustion Temperature Test	1293	1295	1296	1294	
November 2003	RCRA Trial Burn - Risk Burn Test	1752	1781	1778	1770	
September 2009	Comprehensive Performance Test - Minimum Combustion Temperature Test	1315	1304	1274	1298	
August 2014	Comprehensive Performance Test - Table 3-1; Minimum Combustion Temperature Test (Average)	1387	1391	1400	1393	One-Minute Average
August 2014	Comprehensive Performance Test - Table 3-1; Minimum Combustion Temperature Test (Average)	1385	1391	1399	1392	Hourly Rolling Average
August 2014	Comprehensive Performance Test - Table 3-2; Metals, PM, HCL/CL2 emission testing (Average)	2093	2291	2280	2222	One-Minute Average
August 2014	Comprehensive Performance Test - Table 3-2; Metals, PM, HCL/CL2 emission testing (Average)	2059	2269	2253	2193	Hourly Rolling Average
August 2014	Comprehensive Performance Test - Table 3-3; Maximum waste feed rate/maximum steam production rate test	2346	2260	2148	2252	One-Minute Average
August 2014	Comprehensive Performance Test - Table 3-3; Maximum waste feed rate/maximum steam production rate test	2344	2250	2135	2243	Hourly Rolling Average

Notes:

(1) Temperatures from the 2003 RCRA Trial Burn and Boiler No. 4 CPT were taken from Tables 2.5, 3-1, 3-2, and 3-3 of the " Boiler No. 4 Comprehensive Performance Test Report", August 2014, Focus Environmental Inc.

(2) Temperatures are from "Comprehensive Performance Test Report", Revision 1, September 10, 2009, Table 3-1, GE Energy.

Appendix D-9.3
Combustion Stack Gas Temperatures

Appendix D-12
Combustion Stack Gas Temperatures

Test Date	Test Description	# of Runs	Average Temp. (F)	
January 2003	Compliance Test	3	N/A	
November 2003	Trial Burn — Particulate/HCl/Cl2 Sampling	3	354.0	BIF
November 2003	Trial Burn — PCDD/PCDF Sampling	3	257.5	
November 2003	Trial Burn — PCDD/PCDF/PAH/Semi-volatile Organic Sampling	3	362.0	
November 2003	Trial Burn — Total Organics Sampling	3	360.4	
November 2003	Trial Burn — Particle Size Sampling	3	351.8	
November 2003	Trial Burn — Aldehyde/Ketone Sampling	3	367.2	
November 2003	Trial Burn — Aldehyde/Ketone Sampling (QA/QC Run)	1	373.1	
2005 MPRA			N/A	
April 2009	Comprehensive Performance Test — Particulate Sampling (Condition 2)	3	320.3	MACT
April 2009	Comprehensive Performance Test — Metals (Condition 2)	3	325.0	
May 2014	Comprehensive Performance Test — Test 1 (PCDD/PCDF)	3	231.0	
May 2014	Comprehensive Performance Test — Test 2 (Particulate/Hcl/Cl2)	3	311.0	
May 2014	Comprehensive Performance Test — Test 2 (LVM/SVM)	3	308.0	
May 2014	Comprehensive Performance Test — Test 3 (PCDD/PCDF)	3	331.0	

Appendix D-9.4
Boiler No. 4 Comprehensive Performance Test Report
Focus Environmental Inc., August 2014

BOILER NO. 4
COMPREHENSIVE PERFORMANCE TEST REPORT
EPA I.D. NO. SCD 043 348 072

SUBMITTED TO:

ALBEMARLE®

ALBEMARLE CORPORATION
725 CANNON BRIDGE ROAD
ORANGEBURG, SC 29116-1028

AUGUST 2014
FOCUS PROJECT NO. 011408

PREPARED BY:

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Below is list of the analytical data packages. The complete analytical data packages are included on the compact disk with each copy of the CPT Report. When using the compact disk to locate and review the analytical data packages, refer to the Lot Sample Number on the Certificate of Analysis in the Summary Analytical Data Report.

Analytical Data Package Description and Lot Number
Boiler No. 4 Waste Feed & Spiking Material Physical Properties, H4F020409
Boiler No. 4 Method 5/26A Particulate/HCl/Cl_2, H4F020407
Boiler No. 4 Waste Feed, Spiking Material, & Method 29 Metals, H4F020411
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List of Acronyms

acfm	actual cubic feet per minute
APC	air pollution control
ASTM	American Society for Testing and Materials
AWFCO	automatic waste feed cutoff
BIF	Boiler and Industrial Furnace
Btu	British thermal unit
Cd	cadmium
CEM	continuous emissions monitoring
CEMS	continuous emissions monitoring system
CFR	Code of Federal Regulations
Cl^-	chloride ion
Cl_2	molecular chlorine
cm	centimeter
CMS	continuous monitoring system
cP	centipoise
CPMS	continuous process monitoring systems
CPT	comprehensive performance test
Cr	chromium
cSt	centistokes
CVAA or CVAAS	cold vapor atomic absorption spectrometry
dP	differential pressure
DRE	destruction and removal efficiency
dscf	dry standard cubic foot
dscfm	dry standard cubic feet per minute
dscm	dry standard cubic meter
dscmm	dry standard cubic meter per minute
EPA	U.S. Environmental Protection Agency
EDL	estimated detection limit
ft	foot
g	gram
g/cm^3	grams per cubic centimeter
GC/MS	gas chromatograph/mass spectrometry
gpm	gallons per minute
gr	grain
HBCA	health-based compliance alternative
HC or THC	total hydrocarbons
HCl	hydrogen chloride (gas) or hydrochloric acid (aqueous)
Hg	Mercury
hr	hour
HHV	higher (gross) heating value (combustion moisture as liquid water)
HRA	hourly rolling average
HRGC/HRMS	high-resolution gas chromatography/high-resolution mass spectrometry
HWC	Harzardous Waste Combustor
ICP or ICAP	inductively coupled argon plasma spectroscopy
in	inch
inwc	inches water column
kg	kilogram
l or L	liter
lb or Lb	pound
LFB	liquid fuel-fired boiler
LHV	lower (net) heating value (combustion moisture as water vapor)
LVM	low-volatile metals (chromium only)
MACT	Maximum Achievable Control Technology

MDL	method detection limit
mg	milligram
MHWTC	maximum hazardous waste thermal concentration
ml or mL	milliliter
ML	minimum level
Mlb/hr	thousand pounds per hour
MMBtu/hr	million British thermal units per hour
Mscfh	thousand standard cubic feet per hour
MTEC	maximum theoretical emission concentration
OMA	one-minute average
Pb	lead
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
pg	picogram
POHC	principal organic hazardous constituent
ppm	parts per million
ppmv	parts per million by volume
ppmdv	parts per million, dry volume
PM	particulate matter
psig	pounds per square inch, gauge
QA	quality assurance
QAPP	quality assurance project plan
QAO	, Quality Assurance Officer
QC	quality control
RL	reporting limit
SCDHEC	South Carolina Department of Health and Environmental Control
scfh	standard cubic feet per hour
scfm	standard cubic feet per minute
sec	second
SRE	system removal efficiency
SSASP	Stationary Sources Audit Sample Program (SSASP
SVM	semivolatile metals (includes cadmium and lead)
TCDD	tetrachlorinated dibenzo-p-dioxin
TEF	toxicity equivalence factor
TEQ	toxicity equivalents
THC or HC	total hydrocarbons
THRA	12-hour rolling average
vol%	volume percent
w.c.	water column
wt%	weight percent
ug	microgram
ng	nanogram

1.0 EXECUTIVE SUMMARY

1.1 BACKGROUND

This report presents the performance and emissions results from the comprehensive performance test (CPT) of Boiler No. 4 located at the Albemarle Corporation (Albemarle), Orangeburg, South Carolina facility conducted May 27-30, 2014. Treatment of hazardous waste in Boiler No. 4 is regulated under the Hazardous Waste Combustor (HWC) Maximum Achievable Control Technology (MACT) regulations at Title 40 of the Code of Federal Regulations (CFR) Part 63, Subpart EEE. Boiler No. 4 burns hazardous waste, in combination with fossil fuel, to supply steam to the Albemarle manufacturing operations. The test results demonstrate compliance of Boiler No. 4 with the applicable HWC MACT performance standards as promulgated October 12, 2005 and as amended April 14, 2008.

1.2 CPT DATE AND TESTING SCOPE

Albemarle conducted the previous CPT of Boiler No. 4 in April 2009. Recurrent CPTs to demonstrate HWC MACT compliance are required to commence no later than 61 months after the date of commencing the previous CPT [63.1207(d)(1)]. Therefore, testing of Boiler No. 4 was required to commence by May 2014. The CPT plan was submitted to the South Carolina Department for Health and Environmental Compliance (SCDHEC) in May 2013, one year before the test date as required by 40 CFR 63.1207(e)(1)(*i*).

The CPT plan was revised in April 2014 based on agency comments and approved by SCDHEC. The approved plan included three test conditions. One test condition was to demonstrate maximum ash, metals, and chlorine feed rates and associated particulate, HCl/Cl_2, and metals emissions compliance. Boiler No. 4 is equipped with a baghouse for particulate and metals emissions control. The baghouse requires demonstrating compliance with emissions standards for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDFs). PCDD/PCDF emissions compliance was demonstrated at two operating conditions, minimum combustion temperature and maximum waste feed rate/maximum steam production rate.

Provisions at 40 CFR 63.1206(b)(7) and 63.1207(c)(2)(iv) allow for not having to repeat demonstration of organic destruction and removal efficiency (DRE) performance. Specifically, if there have been no engineering changes to the unit that could impact the ability to meet DRE, then DRE performance demonstration does not have to be repeated. Boiler No. 4 has not been modified in any way as to impact DRE since having demonstrated compliance with the Boiler and Industrial Furnace (BIF) rules, 40 CFR 266, Subpart H during the 2003 RCRA trial burn. For HWC MACT compliance, Albemarle retains the DRE-related operating limits established via the 2003 RCRA trial burn:

1.3 HWC MACT PERFORMANCE STANDARDS [40 CFR 63.1217]

Boiler No. 4 is classified as a liquid fuel-fired boiler (LFB) under HWC MACT. Boiler No. 4 is equipped with a baghouse for particulate matter emissions control. The heating values of all the solvent waste

treated in Boiler No. 4 exceed 10,000 Btu/lb. Therefore, the applicable HWC MACT LFB performance standards when burning hazardous waste in Boiler No. 4 are:

- PCDD/PCDFs emissions less than or equal to 0.40 nanograms per dry standard cubic meter (ηg/dscm) 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalents (TEQ) corrected to 7% oxygen for units equipped with a dry particulate emissions control device [40 CFR 63.1217(a)(1)(i)];
- Mercury (Hg) emissions less than or equal to 4.2E-05 pounds per million Btu (lb/MMBtu) of waste fired [40 CFR 63.1217(a)(2)(ii)];
- Semivolatile metals (SVM) [the combined emissions of lead (Pb) and cadmium (Cd)] less than or equal to 8.2E-05 lb/MMBtu of waste fired [40 CFR 63.1217(a)(3)(ii)];
- Chromium (Cr) [low volatility metal (LVM)] emissions less than or equal to 1.3E-04 lb/MMBtu of waste fired [40 CFR 63.1217(a)(4)(ii)];
- Combined emissions of HCl and Cl_2 less than or equal to 5.1E-02 lb/MMBtu of waste fired expressed as chloride (Cl^-) equivalents [40 CFR 63.1217(a)(6)(ii)];
- Stack gas particulate matter (PM) concentration less than or equal to 80 milligrams per dry standard cubic meter (mg/dscm) [0.036 grains per dry standard cubic foot (gr/dscf)] corrected to 7% oxygen [40 CFR 63.1217(a)(7)]; and
- Stack gas carbon monoxide (CO) 60-minute rolling average concentration less than or equal to 100 parts per million, dry volume (ppmdv), corrected to 7% oxygen [40 CFR 63.1217(a)(5)(i)];
- Stack gas total hydrocarbons (HC or THC) 60-minute rolling average concentration less than or equal to 10 ppmdv as propane, corrected to 7% oxygen [40 CFR 63.1217(a)(5)(ii)];
- Organic destruction removal efficiency (DRE) of 99.99% for the selected principle organic hazardous constituent (POHC) [40 CFR 63.1217(c)(1)].

As noted above, the HCl/Cl_2 emissions standard at 40 CFR 63.1217(a)(6)(ii) is 5.1E-02 lb/MMBtu of waste fired expressed as Cl^- equivalents. In October 2007, Albemarle submitted an eligibility demonstration for a health-based compliance alternative (HBCA) for total chorine emissions in accordance with 40 CFR 63.1215(e). This eligibility demonstration proposed retaining the site-specific risk-based RCRA total chlorine feed rate limit of 16.3 lb/hr established for Boiler No. 4. The HBCA petition was approved by the SCDHEC in April 2008. Compliance with the organic DRE standard was previously demonstrated via data-in-lieu from the 2003 RCRA trial burn.

1.4 TEST PROTOCOL [40 CFR 63.1207(f)]

The CPT program for Boiler No. 4 was composed of three test conditions with three replicate sampling runs conducted at each set of operating conditions. The three CPT operating conditions are similar to the 2003 RCRA trial burn and 2009 CPT operating conditions:

- Test 1 was a minimum combustion temperature demonstration. Test 1 demonstrated compliance with HWC MACT standards for PCDD/PCDF, CO, and THC emissions while feeding hazardous waste and operating at minimum combustion temperature. Waste with normal chlorine levels was used during testing.
- Test 2 was a maximum waste feed rate and maximum steam production rate demonstration. Test 2 demonstrated compliance with HWC MACT emissions standards for CO, particulate matter, and metals emissions, and with the HBCA chlorine feed rate limit, while feeding

hazardous waste at the maximum rate and generating steam at the maximum rate. Test 2 included metering to the waste feed an ash surrogate, two metals (chromium and lead), and a chlorinated organic solvent (perchloroethylene).

- Test 3 was a maximum waste feed rate and maximum steam production rate demonstration. Test 3 demonstrated compliance with HWC MACT standards for PCDD/PCDF, CO, and THC emissions while feeding hazardous waste at the maximum rate and generating steam at the maximum rate. Waste with normal chlorine levels was used during testing.

During Test 2, compliance with the applicable emissions standards for LVM (chromium only) and SVM (cadmium and lead) was demonstrated via waste feed analyses, waste feed rate, spiking rate, and emissions testing using EPA Method 29. LVM and SVM emissions were demonstrated at maximum chlorine feed rate conditions as required by 63.1207(n)(4). Maximum LVM and SVM feed rate limits are proposed based on the demonstrated system removal efficiencies (SREs) and extrapolated feed rates of chromium and lead. Compliance with the volatile emission standard (mercury only) was demonstrated via waste feed analyses and waste feed rate under the provisions of the performance test waiver at 40 CFR 63.1207(m)(2). With the performance test waiver, no credit is taken for removal in the boiler system. Compliance with the thermal-based HWC MACT mercury emissions limit was evaluated via Maximum Hazardous Waste Thermal Concentration (MHWTC). Compliance with the particulate emissions standard was demonstrated at maximum ash feed rate conditions. During Test 1 and Test 3, PCDD/PCDF emissions were demonstrated with no enhancements to the waste feed. The chronology of testing is summarized in Table 1-1.

1.5 TEST TEAM

Albemarle was assisted with the management of the testing by Focus Environmental, Inc. (Focus). Waste feed sampling was performed by Albemarle and Focus personnel. Stack sampling was performed by GEL Engineering, LLC (GEL). Waste feed spiking services were provided by Superior Spiking Industries (SSI). All the test samples were analyzed by the TestAmerica, Knoxville, Tennessee laboratory (TestAmerica).

1.6 SUMMARY OF TEST RESULTS

A summary of the performance and emission results is presented in Table 1-2. The test results indicate that Boiler No. 4 meets the applicable performance requirements of HWC MACT. Proposed operating limits for Boiler No. 4 are presented in Table 1-3.

Table 1-1. Boiler No. 4 Boiler No. 4 Comprehensive Performance Test Sampling Method, Dates, and Times

Day	Date	Condition	Sampling	Actual Sampling Times			Spiking
				Start	End	Duration	
1	26-May-14	Not Applicable; Setup					
2	27-May-14	Test Condition 2, Run 4 (PM/HCl/Cl2 & Metals) (Max Feed)	Methods 25A, 5/26A & 29	12:35	14:38	2:03	Ash 22.2 lb/hr net, chloride 14.7 lb/hr net, Lead 3.0 g/hr net, and Chromium 5.0 g/hr net
		Test Condition 2, Run 5 (PM/HCl/Cl2 & Metals) (Max Feed)	Methods 25A, 5/26A & 29	16:20	18:35	2:15	Ash 22.2 lb/hr net, chloride 14.7 lb/hr net, Lead 3.0 g/hr net, and Chromium 5.0 g/hr net
3	28-May-14	Test Condition 2, Run 6 (PM/HCl/Cl2 & Metals) (Max Feed)	Methods 25A, 5/26A & 29	9:35	11:42	2:07	Ash 22.2 lb/hr net, chloride 14.7 lb/hr net, Lead 3.0 g/hr net, and Chromium 5.0 g/hr net
		Test Condition 3, Run 7 (D/Fs/THC) (Max Feed)	Methods 25A & 0023A	12:27	15:34	3:07	None
		Test Condition 3, Run 8 (D/Fs/THC) (Max Feed)	Methods 25A & 0023A	16:05	19:09	3:04	None
4	29-May-14	Test Condition 1, Run 1 (D/Fs/THC) (Min Temp)	Methods 25A & 0023A	11:28	14:35	3:07	None
		Test Condition 1, Run 2 (D/Fs/THC) (Min Temp)	Methods 25A & 0023A	14:55	18:08	3:13	None
5	30-May-14	Test Condition 1, Run 3 (D/Fs/THC) (Min Temp)	Methods 25A & 0023A	8:24	11:32	3:08	None
		Test Condition 3, Run 9 (D/Fs/THC) (Max Feed)	Methods 25A & 0023A	12:30	15:39	3:09	None

SW-846 Method 0023A Dioxins/Furans
EPA Method 29 for Metals (Chromium and Lead)
EPA Method 25A for Total Hydrocarbons
EPA Method 5/26 for Particulate Matter and HCl/Cl_2

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Table 1-2. Boiler No. 4 Comprehensive Performance Test Results Operating Summary

Parameter	Units	HWC MACT Standard	Minimum Combustion Temperature Test (Test 1)			
			Run 1	Run 2	Run 3	Average
Stack gas PCDD/PCDF concentration [1]	ng TEQ/dscm	0.40	0.038	0.0044	0.0054	0.016
Stack gas CO concentration [1]	ppmv, dry HRA	100	10.7	10.0	12.2	11.0
Stack gas THC concentration [1]	ppmv, dry HRA	10	0.30	1.79	0.41	0.83

Parameter	Units	HWC MACT Standard	Maximum Waste Feed Rate Test/Maximum Steam Production Rate Test (Test 2)			
			Run 4	Run 5	Run 6	Average
Stack gas particulate matter [1]	mg/dscm	80	0.51	0.60	0.79	0.63
Stack gas LVM [1,2]	lb/MMBtu	1.3E-04	1.2E-05	4.4E-06	2.4E-06	6.4E-06
Stack gas SVM [1,2]	lb/MMBtu	8.2E-05	< 8.1E-07	< 2.2E-06	< 1.5E-06	< 1.5E-06
Stack gas mercury [1,3]	lb/MMBtu	4.2E-05	< 4.6E-07	< 4.6E-07	< 4.6E-07	< 4.6E-07
Chlorine Feed Rate	lb/hr	16.3	15.2	15.4	14.9	15.2
Stack gas CO concentration [1]	ppmv, dry HRA	100	23.9	23.3	17.4	21.5
Stack gas THC concentration [1]	ppmv, dry HRA	10	0.96	0.80	0.57	0.78

Parameter	Units	HWC MACT Standard	Maximum Waste Feed Rate Test/Maximum Steam Production Rate Test (Test 3)			
			Run 7	Run 8	Run 9	Average
Stack gas PCDD/PCDF concentration [1]	ng TEQ/dscm	0.40	0.057	0.055	0.053	0.055
Stack gas CO concentration [1]	ppmv, dry HRA	100	20.3	19.2	17.5	19.0
Stack gas THC concentration [1]	ppmv, dry HRA	10	0.07	0.34	0.46	0.29

Notes:
1. Corrected to 7% oxygen.
2. Metals emissions results are not blank corrected using the blank train values.
3. Mercury compliance via maximum theoretical emissions concentration (waste feed analysis for mercury content and heating value).

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Table 1-3. Summary of Established Boiler No. 4 HWC MACT Operating Limits

Operational Parameter	*Units*	Limit	AWFCO	Averaging Period	Method of Setting Limit
Group 1 Parameters					
Maximum Liquid Waste Feed Rate	lb/min	20.3	Yes	Hourly Rolling Average	Lesser of the average of the average liquid waste feed rates during the three runs of the 2003 RCRA trial burn maximum waste feed rate/maximum steam production rate test (26.8 lb/min), or the average of the maximum hourly rolling average liquid waste feed rates during the three runs of Test 3. [40 CFR 63.1206(b)(7); 63.1207(c)(2)(iv); and 63.1209(j)(3), (k)(4)]
Maximum Steam Production Rate	lb/hr	20,300	Yes	Hourly Rolling Average	Lesser of the average of the average steam production rates during the three runs of the 2003 RCRA trial burn maximum waste feed rate/maximum steam production rate test (22,600 lb/hr), or the average of the maximum hourly rolling average steam production rates during the three runs of Test 3. [40 CFR 63.1206(b)(7); 63.1207(c)(2)(iv); and 63.1209(j)(2), (k)(3), (m)(1)(i)(C), (n)(5), (o)(2)]
Minimum Combustion Temperature	^{o}F	1,393	Yes	Hourly Rolling Average	Greater of the average of the average combustion temperatures during the three runs of 2003 RCRA trial burn minimum combustion temperature test (1,294 ^{o}F), or the average of the average combustion temperatures during the three runs of Test 1. [40 CFR 63.1206(b)(7) ; 63.1207(c)(2)(iv); and 63.1209(j)(1), (k)(2)]
Maximum Baghouse Inlet Gas Temperature	^{o}F	400	Yes	Hourly Rolling Average	The greater of average of the average baghouse inlet temperature during the three runs of Test 3 or 400^{o}F. [40 CFR 63.1209(k)(1)(i),(n)(1)]
Maximum Liquid Waste Ash Feed Rate	lb/hr	21.6	Yes	12-Hour Rolling Average	Average of the average ash feed rate during the three runs of Test 2. [40 CFR 63.1209(m)(3)]
Maximum Low Volatility Metals (LVM=Total Cr Only) Feed Rate	lb/MMBtu	1.5E-03	Yes	12-Hour Rolling Average	Mass LVM feed rate limit based on the average of the average chromium spiking rate during the three runs of Test 2 extrapolated upward to the lesser of the HWC MACT LVM standard or five times (5X) the demomonstrated chromium spiking rate. [40 CFR 63.1207(f)(1)(x); 63.1209(n)(2)(v)(B)(1); and 63.1217(a)(4)(ii)]
	g/hr	15			
Maximum Semivolatile Metals (SVM=Pb+Cd) Feed Rate	lb/MMBtu	2.4E-03	Yes	12-Hour Rolling Average	Mass SVM feed rate limit based on the average of the average lead spiking rate during the three runs of Test 2 extrapolated upward to the lesser of the HWC MACT SVM standard or five times (5X) the demomonstrated lead spiking rate. [40 CFR 63.1207(f)(1)(x); 63.1209(n)(2)(v)(A)(1), (2); and 63.1217(a)(3)(ii)]
	g/hr	25			

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Table 1-3. Summary of Established Boiler No. 4 HWC MACT Operating Limits (cont'd)

Operational Parameter	Units	Limit	AWFCO	Averaging Period	Method of Setting Limit
Group 2 Parameters					
Maximum Mercury (Hg) Feed Rate	lb/MMBtu	4.2E-05	Yes	12-Hour Rolling Average	Maximum Hg hazardous waste thermal concentration feed rate limit compliance via MTEC/MHWTC. [40 CFR 63.1207(m)(2); 63.1209 (l)(1); and 63.1217(a)(2)(ii)]
Maximum Chloride Feed Rate	lb/hr	15.2	Yes	12-Hour Rolling Average	Lesser of the health-based compliance alternative for total chorine emissions limit approved in accordance with 40 CFR 63.1215(e) based on the RCRA site-specific risk evalution (16.3 lb/hr), or the Test 2 demonstrated feed rate where compliance with metals emissions limits is demonstrated as required by 40 CFR 63.1209(n)(4).
Maximum Combustion Zone Pressure	inwc	0.0	Yes	Instantaneous	HWC MACT Rule [63.1206(c)(5)(i)(B)]
Maximum Stack Gas CO Conc.	ppm, dry @ 7% O_2	100	Yes	Hourly Rolling Average	HWC MACT Rule [40 CFR 63.1217(a)(5)(i)]
Group 3 Parameters					
Minimum Liquid Waste Atomization Air Pressure	psig	10	Yes	Instantaneous; low-pressure switch	Operating experience [40 CFR 63.1209(j)(4)]
Baghouse Leak Detection System Operation and Maintenance	NA	NA	NA	NA	Operating experience and manufacturer's specifications [40 CFR 63.1209(m)(1)(iv), (l)(3), (n)(3)]

Notes:

AWFCO - Automatic waste feed cutoff

N/A-Not applicable

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2.0 TEST PROGRAM SUMMARY

2.1 BRIEF ENGINEERING DESCRIPTION

Boiler No. 4 is a Cleaver Brooks 800 Hermes P (HP) packaged fire-tube boiler. Boiler No. 4 engineering design information is summarized in Table 2-1. Major boiler instrumentation is summarized in Table 2-2. Boiler No. 4 treats liquid hazardous wastes with the generated steam being used by the on-site manufacturing processes. Natural gas is used to bring Boiler No. 4 to waste feed permissive operating temperature, and to maintain combustion temperature when not treating liquid waste.

Boiler No. 4 is equipped with a single, dual-fuel (natural gas/liquid fuel) burner. All hazardous waste feed is pumpable liquid and is pumped to Boiler No. 4 from the collection/storage tanks. A forced draft fan provides air to the burner assembly for combustion of waste and auxiliary fuel.

Natural gas is used for the pilot and as auxiliary fuel to raise the operating temperature to the waste feed permissible limit before liquid waste is introduced. The supply of natural gas is provided from a plant supply line. Feed pressure to the burners is regulated using pressure control valves. An additional pressure control valve provides control of the pilot gas supply pressure. The boiler is permitted to treat liquid hazardous waste at 26.8 lb/min and nominally operates treating waste at 20 lb/min. Boiler No. 4 is equipped with an automatic soot blowing system that blows high-pressure air through the fire tubes to remove soot. One quarter of the fire tubes are soot blown every 15 minutes. Soot blowing lasts for approximately one second.

To control particulate and metals emissions, Boiler No. 4 is equipped with a baghouse. Accumulated fly ash is removed from the bags via reverse air pulse cleaning. The baghouse cleaning cycle is automatic and is initiated based on differential pressure as measured by a photohelic pressure sensor. The fly ash is collected in a tapered hopper with a rotary valve discharge to a connected 55-gallon drum

An induced draft fan provides pressure control for the boiler combustion zone and the baghouse. The induced draft fan maintains a slight vacuum on the boiler combustion zone and draft through the baghouse. The induced draft fan discharges the filtered combustion gas to the boiler stack.

Boiler No. 4 is equipped with a continuous monitoring system (CMS) that measures system flows, pressures, and temperatures. The boiler is also equipped with a continuous emissions monitoring system (CEMS) that measures stack gas concentrations of carbon monoxide and oxygen. Waste feed is rapidly stopped by the automatic waste feed cutoff (AWFCO) system if a regulatory operating limit or safety limit is exceeded. The CMS maintains an electronic record of the system's operation. The CMS's electronic records include three types of data: 1) one-minute average values for each continuously monitored regulatory parameter, 2) data registers for calculating and recording rolling average values for rolling average limited regulatory parameters, and 3) an alarm and AWFCO history log.

2.2 PERFORMANCE AND EMISSIONS OBJECTIVES

Boiler No. 4 is classified as a liquid fuel-fired boiler (LFB) under HWC MACT. Boiler No. 4 is equipped with a baghouse for particulate matter emissions control. The heating values of all the solvents treated in Boiler No. 4 exceed 10,000 Btu/lb. The test program included demonstrating compliance of the Albemarle Boiler No. 4 with the following applicable HWC MACT performance and emissions standards summarized in Table 2-3:

- Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDFs) emissions less than or equal to 0.40 nanograms per dry standard cubic meter (ηg/dscm) 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalents (TEQ) corrected to 7% oxygen for units equipped with dry a particulate emissions control device [40 CFR 63.1217(a)(1)(i)];
- Mercury (Hg) emissions less than or equal to 4.2E-05 pounds per million Btu (lb/MMBtu) of waste fired [40 CFR 63.1217(a)(2)(ii)];
- Semivolatile metals (SVM) [the combined emissions of lead (Pb) and cadmium (Cd)] less than or equal to 8.2E-05 lb/MMBtu of waste fired [40 CFR 63.1217(a)(3)(ii)];
- Chromium (Cr) [low volatility metal (LVM)] emissions less than or equal to 1.3E-04 lb/MMBtu of waste fired [40 CFR 63.1217(a)(4)(ii)];
- Combined emissions of HCl and Cl_2 less than or equal to 5.1E-02 lb/MMBtu of waste fired expressed as chloride (Cl^-) equivalents [40 CFR 63.1217(a)(6)(ii)];
- Stack gas particulate matter (PM) concentration less than or equal to 80 milligrams per dry standard cubic meter (mg/dscm) [0.036 grains per dry standard cubic foot (gr/dscf)] corrected to 7% oxygen [40 CFR 63.1217(a)(7)]; and
- Stack gas carbon monoxide (CO) 60-minute rolling average concentration less than or equal to 100 parts per million, dry volume (ppmdv), corrected to 7% oxygen [40 CFR 63.1217(a)(5)(i)];
- Stack gas total hydrocarbons (HC or THC) 60-minute rolling average concentration less than or equal to 10 ppmdv as propane, corrected to 7% oxygen [40 CFR 63.1217(a)(5)(ii)];
- Organic destruction removal efficiency (DRE) of 99.99% for the selected principle organic hazardous constituent (POHC) [40 CFR 63.1217(c)(1)].

As noted above, the HCl/Cl_2 emissions standard at 40 CFR 63.1217(a)(6)(ii) is 5.1E-02 lb/MMBtu of waste fired expressed as Cl^- equivalents. In October 2007, Albemarle submitted an eligibility demonstration for a health-based compliance alternative (HBCA) for total chorine emissions in accordance with 40 CFR 63.1215(e). This eligibility demonstration proposed retaining the site-specific risk-based RCRA total chlorine feed rate limit of 16.3 lb/hr established for Boiler No. 4. The HBCA petition was approved by the SCDHEC in April 2008. The CPT program demonstrated compliance with the applicable HWC MACT PCDD/PCDF, particulate, metals emission standards, and the HBCA total chlorine feed rate limit.

2.3 PLANNED TEST PROTOCOL

The applicable HWC MACT operating parameter limits (OPLs) are summarized in Table 2-4. Values for some operating limits are demonstrated during the CPT, while others are set independently of the CPT

demonstrated values or results. The CPT process operating data are used to establish the following permissible operating limits under the HWC MACT regulations at 40 CFR 631209(j)-(p):

- Maximum ash feed rate [40 CFR 63.1209(m)(3)]
- Maximum chlorine feed rate [40 CFR 63.1209(n)(4), (o)(1); 63.1215(a)(vi)]
- Maximum HWC MACT metals feed rates [40 CFR 63.1209(l)(1), (n)(2); 63.1207(f)(1)(x)].

Provisions at 40 CFR 63.1206(b)(7) and 63.1207(c)(2)(iv) allow for not having to repeat demonstration of DRE performance. Specifically, if there have been no engineering changes to the unit that could impact the ability to meet DRE, then DRE performance demonstration does not have to be repeated. Boiler No. 4 has not been modified in any way as to impact DRE since having demonstrated compliance with the Boiler and Industrial Furnace (BIF) rules, 40 CFR 266, Subpart H during the 2003 RCRA trial burn. For HWC MACT compliance, Albemarle retains the following DRE-related OPLs established via the 2003 RCRA trial burn:

- Maximum hazardous waste feed rate [40 CFR 63.1209(j)(3), (k)(4)].
- Minimum combustion temperature [40 CFR 63.1209(j)(1), (k)(2)].
- Maximum steam production rate [40 CFR 63.1209(j)(2), (k)(3)].

The 2003 RCRA trial burn demonstrated DRE using the three principal organic hazardous constituents (POHCs): monochlorobenzene (MCB), toluene, and perchloroethylene (PERC). Albemarle included DRE data from the 2003 RCRA trial burn that demonstrate compliance with the RCRA and HWC MACT DRE standard of 99.99% with the 2009 CPT Report and Notification of Compliance (NOC). Summary DRE and other data from the 2003 RCRA trial burn are presented in Table 2-5.

The balance of the HWC MACT operating limits specified at 63.1209 (j)-(p) will be established based on the HWC MACT regulations, e.g., the maximum stack CO concentration, or manufacturer's recommendations, operational safety, and good operating practice considerations, e.g., minimum atomization media pressure for liquid waste feed atomization.

2.4 TEST PROTOCOL [40 CFR 63.1207(f)]

The CPT program for Boiler No. 4 was composed of three test conditions with three replicate sampling runs conducted at each set of operating conditions. The three CPT operating conditions were similar to the 2003 RCRA trial burn and 2009 CPT operating conditions:

- Test 1 was a minimum combustion temperature demonstration. Test 1 demonstrated compliance with HWC MACT standards for PCDD/PCDF, CO, and THC emissions while feeding hazardous waste and operating at minimum combustion temperature. Waste with normal chlorine levels was used during testing.
- Test 2 was a maximum waste feed rate and maximum steam production rate demonstration. Test 2 demonstrated compliance with HWC MACT emissions standards for CO, particulate matter, and metals emissions, and with the HBCA chlorine feed rate limit, while feeding

hazardous waste at the maximum rate and generating steam at the maximum rate. Test 2 including metering to the waste feed an ash surrogate, two metals (chromium and lead), and a chlorinated organic solvent.

- Test 3 was a maximum waste feed rate and maximum steam production rate demonstration. Test 3 demonstrated compliance with HWC MACT standards for PCDD/PCDF, CO, and THC emissions while feeding hazardous waste at the maximum rate and generating steam at the maximum rate. Waste with normal chlorine levels was used during testing.

The three test conditions included the following sampling and analyses:

Test 1 - Minimum Combustion Temperature Condition

- Liquid waste feed for heating value, viscosity, density, ash, and total chlorine analyses;
- Stack gas for PCDD/PCDF emissions using a SW-846 Method 0023A sampling train;
- Stack gas CO and O_2 concentrations by installed continuous emissions monitors (CEMs) according to the protocols in 40 CFR 60, Appendix B, Performance Specification 4B;
- Stack gas THC concentration using a temporary CEM according to the protocols in 40 CFR 60 Appendix A, Method 25A.

Test 2 - Maximum Waste Feed Rate and Maximum Steam Production Rate Condition (Maximum Ash, Metals, and Chlorine)

- Liquid waste feed for heating value, viscosity, density, ash, total chlorine, and the HWC MACT metals [cadmium (Cd), total chromium (Cr), lead (Pb) and mercury (Hg)] analyses;
- Waste feed spiking of two metals (lead and chromium), and an ash surrogate [titanium dioxide (TiO_2)];
- Waste feed spiking of perchloroethylene as a chlorine source
- Stack gas for particulate, HCl, and Cl_2 using a 40 CFR 60, Appendix A, Method 26A sampling train;
- Stack gas for Cd, total Cr, and Pb using a 40 CFR 60, Appendix A, Method 29 sampling train;
- Stack gas CO and O_2 concentrations by installed continuous emissions monitors (CEMs) according to the protocols in 40 CFR 60, Appendix B, Performance Specification 4B.

Test 3 - Maximum Waste Feed Rate and Maximum Steam Production Rate Condition

- Liquid waste feed for heating value, viscosity, density, ash, and total chlorine analyses;
- Stack gas for PCDD/PCDF emissions using a SW-846 Method 0023A sampling train;
- Stack gas CO and O_2 concentrations by installed CEMs according to the protocols in 40 CFR 60, Appendix B, Performance Specification 4B;
- Stack gas THC concentration using a temporary CEM according to the protocols in 40 CFR 60 Appendix A, Method 25A.

The CPT sampling and analyses are summarized in Tables 2-6 and 2-7. The CPT was designed to demonstrate the range of worst-case operation of Boiler No. 4, duplicating as nearly as possible, the operating conditions demonstrated during the 2003 RCRA trial burn and 2009 CPT. Boiler No. 4 was operated treating as-generated liquid waste. There was no spiking of the waste feed during Test 1 or

Test 3. During Test 2, an ash surrogate [titanium dioxide (TiO_2)], two metals (chromium and lead), and chlorine as perchloroethylene (PERC) were metered into the waste feed as necessary to demonstrate the desired feed rate limits for ash, LVM, SVM, and chlorine, respectively.

During the minimum combustion temperature test condition, Test 1, the Boiler No. 4 combustion temperature target was the minimum combustion temperature limit established during the 2003 RCRA trial burn. Compliance with the applicable HWC MACT PCDD/PCDF emissions standard was demonstrated.

During the first segment of the maximum waste feed rate and maximum steam production rate test condition, Test 2, the Boiler No. 4 target maximum liquid waste feed rate and maximum steam production rate were the maximum limits established during the 2003 RCRA trial burn and re-demonstrated during the 2009 CPT. The maximum ash and metals feed rates were demonstrated during this test to show the air pollution control (APC) system's capabilities in meeting the HWC MACT particulate, LVM, and SVM emissions performance standards. Metals emissions control was demonstrated at maximum chlorine feed rate as required by 63.1209(n)(4). The target chlorine feed rate during this testing was the HBCA limit.

During the second segment of the maximum waste feed rate and maximum steam production rate test condition, Test 3, the Boiler No. 4 target maximum liquid waste feed rate and maximum steam production rate were the maximum limits established during the 2003 RCRA trial burn and re-demonstrated during the 2009 CPT. Compliance with the applicable HWC MACT PCDD/PCDF emissions standard was demonstrated.

The potential mercury emissions from the Boiler No. 4 comply with the HWC MACT mercury emissions limit via maximum hazardous waste thermal concentration (MHWTC). Therefore, there was no spiking of mercury during Test 2. Waste feed analyses and waste feed rate were used to assess compliance with the HWC MACT mercury emissions limits via MHWTC.

2.5 TEST IMPLEMENTATION SUMMARY

The Boiler No. 4 test program was conducted in May 2014. The chronology of testing is summarized in Table 1-1. The test conditions are denoted as Test 1, Test 2, and Test 3. The test runs are numbered consecutively. Test 1 includes Runs 1, 2, and 3. Test 2 includes Runs 4, 5, and 6. Test 3 includes Runs 7, 8, and 9. The following paragraphs include more detail on the chronology of the testing program.

Test 2 was conducted May 27-28. Boiler No. 4 was operated at maximum waste feed rate/maximum steam production conditions. The first two test runs, Run 4 and Run 5, were conducted on May 27. The third test run, Run 6, was conducted on May 28. During each run, a mineral oil dispersion containing an ash surrogate, titanium dioxide (TiO_2) and two metals, chromium as strontium chromate ($SrCrO_4$) and lead as lead oxide (PbO), was metered to the waste feed. Concurrently, perchloroethylene (C_2Cl_4) was metered to the waste feed to provide maximum chlorine feed rate. Particulate and HCl/Cl_2 emissions

were measured using EPA Method 26A. LVM and SVM emissions were measured using EPA Method 29. Waste feed samples were collected for heating value, density, viscosity, ash, chlorine, and metals analysis during each test run. Ash/metals spiking material samples were collected for confirmation analysis.

The first two runs of Test 3 were conducted May 28. After completing Test 2, Run 6, metering of ash/metals and chlorine was discontinued. Operation of Boiler No. 4 was continued at maximum waste feed rate/maximum steam production conditions. The first two test runs of Test 3, Run 7 and Run 8, were then conducted. PCDD/PCDF emissions were measured using SW-846 Method 0023A and THC emissions were measured using EPA Method 25A. Waste feed samples were collected for heating value, density, viscosity, ash, and chlorine analysis during each test run.

Cooling Boiler No. 4 down requires a significant amount of time. The test team elected to allow the boiler to cool down with waste feed off overnight on May 28 and begin the minimum combustion temperature testing the following morning on May 29. When the test team arrived on the morning of May 29, there was a problem with the boiler water level indicator which delayed the start of testing. Once the level indicator was repaired, the boiler operation was established with waste feed on at minimum combustion temperature conditions. The first two runs of Test 1, Run 1 and Run 2, were then conducted. PCDD/PCDF emissions were measured using SW-846 Method 0023A and THC emissions were measured using EPA Method 25A. Waste feed samples were collected for heating value, density, viscosity, ash, and chlorine analysis during each test run.

Operation of Boiler No. 4 was maintained at minimum combustion temperature condition with waste feed off overnight on May 29. Operation of Boiler No. 4 was established with waste feed on at minimum combustion temperature conditions. The third run of Test 1, Run 3, was then conducted on the morning of May 30. PCDD/PCDF emissions were measured using SW-846 Method 0023A and THC emissions were measured using EPA Method 25A. Waste feed samples were collected for heating value, density, viscosity, ash, and chlorine analysis during the test run.

The third run of Test 3 was conducted May 30, 2013. After completing Test 1, Run 3, Boiler No. 4 operation was ramped up to maximum waste feed rate/maximum steam production conditions. The third run of Test 3, Run 9, was then conducted. PCDD/PCDF emissions were measured using SW-846 Method 0023A and THC emissions were measured using EPA Method 25A. Waste feed samples were collected for heating value, density, viscosity, ash, and chlorine analysis during the test run.

2.6 DEVIATIONS FROM THE TEST PLAN

Testing of Boiler No. 4 was conducted in substantial conformance with the approved test plan. No significant deviations were noted.

Table 2-1. Boiler No. 4 Engineering Data

Parameter	Boiler No. 4
Manufacturer:	Cleaver-Brooks
Model No.:	800 Hermes P (HP)
Type:	Packaged Fire Tube
Date of Mfr.:	1970
No. of Burners:	One
Burner Type:	Dual fuel natural gas/liquid fuel
Burner Thermal Rating	27 MMBtu/hr
Combustion Air Blower Capacity	6500 scfm
Liquid Waste Atomization Media	Air
Burner Viscosity Rating	0.45 to 150 cP
Internal Volume	488 ft^3
Maximum Liquid Feed to the Burner	1,970 lb/hr @ 17,000 Btu/lb
Maximum Steam Conditions	200 psig, saturated
Maximum Steam Production	27,600 lbs/hr
Maximum Heat Release	32 MM Btu/hr
CO CEMs Manufacturer/Type	Rosemount Model 880 Nondispersive Infrared (NDIR) Analyzer
O_2 CEMs Manufacturer/Type	Rosemount Model 775 Paramagnetic Analyzer
Emissions Control	**Baghouse**
Manufacturer:	Aeropulse, Inc.
Model No.	PR-256-10-H-N
No. of Bags	256
Bag Manufacturer	Midwesco
Bag Diameter	Five (5) inches
Bag Length	10 feet
Total Collection Area	3,386 ft^2
Bag Material	21-oz. Fiberglass Midwesco Part No. FW8446-0106
Baghouse Cleaning Mechanism	Photohelic pressure sensor; reverse pulse cleaning
Air to Cloth Ratio	3.5 cfm/ft^2
Maximum Operating Temperature	500 ^oF (260 ^oC)
Maximum Operating Pressure	40 inwc
Fly Ash Handling	Tapered hopper with rotary valve discharge to connected 55 gal. drum
Induced Draft Fan and Stack	**Statistics**
Induce Draft Fan Capacity	10,500 scfm @ 15 inwc
Diameter	24 inches
Discharge Height	60 feet

Table 2-2. Boiler No. 4 Major Process Instrumentation

Process Parameter	Units	Instrument Tag Number	Instrument Type	Range	Accuracy	Typical Value
Combustion Temperature	^{o}C	TI-E8394-068	Type R Thermocouple	0-1500 ^{o}C	±5 ^{o}C	1025-1080
Natural Gas Feed Rate	scfm	FI-E8394-071	Johnson-Yokogowa Vortex Meter Model YF105 with YFCT transmitter	0-488	±2% of reading	200-300
Liquid Waste Feed Rate	lb/min	FI-E8394-069	Micro-Motion Mass Flow Meter	0-800	±0.2% of reading	10-25
Steam Production Rate	lb/hr	FI-E8394-051	Johnson-Yokogowa Vortex Meter Model YF115 with YFCT transmitter	0-25,000	±2% of reading	10,000-20,000
Ash Feed Rate	lb/hr	NA; system calculated				
Chloride Feed Rate	lb/MMBtu	NA; system calculated				
Mercury Feed Rate	lb/MMBtu	NA; system calculated				
SVM Feed Rate	lb/MMBtu	NA; system calculated				
Chromium Feed Rate	lb/MMBtu	NA; system calculated				
Atomizing Air Pressure	psig	Local PI; Low Pressure Switch	Wika Instrument Corp	0-100	±2%	15-25
Baghouse Inlet Temperature	^{o}F	TI-E8397-D	Type J Thermocouple	32-482	±2 ^{o}F	350-380
Baghouse Differential Pressure	inwc	DPI-S8397-A	Dwyer dP cell	0-20	± 0.25% of range	1-10
Bag Leak Detection (Opacity)	%	AI-S8397-A	Auburn Systems Trioflow 3400-11	0-100	± 1 mg/dscm	25-35
Stack Gas Temperature	^{o}C	TI-E8394-073	Type J Thermocouple	0-250 ^{o}C	±1 ^{o}C	200-220
Stack CO Concentration	ppmdv @7% O_2	AE-S8394-A	Rosemount Model 880	0-200	± 3 of range	10-20
		AT-S8394-A		0-3000		
Stack O_2 Concentration	vol%, dry	AE-S8394-A AT-S8394-A	Rosemount Model 775	0-25	± 1% O_2	5.0-8.0%

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Table 2-3. Performance and Emissions Standards for Existing Liquid Fuel-fired Boilers

Parameter	Performance and Emissions Standards	
	< 10,000 Btu/lb	**≥ 10,000 Btu/lb**
Dioxins and furans	Compliance with the CO or HC emission standard	
Mercury	19 ug/dscm [a]	4.2E-05 lb/MMBtu
Semivolatile metals	150 ug/dscm [a]	8.2E-05 lb/MMBtu
Chromium	370 ug/dscm [a]	1.3E-04 lb/MMBtu
Hydrogen chloride and chlorine	31 ppmdv [a]	5.1E-02 lb/MMBtu
Particulate matter	80 mg/dscm [a]	
Carbon monoxide	100 ppmdv (dry) [a]	
Hydrocarbons [b]	10 ppmdv (dry) [a]	
Destruction and removal efficiency	99.99%	

Notes:

[a] Corrected to seven percent oxygen.

[b] Compliance with the THC standard is only demonstrated during the DRE performance test.

Table 2-4. Boiler No. 4 Applicable HWC MACT Operating Limits

LIMIT	REGULATORY CITATION - 63.1209	HOW ESTABLISHED	AVERAGING TIME	ASSOCIATED STANDARD						
				DRE	Dioxins/ Furans	Hg	SVM	LVM	PM	HCl/Cl_2
LIMITS ASSOCIATED WITH THE COMBUSTION UNIT										
Minimum combustion chamber temperature	(j)(1), (k)(2)	Average of test run averages	Hourly rolling average	**NT Note a**	**Test 1 (Note b)**					
Maximum combustion chamber pressure (Note c)	(p)	Not applicable; complies with 63.1205(c)(5)(i)(a) [sealed combustion zone]	None	For control of fugitive emissions - no quantified limits established						
Maximum combustion gas velocity or production rate	(j)(2), (k)(3), (m)(2), (n)(5), (o)(2)	Average of the maximum hourly rolling averages	Hourly rolling average	**NT Note a**	**Test 3 (Note b)**		**Test 2**	**Test 2**	**Test 2**	**Test 2**
Operation of waste firing system	(j)(4)	Manufacturer's specifications or other means	Hourly rolling average	**NT**						
LIMITS ASSOCIATED WITH THE FEED STREAMS										
Maximum hazardous waste feed rate	(j)(3), (k)(4), Preamble 9/30/99 Rule, page 52937	Maximum pumpable and maximum total as the average of the maximum rolling hour averages	Hourly rolling average	**NT Note a**	**Test 3 (Note b)**					
Maximum feed rate of mercury	(l)(1)	Average of the average hourly rolling averages (may be extrapolated upward)	12-hour rolling average			**MHWTC**				
Maximum feed rate of SVM	(n)(2)(A)	Average of the average hourly rolling averages (may be extrapolated upward)	12-hour rolling average				**Test 2**			

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Table 2-4. Boiler No. 4 Applicable HWC MACT Operating Limits

LIMIT	REGULATORY CITATION - 63.1209	HOW ESTABLISHED	AVERAGING TIME	ASSOCIATED STANDARD						
				DRE	Dioxins/ Furans	Hg	SVM	LVM	PM	HCl/Cl_2
Maximum feed rate of LVM	(n)(2)(B), (n)(2)(C)	Average of the average hourly rolling averages (may be extrapolated upward)	12-hour rolling average					**Test 2**		
Maximum feed rate of total chlorine and chloride	(n)(4), (o)(1)	Average of the average hourly rolling averages	12-hour rolling average				**Test 2**	**Test 2**		**Test 2**
Maximum ash feed rate	(m)(3), Preamble 9/30/99 Rule, page 52954 and 52955	Average of the average hourly averages	12-hour rolling average						**Test 2**	
LIMITS ASSOCIATED WITH THE BAGHOUSE										
Maximum inlet gas temperature	(k)(1), (n)(1)	Average of the average hourly averages	Hourly rolling average		**Test 3 (Note b)**		**Test 2**	**Test 2**		

Notes:

[a] Albemarle will submit DRE data from the 2003 RCRA trial burn as data-in-lieu as allowed by 63.1206(b)(7) and 63.1207(c)(2)(iv). The OPLs for maximum hazardous waste feed rate, minimum combustion temperature, and maximum steam production rate established under RCRA will be retained under HWC MACT operation.

[b] PCDD/PCDF emissions will be measured during this CPT to confirm compliance with the applicable standard. However, the operating limit, which is also a DRE related limit, established by the 2003 RCRA trial burn will be retained.

[c] Three control options at 63.1206(c)(5)(i):
(A) sealed combustion zone
(B) maintain sub-atmospheric (negative) pressure in the combustion zone
(C) alternative method.

MHWTC = Maximum Hazardous Waste Thermal Concentration
NT = Not tested.

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Table 2-5. Boiler No. 4 November 2003 RCRA Trial Burn Results

Parameter	Units	HWC MACT Standard	November 2003 RCRA Trial Burn Results			
			Run 1	Run 2	Run 3	Average
Maximum Waste Feed Rate Test						
Combustion Temperature	deg F	NA	1,838	1,879	1,990	1,902
Steam Production Rate	Mlb/hr	NA	22.3	23.0	22.7	22.7
Waste Feed Rate	lb/min	NA	25.0	25.3	25.4	25.2
Baghouse Temperature	deg F	NA	434	429	429	431
Monochlorobenzene DRE	%	99.99	99.994	99.993	99.996	99.994
Toluene DRE	%	99.99	99.994	99.996	99.996	99.995
Perchloroethylene DRE	%	99.99	99.9995	99.9989	99.9995	99.9993
CO Emissions	ppmdv [1]	≤100	22.2	11.7	12.2	15.4
Minimum Combustion Temperature Test						
Combustion Temperature	deg F	NA	1,293	1,295	1,296	1,294
Steam Production Rate	Mlb/hr	NA	7.1	7.4	7.3	7.3
Waste Feed Rate	lb/min	NA	9.7	9.7	9.7	9.7
Baghouse Temperature	deg F	NA	378	376	376	377
Monochlorobenzene DRE	%	99.99	99.998	99.998	99.998	99.998
Toluene DRE	%	99.99	99.9996	99.9996	99.9993	99.9995
Perchloroethylene DRE	%	99.99	99.9998	99.9992	99.9990	99.9993
CO Emissions	ppmdv [1]	≤100	9.3	9.5	15.1	11.3
Dioxin Emissions	ng TEQ/dscm [1]	0.40	0.15	0.20	0.14	0.16
Risk Burn Test						
Combustion Temperature	deg F	NA	1,752	1,781	1,778	1,770
Steam Production Rate	Mlb/hr	NA	24.2	23.7	23.6	23.8
Waste Feed Rate	lb/min	NA	27.4	26.9	27.0	27.1
Baghouse Temperature	deg F	NA	421	432	440	431
CO Emissions	ppmdv [1]	≤100	9.8	9.6	15.9	11.8
Dioxin Emissions	ng TEQ/dscm [1]	0.40	0.14	0.31	0.35	0.27

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Table 2-6. Boiler No. 4 Sampling and Analysis-Test 1 and Test 3

Sample Name	Sampling Location/ Access	Sampling Equipment	Sampling Reference Method [a]	Sample Size/Frequency	Analytical Parameters	Analytical Reference Method [a]
Liquid Waste Feed	Tap on line	250 mL bottle for grab sampling; 4 L glass jug 250 and 500 mL glass bottles	ASTM E-300-86	Collect a 250 mL grab sample of the waste feed at each 30-minute interval during each test run. The grab samples of the waste feed stream will be used to build a composite sample in a 4L jug. The run composite is maintained on ice between sampling intervals. At the end of the test run, collect two- 250 mL sample bottles for properties analysis from the homogenized composite sample.	Heating Value Viscosity Density Ash Content Total Chloride	ASTM D-240 & D-5865 ASTM D-445 ASTM D-891& D-854 ASTM D-482 & D-3174 ASTM D-808 or SW846 5050, SW846 9056
Stack Gas	Isokinetic Port	Method 0023A Sampling Train	SW846, Method 0023A	Minimum of 180 minutes and 2.5 dry standard cubic meters (dscm) of stacks gas sampled [b,c]	PCDD/PCDFs	SW846 Methods 0023A & 8290; EPA Method 23
Stack Gas	CEMS Port	Installed CO and O_2 CEMS	40 CFR 60 Appendix B Specification 4B	Continuous during test run	CO and O_2	40 CFR 60 Appendix B Specification 4B
Stack Gas	CEMS Port	Temporary THC CEMS	40 CFR 60 Appendix A Method 25A	Continuous during test run	HC	40 CFR 60 Appendix A Method 25A

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Table 2-6. Boiler No. 4 Sampling and Analysis-Test 1 and Test 3

Notes:

[a] Reference Method Sources:

"ASTM" refers to American Society for Testing Materials, Annual Book of ASTM Standards, Annual Series
"SW846" refers to Test Methods for Evaluating Solid Waste, Third Edition, November 1986, and Updates.
"EPA Method" refers to New Source Performance Standards, Test Methods and Procedures, Appendix A, 40 CFR 60.

[b] The exact volume of gas sampled will depend on the isokinetic sampling rate.

[c] Isokinetic sampling trains include:

- Collecting one set of bag samples (or using CEM) for oxygen and carbon dioxide to determine stack gas molecular weight (EPA Method 3 or 3A)
- Performing stack gas velocity, pressure and temperature profile measurement for each sampling location (EPA Method 2)
- Determining the moisture content of the stack gas for each sampling train sample (EPA Method 4).

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Table 2-7. Boiler No. 4 Sampling and Analysis-Test 2

Sample Name	Sampling Location/ Access	Sampling Equipment	Sampling Reference Method [a]	Sample Size/Frequency	Analytical Parameters	Analytical Reference Method [a]
Liquid Waste Feed	Tap on line	250 mL bottle for grab sampling; 4 L glass jug 250 and 500 mL glass bottles	ASTM E-300-86	Collect a 250 mL grab sample of the waste feed at each 30-minute interval during each test run. The grab samples of the waste feed stream will be used to build a composite sample in a 4L jug. The run composite is maintained on ice between sampling intervals. At the end of the test run, collect two-250 mL sample bottles for properties analysis, and one 250 mL sample bottle for metals analysis from the homogenized composite sample.	Heating Value Viscosity Density Ash Content Total Chloride Metals: Cd, Cr, Pb, & Hg	ASTM D-240 & D-5865 ASTM D-445 ASTM D-891& D-854 ASTM D-482 & D-3174 ASTM D-808 or SW846 5050, SW846 9056 ICAP (SW846 3050/3051, and 6010 or 6020) Hg: CVAAS (Method 3050/3051 & 7470)
Ash/Metals Spiking Material	Tap on line	250 mL sample bottle	ASTM E-300-86	Collect one 250 mL sample bottle of solution once during each test run	Metals: Cr & Pb Ash Content	ICAP (SW846 3050/3051, and 6010 or 6020) ASTM D-482
Chlorine Spiking Material	Tap on line	250 mL sample bottle	ASTM E-300-86	Collect one 250 mL sample bottle of solution once during test	None	Archive
Stack Gas	Isokinetic Port	Method 29 Sampling Train	40 CFR 60; App A, Method 29	Minimum 120 minutes [b,c]	Metals: Cd, Cr, & Pb	EPA Method 29; SW846 Method 3010/3050/3051, 6010 or 6020
Stack Gas	Isokinetic Port	Method 26A	40 CFR 60; App A, Method 26A	Minimum of 60 minutes [b,c]	Particulate HCl/Cl_2	EPA Method 5 SW846 Method 9057
Stack Gas	CEMS Port	Installed CO and O_2 CEMS	40 CFR 60 Appendix B Specification 4B	Continuous	CO and O_2	40 CFR 60 Appendix B Specification 4B

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Table 2-7. Boiler No. 4 Sampling and Analysis-Test 2

Notes:

[a] Reference Method Sources:

"ASTM" refers to American Society for Testing Materials, Annual Book of ASTM Standards, Annual Series
"SW846" refers to Test Methods for Evaluating Solid Waste, Third Edition, November 1986, and Updates.
"EPA Method" refers to New Source Performance Standards, Test Methods and Procedures, Appendix A, 40 CFR 60.

[b] The exact volume of gas sampled will depend on the isokinetic sampling rate.

[c] Isokinetic sampling trains include:

- Collecting one set of bag samples (or using CEM) for oxygen and carbon dioxide to determine stack gas molecular weight (EPA Method 3 or 3A)
- Performing stack gas velocity, pressure and temperature profile measurement for each sampling location (EPA Method 2)
- Determining the moisture content of the stack gas for each sampling train sample (EPA Method 4).

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3.0 PROCESS OPERATIONS

3.1 PROCESS OPERATING CONDITIONS

Boiler No. 4 was operated at three operating conditions. Key process operating parameters were continuously monitored and recorded during each test run by the data acquisition system. Table 3-1 summarizes the key operating data collected during the minimum combustion temperature PCDD/PCDF emissions testing, Test 1. Table 3-2 summarizes the key operating data collected during the metals, particulate matter, and HCl/Cl_2 emissions compliance testing, Test 2. Table 3-3 summarizes the key operating data collected during maximum waste feed rate/maximum steam production rate PCDD/PCDF emissions testing, Test 3. Appendix A presents the 1-minute process operating data from each test run.

Key process instruments were calibrated prior to the testing. Process instrument calibration documentation is included in Appendix E. The CO and O_2 CEMS calibrations were conducted daily before commencing testing.

3.2 WASTE FEED MATERIAL CHARACTERISTICS

Grab samples of the liquid waste stream were collected at 30-minute intervals during each test run. The grab samples were used to build composite samples of the liquid waste stream during the course of the test run. At the end of each test run, samples for analysis were collected from the homogenized composite sample. Liquid waste feed analyses are summarized in Table 3-4. Waste feed heat input, and the native ash, chlorine, and HWC MACT metals feed rates during Test 2 are summarized in Table 3-5.

3.3 WASTE FEED SPIKING

During Test 2, the particulate matter, HCl/Cl_2, and metals emissions testing, a mineral oil dispersion of an ash surrogate (titanium dioxide, TiO_2) and two metals, chromium as strontium chromate ($SrCrO_4$) and lead as lead oxide (PbO), was metered to the waste feed. Concurrently, perchloroethylene (C_2Cl_4) was metered to the waste feed to provide maximum chlorine feed rate and to demonstrate the proposed HBCA chlorine feed rate limit. The documentation and certificates for the ash surrogate/metals dispersion, and manufacturer's assay for the perchloroethylene are included in Appendix D.

Samples of the ash/metals spiking material were collected once during each run of Test 2 for confirmation analysis. Ash, chromium, and lead confirmation analysis results and feed rates are summarized in Table 3-6. The ash analysis results confirm the prepared the dispersion concentration. The chromium and lead analysis results were substantially higher than the prepared the dispersion concentrations. The lesser values, preparation versus analyses, were used in assessing the metered feed rates of ash, chromium and lead. Industrial grade perchloroethylene (C_2Cl_4) was used with a stoichiometric concentration of 85.52 wt% chlorine. No samples of the perchloroethylene were collected or analyzed. Native and spiked ash, metals, and chlorine feed rates are summarized in Table 3-5. The constituent feed rate values and system removal efficiencies presented in Table 3-5 are based on each constituent being present in the test samples at the full analytical detection limit.

Table 3-1. Boiler No. 4 Operating Data Summary-Test 1

Operational Parameter	Units	Target	Statistic	Run 1	Run 2	Run 3	Test 1 Avg.
Waste Feed Rate	lb/min OMA	NA	Average	3.40	4.99	4.17	4.19
			Maximum	8.67	11.71	7.02	9.14
			Minimum	0.02	0.02	0.03	0.02
			St. Dev.	2.76	2.95	1.18	2.30
Waste Feed Rate	lb/min HRA	26.8	Average	3.92	4.54	3.78	4.08
			Maximum	6.42	7.71	4.54	6.23
			Minimum	1.49	0.52	3.34	1.78
			St. Dev.	1.65	2.25	0.29	1.40
Combustion Temperature	deg F OMA	NA	Average	1,387	1,391	1,400	1,393
			Maximum	1,393	1,395	1,422	1,403
			Minimum	1,376	1,383	1,391	1,383
			St. Dev.	4	2	5	4
Combustion Temperature	deg F HRA	NA	Average	1385	1391	1399	1,392
			Maximum	1390	1392	1405	1,396
			Minimum	1380	1390	1397	1,389
			St. Dev.	4	1	2	2
Steam Production Rate	Mlb/hr OMA	NA	Average	3.40	4.99	4.17	4.19
			Maximum	8.67	11.71	7.02	9.14
			Minimum	0.02	0.02	0.03	0.02
			St. Dev.	2.76	2.95	1.18	2.30
Steam Production Rate	Mlb/hr HRA	22.6	Average	3.92	4.54	3.78	4.08
			Maximum	6.42	7.71	4.54	6.23
			Minimum	1.49	0.52	3.34	1.78
			St. Dev.	1.65	2.25	0.29	1.40
Baghouse Temperature	deg F OMA	380	Average	292	289	307	296
			Maximum	298	298	311	302
			Minimum	287	278	302	289
			St. Dev.	2	7	3	4
Baghouse dP	inwc OMA	NA	Average	0.68	0.73	0.94	0.78
			Maximum	0.74	0.79	0.97	0.84
			Minimum	0.63	0.68	0.89	0.73
			St. Dev.	0.03	0.02	0.02	0.02
Baghouse dP	inwc HRA	NA	Average	0.65	0.71	0.93	0.77
			Maximum	0.68	0.73	0.96	0.79
			Minimum	0.62	0.69	0.91	0.74
			St. Dev.	0.02	0.01	0.02	0.02
Baghouse Bag Leak Detection	% OMA	NA	Average	15.0	15.3	20.0	16.8
			Maximum	17.8	35.1	20.3	24.4
			Minimum	13.2	6.2	19.2	12.9
			St. Dev.	1.3	7.0	0.3	2.8

Table 3-1. Boiler No. 4 Operating Data Summary-Test 1 (cont'd)

Operational Parameter	Units	Target	Statistic	Run 1	Run 2	Run 3	Test 1 Avg.
Stack Gas O_2	vol% dry OMA	NA	Average	11.7	11.6	11.9	11.7
			Maximum	12.0	12.0	12.2	12.1
			Minimum	11.4	11.4	11.3	11.4
			St. Dev.	0.1	0.1	0.2	0.1
Stack Gas CO, corrected to 7% O_2	ppmdv OMA	NA	Average	10.5	10.1	14.8	11.8
			Maximum	10.7	10.3	247.3	89.4
			Minimum	10.3	10.0	10.9	10.4
			St. Dev.	0.1	0.1	17.6	5.9
Stack Gas CO, corrected to 7% O_2	ppmdv HRA	<100	Average	10.7	10.0	12.2	11.0
			Maximum	11.1	10.2	15.0	12.1
			Minimum	10.3	10.0	9.7	10.0
			St. Dev.	0.2	0.1	1.7	0.7

OMA = One-Minute Average
HRA = Hourly Rolling Average

Table 3-2. Boiler No. 4 Operating Data Summary-Test 2

Operational Parameter	Units	Target	Statistic	Run 4	Run 5	Run 6	Test 2 Avg.	Run 7
Waste Feed Rate	lb/min OMA	NA	Average	18.77	19.21	20.89	19.62	19.99
			Maximum	20.57	22.30	29.41	24.09	25.72
			Minimum	15.39	16.38	16.89	16.22	17.86
			St. Dev.	1.02	1.21	2.77	1.66	1.18
Waste Feed Rate	lb/min HRA	26.8	Average	19.06	19.06	20.23	19.45	19.77
			Maximum	19.46	19.31	20.98	19.91	19.94
			Minimum	18.51	18.86	18.44	18.60	19.59
			St. Dev.	0.25	0.12	0.57	0.32	0.09
Combustion Temperature	deg F OMA	NA	Average	2,093	2,291	2,280	2,222	2,346
			Maximum	2,157	2,343	2,336	2,278	2,368
			Minimum	2,016	2,245	2,205	2,155	2,320
			St. Dev.	43	26	35	35	14
Combustion Temperature	deg F HRA	NA	Average	2059	2269	2253	2,193	2344
			Maximum	2129	2314	2308	2,250	2359
			Minimum	1998	2212	2195	2,135	2326
			St. Dev.	43	29	35	36	12
Steam Production Rate	Mlb/hr OMA	NA	Average	18.77	19.21	20.89	19.62	19.99
			Maximum	20.57	22.30	29.41	24.09	25.72
			Minimum	15.39	16.38	16.89	16.22	17.86
			St. Dev.	1.02	1.21	2.77	1.66	1.18
Steam Production Rate	Mlb/hr HRA	22.6	Average	19.06	19.06	20.23	19.45	19.77
			Maximum	19.46	19.31	20.98	19.91	19.94
			Minimum	18.51	18.86	18.44	18.60	19.59
			St. Dev.	0.25	0.12	0.57	0.32	0.09
Baghouse Temperature	deg F OMA	380	Average	340	344	382	356	388
			Maximum	344	347	387	359	392
			Minimum	337	341	373	350	385
			St. Dev.	2	2	4	2	1
Baghouse dP	inwc OMA	NA	Average	3.72	3.66	3.66	3.68	3.60
			Maximum	3.99	3.97	3.98	3.98	3.98
			Minimum	3.07	2.98	3.04	3.03	2.91
			St. Dev.	0.20	0.23	0.23	0.22	0.25
Baghouse dP	inwc HRA	NA	Average	3.68	3.65	3.63	3.65	3.62
			Maximum	3.71	3.67	3.67	3.68	3.67
			Minimum	3.60	3.64	3.60	3.61	3.47
			St. Dev.	0.03	0.01	0.02	0.02	0.05
Baghouse Bag Leak Detection	% OMA	NA	Average	11.0	11.8	10.8	11.2	12.7
			Maximum	15.3	16.1	32.3	21.3	15.7
			Minimum	9.6	10.4	6.3	8.8	11.1
			St. Dev.	0.9	0.9	3.3	1.7	0.8

Table 3-2. Boiler No. 4 Operating Data Summary-Test 2 (cont'd)

Operational Parameter	Units	Target	Statistic	Run 4	Run 5	Run 6	Test 2 Avg.
Stack Gas O_2	vol% dry OMA	NA	Average	5.0	4.9	4.9	5.0
			Maximum	5.3	5.2	5.6	5.4
			Minimum	4.7	4.7	4.7	4.7
			St. Dev.	0.2	0.1	0.2	0.2
Stack Gas CO, corrected to 7% O_2	ppmdv OMA	NA	Average	24.7	23.5	19.3	22.5
			Maximum	56.9	40.5	28.3	41.9
			Minimum	18.1	17.2	16.1	17.1
			St. Dev.	9.0	5.6	1.9	5.5
Stack Gas CO, corrected to 7% O_2	ppmdv HRA	<100	Average	23.9	23.3	17.4	21.5
			Maximum	29.9	27.0	24.0	26.9
			Minimum	19.0	18.9	16.0	18.0
			St. Dev.	3.2	2.2	2.3	2.6

OMA = One-Minute Average
HRA = Hourly Rolling Average

Table 3-3. Boiler No. 4 Operating Data Summary-Test 3

Operational Parameter	Units	Target	Statistic	Run 7	Run 8	Run 9	Test 3 Avg.
Waste Feed Rate	lb/min OMA	NA	Average	19.99	20.69	19.68	20.12
			Maximum	25.72	24.29	21.88	23.96
			Minimum	17.86	17.28	17.48	17.54
			St. Dev.	1.18	1.21	0.97	1.12
Waste Feed Rate	lb/min HRA	26.8	Average	19.77	19.93	19.19	19.63
			Maximum	19.94	21.17	19.79	20.30
			Minimum	19.59	17.88	17.02	18.17
			St. Dev.	0.09	1.16	0.46	0.57
Combustion Temperature	deg F OMA	NA	Average	2,346	2,260	2,148	2,252
			Maximum	2,368	2,282	2,161	2,270
			Minimum	2,320	2,224	2,113	2,219
			St. Dev.	14	21	11	15
Combustion Temperature	deg F HRA	NA	Average	2344	2250	2135	2,243
			Maximum	2359	2277	2156	2,264
			Minimum	2326	2197	1994	2,172
			St. Dev.	12	25	28	21
Steam Production Rate	Mlb/hr OMA	NA	Average	19.99	20.69	19.68	20.12
			Maximum	25.72	24.29	21.88	23.96
			Minimum	17.86	17.28	17.48	17.54
			St. Dev.	1.18	1.21	0.97	1.12
Steam Production Rate	Mlb/hr HRA	22.6	Average	19.77	19.93	19.19	19.63
			Maximum	19.94	21.17	19.79	20.30
			Minimum	19.59	17.88	17.02	18.17
			St. Dev.	0.09	1.16	0.46	0.57
Baghouse Temperature	deg F OMA	380	Average	388	381	387	386
			Maximum	392	388	389	390
			Minimum	385	373	385	381
			St. Dev.	1	3	1	2
Baghouse dP	inwc OMA	NA	Average	3.60	3.54	2.75	3.30
			Maximum	3.98	3.96	2.94	3.63
			Minimum	2.91	2.51	2.52	2.64
			St. Dev.	0.25	0.32	0.12	0.23
Baghouse dP	inwc HRA	NA	Average	3.62	3.50	2.65	3.26
			Maximum	3.67	3.69	2.86	3.41
			Minimum	3.47	3.25	2.22	2.98
			St. Dev.	0.05	0.15	0.14	0.12
Baghouse Bag Leak Detection	% OMA	NA	Average	12.7	12.0	17.3	14.0
			Maximum	15.7	16.8	21.8	18.1
			Minimum	11.1	8.5	13.1	10.9
			St. Dev.	0.8	1.3	0.6	0.9

Table 3-3. Boiler No. 4 Operating Data Summary-Test 3 (cont'd)

Operational Parameter	Units	Target	Statistic	Run 7	Run 8	Run 9	Test 3 Avg.
Stack Gas O_2	vol% dry OMA	NA	Average	4.9	5.2	5.1	5.1
			Maximum	5.5	5.5	5.4	5.5
			Minimum	4.5	4.9	5.0	4.8
			St. Dev.	0.3	0.2	0.1	0.2
Stack Gas CO, corrected to 7% O_2	ppmdv OMA	NA	Average	22.1	17.0	19.1	19.4
			Maximum	31.0	19.9	20.9	23.9
			Minimum	16.8	14.1	17.2	16.0
			St. Dev.	3.9	1.7	1.1	2.2
Stack Gas CO, corrected to 7% O_2	ppmdv HRA	<100	Average	20.3	19.2	17.5	19.0
			Maximum	24.0	26.9	19.0	23.3
			Minimum	17.5	14.3	15.8	15.9
			St. Dev.	2.1	4.7	0.9	2.6

OMA = One-Minute Average
HRA = Hourly Rolling Average

Table 3-4. Boiler No. 4 Waste Feed Analyses

Test 1, Minimum Combustion Temperature Demonstration, Dioxin/Furan Emissions

Parameter	Units	Run 1	Run 2	Run 3	Average
Ash Content	mg/kg	474	444	471	463
Density	g/cm^3	0.894	0.893	0.892	0.893
Higher Heating Value (HHV)	Btu/lb	17,800	17,500	17,600	17,633
Viscosity	cSt	8.44	8.52	8.51	8.49
Total Chlorine	mg/kg	390 ND	217 BJ	161 BJ	256

Test 2, Maximum Waste Feed Rate Demonstration, PM/HCl/Cl2 and Metals Emissions

Parameter	Units	Run 4	Run 5	Run 6	Average
Ash Content	mg/kg	392	409	386	396
Density	g/cm^3	0.893	0.893	0.894	0.89
Higher Heating Value (HHV)	Btu/lb	17,500	17,500	17,500	17,500
Viscosity	cSt	8.920	8.80	8.62	8.78
Average Waste Feed Rate	lb/min	21.88	21.87	21.97	21.91
Waste Heat Release	MMBtu/hr	22.97	22.97	23.07	23.00
Total Chlorine	mg/kg	401 J	388 ND	166 BJ	318
Total Chlorine	lb/MMBtu	2.3E-02 J	2.2E-02 ND	9.5E-03 BJ	1.8E-02
Chromium	mg/kg	0.13	0.13	0.14	0.13
Chromium	lb/MMBtu	7.4E-06	7.4E-06	8.0E-06	7.6E-06
Cadmium	mg/kg	0.020 ND	0.020 ND	0.020 ND	0.020 ND
Cadmium	lb/MMBtu	1.1E-06 ND	1.1E-06 ND	1.1E-06 ND	1.1E-06 ND
Lead	mg/kg	0.060 ND	0.060 ND	0.060 ND	0.060 ND
Lead	lb/MMBtu	3.4E-06 ND	3.4E-06 ND	3.4E-06 ND	3.4E-06 ND
SVM (Cadmium + Lead)	mg/kg	0.080 ND	0.080 ND	0.080 ND	0.080 ND
SVM (Cadmium + Lead)	lb/MMBtu	4.6E-06 ND	4.6E-06 ND	4.6E-06 ND	4.6E-06 ND
Mercury	mg/kg	0.0080 ND	0.0080 ND	0.0080 ND	0.0080 ND
Mercury	lb/MMBtu	4.6E-07 ND	4.6E-07 ND	4.6E-07 ND	4.6E-07 ND

Test 3, Maximum Waste Feed Rate Demonstration, Dioxin/Furan Emissions

Parameter	Units	Run 7	Run 8	Run 9	Average
Ash Content	mg/kg	590	415	552	519
Density	g/cm^3	0.892	0.889	0.886	0.89
Higher Heating Value (HHV)	Btu/lb	17,100	17,500	17,400	17,333
Viscosity	cSt	8.600	8.58	8.57	8.58
Total Chlorine	mg/kg	227 BJ	249 BJ	180 BJ	219

Table 3-4. Boiler No. 4 Waste Feed Analyses (cont'd)

Boiler No. 4 Sample Numbers (Test 1)			
Process Sample	**Run 1**	**Run 2**	**Run 3**
Liquid Waste (Properties)	S-1833	S-1838	S-1843

Boiler No. 4 Sample Numbers (Test 2)			
Process Sample	**Run 4**	**Run 5**	**Run 6**
Liquid Waste (Properties)	S-1848	S-1860	S-1873
Liquid Waste (Metals)	S-1849	S-1861	S-1874

Boiler No. 4 Sample Numbers (Test 3)			
Process Sample	**Run 7**	**Run 8**	**Run 9**
Liquid Waste (Properties)	S-1882	S-1887	S-1892

Analytical Notes:
ND - Non-detect at the reporting limit (RL)
B - Estimated result. Result is less than RL.
J - Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Table 3-5. Boiler No. 4 Native and Spiked HWC MACT Constituent Feed Rates-Test 2

Constituent	Parameter	Units	Run 4	Run 5	Run 6	Average
Chromium	Liquid Waste Feed Conc.	mg/kg	0.13	0.13	0.14	0.13
	Native Feed with Waste Feed	g/hr	0.077	0.077	0.084	0.080
	Spike Rate to Liquid Feed (SSI Values)	g/hr	3.10	3.02	3.04	3.05
	Total Feed Rate	g/hr	3.17	3.10	3.13	3.13
	Emission Rate	g/hr	1.3E-01	4.6E-02	2.5E-02	6.7E-02
	Emission Rate	lb/MMBtu	1.2E-05	4.4E-06	2.4E-06	6.4E-06
	Percent of HWC MACT Std.	%	9.6%	3.4%	1.9%	4.9%
	Total System Removal Efficiency	%	95.90%	98.53%	99.19%	97.87%
Cadmium	Liquid Waste Feed Conc.	mg/kg	< 0.020	< 0.020	< 0.020	< 0.020
	Native Feed with Waste Feed	g/hr	< 0.012	< 0.012	< 0.012	< 0.012
	Emission Rate	g/hr	< 4.1E-03	< 4.0E-03	< 4.2E-03	< 4.1E-03
	Total System Removal Efficiency	%	> 65.69%	> 66.14%	> 64.74%	> 65.52%
Lead	Liquid Waste Feed Conc.	mg/kg	< 0.060	< 0.060	< 0.060	< 0.060
	Native Feed with Waste Feed	g/hr	< 0.036	< 0.036	< 0.0359	< 0.036
	Spike Rate to Liquid Feed (SSI Values)	g/hr	5.15	5.03	5.06	5.08
	Total Feed Rate	g/hr	< 5.19	< 5.06	< 5.09	< 5.11
	Emission Rate	g/hr	9.5E-06	4.3E-05	2.6E-05	2.6E-05
	Total System Removal Efficiency	%	> 99.99982%	> 99.99916%	> 99.99949%	> 99.99949%
Total SVM (Cd+Pb)	Total Feed Rate	g/hr	< 5.197	< 5.075	< 5.105	< 5.126
	Total Emission Rate	g/hr	< 4.1E-03	< 4.1E-03	< 4.2E-03	< 4.1E-03
	Emission Rate	lb/MMBtu	< 3.9E-07	< 3.9E-07	< 4.1E-07	4.0E-07
	Percent of HWC MACT Std.	%	< 0.48%	< 0.48%	< 0.49%	0.48%
	System Removal Efficiency	%	> 99.921%	> 99.920%	> 99.917%	> 99.919%
Mercury	Liquid Waste Feed Conc.	mg/kg	< 0.0080	< 0.0080	< 0.0080	< 0.008
	Native Feed with Waste Feed	g/hr	< 0.0048	< 0.0048	< 0.0048	< 0.0048
	Native Feed with Waste Feed	lb/hr	< 1.1E-05	< 1.0E-05	< 1.1E-05	< 1.1E-05
	Maximum Theoretical Feed Conc.	lb/MMBtu	< 4.6E-07	< 4.6E-07	< 4.6E-07	< 4.6E-07
	Percent of HWC MACT Std.	%	< 1.1%	< 1.1%	< 1.1%	< 1.1%

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Table 3-5. Boiler No. 4 Native and Spiked HWC MACT Constituent Feed Rates

Constituent	Parameter	Units	Run 4	Run 5	Run 6	Average
Chloride (as Cl)	Liquid Waste Feed Conc.	mg/kg	401	< 388	166	< 318
	Native Feed with Waste Feed	lb/hr	0.53	< 0.51	0.22	< 0.42
	Spike Rate to Liquid Feed (SSI Values)	lb/hr	14.64	14.94	14.72	14.77
	Total Feed Rate	lb/hr	15.17	< 15.45	14.94	< 15.18
	HCl Emission Rate as Cl^-	lb/hr	0.47	7.72	11.1	6.42
	Cl2 Emission Rate as Cl^-	lb/hr	0.038	0.044	0.063	0.048
	HCl+Cl_2 as Cl^- Emission Rate	lb/hr	0.50	7.76	11.1	6.47
	System Removal Efficiency	%	96.7%	> 49.8%	25.5%	57.3%
Ash (PM)	Liquid Waste Feed Conc.	mg/kg	392	409	386	< 396
	Native Feed with Waste Feed	lb/hr	0.515	0.537	0.509	< 0.520
	Ash with Metals Spikes (Analysis Values)	lb/hr	22.10	21.30	19.98	21.13
	Total Feed Rate	lb/hr	22.61	21.84	20.49	21.65
	Total PM Emission Rate	lb/hr	0.012	0.014	0.021	0.016
	Total System Removal Efficiency	%	99.946%	99.934%	99.898%	99.926%

Waste Feed Stream	Units	Run 4	Run 5	Run 6	Average
Liquid Waste Average Feed Rate (Note 1)	lb/min	21.88	21.87	21.97	21.91
Liquid Waste Average Heat Input	MMBtu/hr	22.97	22.97	23.07	23.00

Note 1: The waste feed rate is the arithmetic average of the one-minute average feed rate values.

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Table 3-6. Boiler No. 4 Waste Feed Spiking Summary-Test 2

Parameter	Units	Target	Run 4	Run 5	Run 6	Average
Ash/Chromium/Lead Spike Dispersion	lb/hr	89.30	92.06	89.89	90.41	90.79
Ash Spiking						
Ash Concentration (Spiking Report)	wt%	24.86	24.86	24.86	24.86	24.86
Ash Spike (Spiking Report)	lb/hr	22.2	22.89	22.35	22.48	22.57
Ash Concentration (Lab Analysis)	wt%	NA	24.0	23.7	22.1	23.27
Ash Spike (Lab Analysis)	lb/hr	NA	22.10	21.30	19.98	21.13
Ash Spike (Lesser Value)	lb/hr	22.2	22.10	21.30	19.98	21.13
Chromium Spiking						
Chromium Concentration (Spiking Report)	mg/kg	74.1	74.1	74.1	74.1	74.1
Chromium Spike (Spiking Report)	lb/hr	0.00662	0.00682	0.00666	0.00670	0.00673
Chromium Spike (Spiking Report)	g/hr	3.0	3.10	3.02	3.04	3.05
Chromium Spike (Lab Analysis)	mg/kg	NA	121	643	1,010	591
Chromium Spike (Lab Analysis)	g/hr	NA	5.06	26.2	41.5	24.3
Chromium Spike (Lesser Value)	g/hr	3.0	3.10	3.02	3.04	3.05
Lead Spiking						
Lead Concentration (Spiking Report)	mg/kg	123.2	123.2	123.2	123.2	123.2
Lead Spike (Spiking Report)	lb/hr	0.01100	0.01134	0.01107	0.01114	0.01118
Lead Spike (Spiking Report)	g/hr	5.0	5.15	5.03	5.06	5.08
Lead Spike (Lab Analysis)	mg/kg	NA	191	456	643	430
Lead Spike (Lab Analysis)	g/hr	NA	7.98	18.6	26.4	17.7
Lead Spike (Lesser Value)	g/hr	5.0	5.15	5.03	5.06	5.08
Chlorine Spiking						
Perchloroethylene Spike (Spiking Report)	lb/hr	17.07	17.12	17.47	17.21	17.27
Perchloroethylene Chlorine Concentration	wt%	85.52	85.52	85.52	85.52	85.52
Chlorine Spike	lb/hr	14.60	14.64	14.94	14.72	14.77

Spiking Material Concentrations		
Parameter	**Units**	**Value**
Ash Concentration	wt%	24.86
Lead Spike Concentration	mg/kg	74.1
Chromium Spike Concentration	mg/kg	123.2
Chlorine Spike Concentration	wt%	85.52

Boiler No. 4 Spiking Material Sample Numbers (Test 2)			
Process Sample	**Run 4**	**Run 5**	**Run 6**
Ash/Chromium/Lead Spiking Dispersion for Ash	S-1850	S-1862	S-1871
Ash/Chromium/Lead Spiking Dispersion for Metals	S-1851	S-1863	S-1872

4.0 HWC MACT COMPLIANCE RESULTS

4.1 PARTICULATE EMISSIONS

Particulate matter emissions were measured during Test 2. Particulate matter emissions results are summarized in Table 4-1. All particulate matter emissions results are less than the HWC MACT standard of 80 mg/dscm (0.036 gr/dscf) corrected to 7% oxygen. Ash surrogate (titanium dioxide, TiO_2) was metered to the waste feed during Test 1 to demonstrate maximum ash feed rate. The particulate matter emissions were sampled using EPA Method 5 analysis of the filter element and acetone probe rinse fractions from the Method 26A sampling train.

4.2 HYDROGEN CHLORIDE AND CHLORINE EMISSIONS

Test 2 included measurement of the HCl/Cl_2 emissions while metering perchloroethylene to the waste feed. HCl/Cl_2 emissions were sampled using EPA Method 26A. Spiking of chlorine and measurement of the subsequent HCl/Cl_2 emissions were performed to demonstrate the HBCA chlorine feed rate limit. The summary in Table 3-5 shows the total chlorine feed rate (native plus spiked) during the HBCA Test. HCl/Cl_2 emissions results are summarized in Table 4-1.

The Boiler No. 4 system is not designed for HCl/Cl_2 emissions control. The known chloride feed rate and measured emissions do not match. The measured chloride emissions are substantially lower than the total chlorine feed rate, but are steadily increasing with each successive test run. This phenomenon has been observed during previous chloride feed and HCl/Cl_2 emissions testing of Boiler No. 4. Albemarle does not inject lime or similar material into the baghouse for HCl control. However, Albemarle believes the collected particulate matter on the baghouse bags acts as an absorbent media. If the chlorine feed rate were sustained for an extended period until the absorbing capacity of the accumulated particulate matter was exhausted, the chloride feed and emission rates would likely more closely match.

4.3 METALS EMISSIONS

Compliance with the HWC MACT thermal input based emissions limit for metals was demonstrated during Test 2. Chromium and lead were metered to the waste feed for demonstration of LVM and SVM emissions, respectively. LVM and SVM emissions were measured using Method 29. LVM and SVM emissions compliance with the thermal input based emission limits was evaluated using the liquid waste feed rate, liquid waste heating value, spiking rate, and measured LVM and SVM emissions. Method 29 LVM and SVM emissions test results are summarized in Table 4-2. Evaluation of LVM and SVM emissions compliance is summarized in Table 4-3. The LVM and SVM emissions comply with the thermal input based emissions standards at the feed rates noted in Table 3-5 and repeated in 4-3. System removal efficiencies (SREs) for LVM and SVM are calculated based on the chromium and lead feed rates, respectively. Proposed SVM and LVM feed rate limits based on extrapolation of the demonstrated SREs are discussed and presented in Section 6.4

Compliance with the thermal input based emission limit for mercury was evaluated via Maximum Hazardous Waste Thermal Concentration (MHWTC). MHWTC compliance was evaluated using waste feed analyses for mercury and heating value. The summary in Table 4-3 shows the native mercury feed rate during Test 2 complies with the HWC MACT mercury emissions limit.

4.4 DIOXIN AND FURAN EMISSIONS

Test 1 and Test 3 included measurement of PCDD/PCDF emissions. PCDD/PCDF emissions were measured at minimum combustion temperature conditions during Test 1. PCDD/PCDF emissions were measured at maximum waste feed rate/maximum steam production rate conditions during Test 3. During both test conditions, waste with normal levels of chlorine were treated as required by 63.1207(g)(1)(i)(A). The Boiler No. 4 emissions comply with the applicable emission standard of 0.40 ng/dscm TEQ corrected to 7% oxygen.

The Method 0023A sampling train operating data and PCDD/PCDF emissions results for Test 1 are summarized in Table 4-4. Tables 4-5 through 4-7 show the 2,3,7,8-TCDD TEQ calculations and results for each test run.

The Method 0023A sampling train operating data and PCDD/PCDF emissions results for Test 3 are summarized in Table 4-8. Tables 4-9 through 4-11 show the 2,3,7,8-TCDD TEQ calculations and results for each test run.

The Method 0023A sampling was performed for a minimum of 180 minutes during each test run to sample more than 2.5 dry standard cubic meters of stack gas. The Method 0023A analyses were conducted according to SW-846 Method 8290. PCDD/PCDF emissions are summarized in terms of total PCDD/PCDFs and 2,3,7,8-TCDD TEQ (tetrachlorinated dibenzo-p-dioxin toxicity equivalents). In accordance with 40 CFR 63.1208(b)(1)(*ii*) & (*iii*), any 2,3,7,8-congener that was non-detect was counted as zero in calculating the 2,3,7,8-TCDD TEQ results. Positive analysis results above the EDL are reported.

4.5 STACK GAS OXYGEN, CARBON MONOXIDE, AND TOTAL HYDROCARBONS

Carbon monoxide, oxygen, and THC emissions were measured during all DRE test periods. These emissions results are summarized in Table 4-12. Carbon monoxide emissions results are less than the HWC MACT standard of 100 ppmdv corrected to 7% oxygen. THC emissions results are less than the HWC MACT standard of 10 ppmdv as propane corrected to 7% oxygen.

4.6 COMBUSTION GAS RESIDENCE TIME

The calculation of the Boiler No. 4 combustion gas residence times at Test 1, Test 2, and Test 3 conditions are presented in Table 4-13. Residence times for Test 1 and Test 3 are calculated based on average Method 0023A sampling train stack flow measurements corrected for combustion zone

temperature and combustion zone volume. The residence time for Test 2 is calculated based on average Method 5/26A sampling train stack flow measurements corrected for combustion zone temperature and combustion zone volume.

4.7 CONTINUOUS MONITORING SYSTEM (CMS) PERFORMANCE EVALUATION TEST SUMMARY

The continuous monitoring system (CMS) associated with HWC MACT compliance was tested in accordance with the CMS Performance Evaluation Test Plan approved with the CPT Plan. The CMS consists of both process monitoring systems and emissions monitoring systems. The process monitoring systems include instrumentation for measuring such parameters as temperature, flow, pH, etc., and are referred to as Continuous Process Monitoring Systems (CPMS). The emissions monitoring systems include instrumentation for measurement of stack gas CO and O_2 concentration, and are referred to as Continuous Emissions Monitoring Systems (CEMS). The results of the CMS performance evaluation are presented in Appendix J. The CPMS calibration records are presented in Appendix E.

4.8 CONTINUOUS EMISSION MONITORING SYSTEM (CEMS) PERFORMANCE EVALUATION TEST SUMMARY

The CEMS performance test conducted demonstrated that the installed CO and O_2 CEMS are operating in accordance with the relative accuracy, calibration error, calibration drift, and response time requirements of 40 CFR Part 60, Appendix B, Performance Specification 4B. The results of the CEMS performance evaluation are presented in Appendix K.

Table 4-1. Boiler No. 4 Particulate and HCl/Cl_2 Emission Results-Test 2

Parameter	Units	Run 4	Run 5	Run 6	Average
Stack Sampling Parameters					
Test Day	Date	27-May-14	27-May-14	28-May-14	
Time Start	24-hr clock	12:35	16:20	9:30	
Time Stop	24-hr clock	14:38	18:35	11:42	
Run Duration	HH:MM	2:03	2:15	2:12	
Net sampling time	minutes	120	120	120	120
Stack gas flow rate	dscfm	5,617	5,583	6,250	5,817
	dscm/min	159.1	158.1	177.0	164.7
	acfm	9,030	9,040	10,410	9,493
	acm/min	255.7	256.0	294.8	268.9
Stack gas temperature	°F	300	301	334	311
Stack gas sample volume	dscf	82.453	81.446	82.067	81.989
	dscm	2.335	2.307	2.324	2.322
Isokinetic	%	100.7	101.9	99.5	100.7
Stack gas carbon dioxide content	vol %, dry	12.97	12.94	13.04	12.98
Stack gas oxygen content	vol %, dry	5.03	4.94	5.12	5.03
Particulate Matter					
Particulate matter-Filter	mg	0.500 ND	0.640	0.740	0.627
Particulate matter-Probe rinse	mg	0.860	0.940	1.33	1.04
Particulate matter collected	mg	1.4	1.6	2.1	1.7
Particulate concentration	gr/dscf	0.00025	0.00030	0.00039	0.00031
	gr/dscf @ 7% O_2	0.00022	0.00026	0.00035	0.00028
	mg/dscm	0.58	0.68	0.89	0.72
	mg/dscm @ 7% O_2	0.51	0.60	0.79	0.63
Particulate emission rate	lb/hr	0.012	0.014	0.021	0.016
	kg/hr	0.0056	0.0065	0.0095	0.0072
	g/s	0.0015	0.0018	0.0026	0.0020

0392

Table 4-1. Boiler No. 4 Particulate and HCl/Cl2 Emission Results-Test 2 (cont'd)

Parameter	Units	Run 4	Run 5	Run 6	Average
Hydrogen Chloride and Chlorine					
HCl collected as HCl	ug	53,100	875,000	1,130,000	686,033
HCl collected as Cl^-	ug	51,645	851,027	1,099,041	667,238
Cl_2 collected as Cl^-	ug	4,260	4,900	6,210	5,123
Stack gas HCl concentration as Cl^-	mg/dscm	22.1	369	473	288
	mg/dscm @7% O_2	19.5	324	420	254
	ppmv, dry @7% O_2	13.2	220	285	172
Stack gas HCl emission rate as Cl^-	lb/hr	0.47	7.72	11.1	6.42
	kg/hr	0.21	3.50	5.02	2.91
	g/s	0.059	0.972	1.40	0.809
Stack gas Cl_2 concentration as Cl^-	mg/dscm	1.82	2.12	2.67	2.2
	mg/dscm @7% O_2	1.61	1.86	2.37	1.9
	ppmv, dry @7% O_2	1.1	1.3	1.6	1.3
Stack gas Cl_2 emission rate Cl^-	lb/hr	0.0384	0.0444	0.0626	0.0485
	kg/hr	0.0174	0.0202	0.0284	0.0220
	g/s	0.00484	0.00560	0.00788	0.00611
Stack gas HCl+Cl_2 concentration as Cl^-	ppmv, dry	16	252	323	197
	ppmv, dry @7% O_2	14	221	286	174
Stack gas HCl+Cl_2 emission rate as Cl^- equivalents	lb/hr	0.504	7.76	11.1	6.47
	kg/hr	0.228	3.52	5.05	2.93
	g/s	0.063	0.978	1.40	0.815

Train Fraction	Run 4	Run 5	Run 6
Filter	S-1856	S-1867	S-1878
Acetone Rinse	S-1857	S-1868	S-1879
H_2SO_4 Impinger	S-1858	S-1869	S-1880
NaOH Impinger	S-1859	S-1870	S-1881

0393

Table 4-2. Boiler No. 4 LVM and SVM Emission Results-Test 2

Parameter	Units	Run 4	Run 5	Run 6	Average
Stack Sampling Parameters					
Test Day	Date	27-May-14	27-May-14	28-May-14	
Clock Time Start	24-hr clock	12:35	16:20	9:30	
Clock Time Stop	24-hr clock	14:38	18:35	11:42	
Run Duration	HH:MM	2:03	2:15	2:12	
Net sampling time	minutes	120	120	120	120
Stack gas flow rate	dscfm	5,717	5,667	6,467	5,950
	dscm/min	161.9	160.5	183.1	168.5
	acfm	9,130	9,070	10,700	9,633
	acm/min	258.6	256.9	303.0	272.8
Stack gas temperature	°F	295	296	332	308
Stack gas sample volume	dscf	83.946	84.349	92.005	86.767
	dscm	2.377	2.389	2.606	2.457
Isokinetic	%	101.5	102.5	99.5	101.2
Stack gas carbon dioxide content	vol %, dry	12.97	12.94	13.04	12.98
Stack gas oxygen content	vol %, dry	5.03	4.94	5.12	5.03
HWC MACT Metals					
Low-Volatile Metals (Cr Only)	ug/dscm @ 7% O_2	12	4.1	2.0	6.0
Semi-Volatile Metals (Cd+Pb)	ug/dscm @ 7% O_2	< 0.76	< 2.1	< 1.3	< 1.4
Cadmium					
Filter & Probe Rinse	ug	< 0.50 ND	< 0.50 ND	< 0.50 ND	< 0.50 ND
Acidified Peroxide Impingers	ug	< 0.50 ND	< 0.50 ND	< 0.50 ND	< 0.50 ND
Total Metal collected	ug	< 1.00 ND	< 1.00 ND	< 1.0 ND	< 1.0 ND
Metal concentration	ug/dscm	< 0.42 ND	< 0.42 ND	< 0.38 ND	< 0.41 ND
	ug/dscm @ 7% O_2	< 0.37 ND	< 0.37 ND	< 0.34 ND	< 0.36 ND
Metal emission rate	lb/hr	< 9.0E-06 ND	< 8.9E-06 ND	< 9.3E-06 ND	< 9.1E-06 ND
	g/s	< 1.1E-06 ND	< 1.1E-06 ND	< 1.2E-06 ND	< 1.1E-06 ND

0394

Table 4-2. Boiler No. 4 LVM and SVM Emission Results-Test 2 (cont'd)

Parameter	Units	Run 4	Run 5	Run 6	Average
Chromium					
Filter & Probe Rinse	ug	30.4	8.9	4.1	14
Acidified Peroxide Impingers	ug	1.4	2.4	1.9	1.9
Total Metal collected	ug	32	11	6.0	16
Metal concentration	ug/dscm	13	4.7	2.3	6.7
	ug/dscm @ 7% O_2	12	4.1	2.0	5.9
Metal emission rate	lb/hr	2.9E-04	1.0E-04	5.6E-05	1.5E-04
	g/s	3.6E-05	1.3E-05	7.0E-06	1.9E-05
Lead					
Filter & Probe Rinse	ug	0.77 B	1.6	2.3	1.6
Acidified Peroxide Impingers	ug	0.29 B	3.2	0.50 B	1.3
Total Metal collected	ug	1.1	4.8	2.8	2.9
Metal concentration	ug/dscm	0.45	2.0	1.1	1.2
	ug/dscm @ 7% O_2	0.39	1.8	1.0	1.0
Metal emission rate	lb/hr	9.5E-06	4.3E-05	2.6E-05	2.6E-05
	g/s	1.2E-06	5.4E-06	3.3E-06	3.3E-06

Sample Numbers			
Sampling Train Fraction	**Run 4**	**Run 5**	**Run 6**
Filter	S-1853	S-1864	S-1875
Front Half Nitric Acid Rinse	S-1854	S-1865	S-1876
Acidified Peroxide Impingers	S-1855	S-1866	S-1877

0395

Table 4-3. Boiler No. 4 Metals Emission Compliance Results-Test 2

Metal Group	Parameter	Units	Run 4	Run 5	Run 6	Average
Waste Heat Input Data	Average Liquid Waste Feed Rate (Note 1)	lb/min	21.88	21.87	21.97	21.91
	Liquid Waste Heating Value (Note 2)	Btu/lb	17,500	17,500	17,500	17,500
	Average Liquid Waste Heat Input (Note 3)	MMBtu/hr	22.97	22.97	23.07	23.00
Total LVM (Cr Only)	Cr Emission Rate via EPA Method 29 (Note 4)	lb/hr	2.9E-04	1.0E-04	5.6E-05	1.5E-04
		lb/MMBtu	1.2E-05	4.4E-06	2.4E-06	6.4E-06
	HWC MACT LVM Emissions Standard	lb/MMBtu	1.3E-04			
	Cr Emissions as Percent of HWC MACT LVM Standard	% of Std.	9.6%	3.4%	1.9%	4.9%
Total SVM (Cd+Pb)	Cd+Pb Emission Rate via EPA Method 29 (Note 4)	lb/hr	< 1.9E-05	< 5.2E-05	< 3.5E-05	< 3.5E-05
		lb/MMBtu	< 8.1E-07	< 2.2E-06	< 1.5E-06	< 1.5E-06
	HWC MACT SVM Emissions Standard	lb/MMBtu	8.2E-05			
	Cd+Pb Emissions as Percent of HWC MACT Standard	% of Std.	0.99%	2.7%	1.9%	1.9%
Total Mercury (Hg) via MTEC	HWC MACT Hg Emissions Standard	lb/MMBtu	4.2E-05			
	Liquid Waste Feed Rate Hg Concentration (Note 5)	mg/kg	< 0.0080	< 0.0080	< 0.0080	< 0.0080
	Hg Feed Rate (Note 6)	lb/hr	< 1.05E-05	< 1.05E-05	< 1.05E-05	< 1.05E-05
		lb/MMBtu	4.6E-07	4.6E-07	4.6E-07	4.6E-07
	Hg Feed Rate as Percent of HWC MACT Standard	% of Std.	1.1%	1.1%	1.1%	1.1%

Notes:
1. Average liquid waste feed rate during test run.
2. Liquid waste feed heating value from analysis data.
3. Calculated waste feed heat input rate.
4. Emission rate measured using EPA Method 29.
5. Mercury concentration in the liquid waste feed based on analysis.
6. Calculated theoretical mercury feed rate based on waste feed analyses and waste feed rate.

0396

Table 4-4. Boiler No. 4 PCDD/PCDF Emissions Summary-Minimum Combustion Temperature Test (Test 1)

Page 1 of 3

Parameter	Units	Run 1	Run 2	Run 3	Average
Stack Sampling Parameters					
Test Day	Date	29-May-14	29-May-14	30-May-14	
Time Start	24-hr clock	11:28	14:55	8:24	
Time Stop	24-hr clock	14:35	18:08	11:32	
Run Duration	HH:MM	3:07	3:13	3:08	
Sampling Time	Minutes	180	180	180	180
Stack gas flow rate	dscfm	2,983	2,900	2,983	2,956
	dscm/min	84.49	82.13	84.49	83.70
	acfm	4,240	4,130	4,200	4,190
	acm/min	120.1	117.0	118.9	118.7
Stack gas temperature	°F	234	232	228	231
Stack gas sample volume	dscf	118.491	112.229	116.628	115.783
	dscm	3.356	3.178	3.303	3.279
Isokinetic	%	97.9	101.1	99.4	99.5
Stack gas carbon dioxide	vol %, dry	7.68	7.16	7.04	7.29
Stack gas oxygen	vol %, dry	11.54	11.57	11.83	11.65
Total PCDD/PCDFs					
Total PCDD/PCDF	ng/sample	< 0.76	< 0.81	< 1.0	< 0.87
Stack gas PCDD/PCDFs	ng/dscm	< 0.23	< 0.25	< 0.32	< 0.27
Stack gas PCDD/PCDFs	ng/dscm @7% O_2	< 0.33	< 0.38	< 0.48	< 0.40
PCDD/PCDF emission rate	g/s	< 3.2E-10	< 3.5E-10	< 4.5E-10	< 3.7E-10
PCDD/PCDF Toxicity Equivalents as 2,3,7,8-TCDD					
Stack gas PCDD/PCDFs	ng/dscm	0.026	0.0029	0.0036	0.011
Stack gas PCDD/PCDFs	ng/dscm @7% O_2	0.038	0.0044	0.0054	0.016
PCDD/PCDF emission rate	g/s	3.6E-11	4.0E-12	5.0E-12	1.5E-11

0397

Table 4-4. PCDD/PCDF Emissions Summary-Minimum Combustion Temperature Test (Test 1)

Page 2 of 3

	PCDD/PCDF Compound	CAS No.	Run 1		Run 2		Run 3	
			Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0043 ND	0.0056 ND	0.0037 ND	0.0040 ND	0.0034 ND	0.0037 ND
	Total TCDD	41903-57-5	0.0068 QBJ	0.14 Q	0.0037 ND	0.075 Q	0.0060 QBJ	0.097 Q
2	1,2,3,7,8-PeCDD	40321-76-4	0.0015 ND	0.0040 QJ	0.0015 ND	0.0018 ND	0.0015 ND	0.0029 QJ
	Total PeCDD	36088-22-9	0.0015 ND	0.068 QJ	0.0015 ND	0.039 QJ	0.0015 ND	0.06 QJ
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0012 ND	0.0015 QJ	0.0011 ND	0.0013 ND	0.0010 ND	0.0013 ND
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0012 ND	0.0022 ND	0.0011 ND	0.0018 QJ	0.0010 ND	0.0019 J
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0012 ND	0.0040 QJ	0.0011 ND	0.0020 J	0.0010 ND	0.0020 QJ
	Total HxCDD	34465-46-8	0.0012 ND	0.054 QJ	0.0011 ND	0.038 QJ	0.0048 QJ	0.033 QJ
6	1,2,3,4,6,7,8-HpCDD	35822-39-4	0.0015 ND	0.0083 QJ	0.0011 ND	0.0091 J	0.00085 ND	0.0075 QJ
	Total HpCDD	37871-00-4	0.0015 ND	0.020 QJ	0.0011 ND	0.014 QJ	0.00085 ND	0.013 QJ
7	OCDD	3268-87-9	0.0042 BJ	0.011 QBJ	0.0048 QBJ	0.0090 BJ	0.0040 BJ	0.0064 QBT
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0019 ND	0.68 Q	0.0017 ND	0.013 Q	0.0013 ND	0.013 Q
	Total TCDF	55722-27-5	0.0019 ND	0.023 Q	0.0023 J	0.35 Q	0.0019 J	0.53 Q
9	1,2,3,7,8-PeCDF	57117-41-6	0.0011 ND	0.030 QJ	0.0010 ND	0.014 QJ	0.00090 ND	0.015 QJ
10	2,3,4,7,8-PeCDF	57117-31-4	0.0011 ND	0.021 QJ	0.0010 ND	0.010 QJ	0.00090 ND	0.012 QJ
	Total PeCDF	30402-15-4	0.00057 B	0.31 Q	0.0010 ND	0.19 Q	0.00090 ND	0.210 Q
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00063 ND	0.013 QJ	0.00057 ND	0.0092 QJ	0.00058 ND	0.0085 CJ
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00058 ND	0.011 QJ	0.00053 ND	0.0048 QJ	0.00054 ND	0.0052 QJ
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00061 ND	0.0061 QJ	0.00056 ND	0.0039 QJ	0.00057 ND	0.0035 J
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00067 ND	0.0015 ND	0.00062 ND	0.00093 ND	0.00063 ND	0.0011 ND
	Total HxCDF	55684-94-1	0.00062 ND	0.086 QJ	0.00057 ND	0.057 QJ	0.00058 ND	0.055 QJ
15	1,2,3,4,6,7,8-HpCDF	67562-394	0.00097 ND	0.0077 QJ	0.00088 ND	0.0056 QJ	0.0016 QJ	0.0068 J
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	0.0012 ND	0.0027 J	0.0011 ND	0.0032 J	0.00094 ND	0.0013 ND
	Total HpCDF	38998-75-3	0.0011 ND	0.013 JQ	0.00098 ND	0.010 QJ	0.0016 QJ	0.0080 QJ
17	OCDF	39001-02-0	0.0024 QBJ	0.010 QBJ	0.0012 ND	0.0078 QBJ	0.0035 BJ	0.0068 BJ

0398

Table 4-4. PCDD/PCDF Emissions Summary-Minimum Combustion Temperature Test (Test 1)

PCDD/PCDF Compound	CAS No.	Run 1		Run 2		Run 3	
		Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)
Internal Standard Recoveries (%)							
13C-2,3,7,8-TCDD (40-135%)	NA	65	68	69	71	69	73
13C-1, 2,3,7,8-PeCDD (40-135%)	NA	78	76	74	81	79	81
13C-1,2,3,6,7,8-HxCDD (40-135%)	NA	74	71	79	76	75	76
13C-1,2,3,4,6,7,8-HpCDD (40-135%)	NA	73	71	79	77	81	78
13C-OCDD (40-135%)	NA	81	80	81	84	89	91
13C-2,3,7,8-TCDF (40-135%)	NA	66	69	67	71	69	73
13C-1,2,3,7,8-PeCDF (40-135%)	NA	69	71	65	73	72	76
13C-1,2,3,6,7,8-HxCDF (40-135%)	NA	76	73	79	76	80	74
13C-1,2,3,4,6,7,8-HpCDF (40-135%)	NA	71	66	76	71	80	73
13C-OCDF (40-135%)	NA	74	73	67	74	74	82
13C-2,3,7,8-TCDF (40-135%) DB-225	NA	NA	73	NA	74	NA	78
Surrogate Recoveries (%)							
37Cl4-2,3,7,8-TCDD (70-130%)		106	99	99	99	99	96
13C-1,2,3,4,7,8-HxCDD (70-130%)		106	96	96	96	96	97
13C-2,3,4,7,8-PeCDF (70-130%)		109	103	103	104	103	101
13C-1,2,3,4,7,8-HxCDF (70-130%)		94	87	87	89	87	91
13C-1,2,3,4,7,8,9-HpCDF (70-130%)		90	93	79	88	79	88
Sample Numbers							
Filter		S-1834		S-1839		S-1844	
Front Half Acetone/MeCl2/Toluene Rinses		S-1835		S-1840		S-1845	
Front Half Toluene Rinse		NA		NA		NA	
XAD Resin			S-1836		S-1841		S-1846
Back Half Acetone/MeCl2/Toluene Rinses			S-1837		S-1842		S-1847

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

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Table 4-5. PCDD/PCDF Congener and TEQ Emissions Summary-Run 1 (Test 1)

Page 1 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng)		Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			Front Half	Back Half				
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0043 ND	0.0056 ND	< 0.003	1	0.0E+00	0.0E+00
	Total TCDD	41903-57-5	0.0068 QBJ	0.14 Q	0.044			
2	1,2,3,7,8-PeCDD	40321-76-4	0.0015 ND	0.0040 QJ	< 0.0016	0.5	6.0E-04	8.4E-13
	Total PeCDD	36088-22-9	0.0015 ND	0.068 QJ	< 0.021			
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0012 ND	0.0015 QJ	< 0.00080	0.1	4.5E-05	6.3E-14
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0012 ND	0.0022 ND	< 0.0010	0.1	0.0E+00	0.0E+00
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0012 ND	0.0040 QJ	< 0.0015	0.1	1.2E-04	1.7E-13
	Total HxCDD	34465-46-8	0.0012 ND	0.054 QJ	< 0.016			
6	1,2,3,4,6,7,8-HpCDD	35822-39-4	0.0015 ND	0.0083 QJ	< 0.0029	0.01	2.5E-05	3.5E-14
	Total HpCDD	37871-00-4	0.0015 ND	0.020 QJ	< 0.0064			
7	OCDD	3268-87-9	0.0042 BJ	0.011 QBJ	0.0045	0.001	4.5E-06	6.4E-15
Total PCDDs(d)			< 0.015	< 0.29	< 0.092		0.00079	1.1E-12
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0019 ND	0.68 Q	< 0.20	0.1	2.0E-02	2.9E-11
	Total TCDF	55722-27-5	0.0019 ND	0.023 Q	< 0.0074			
9	1,2,3,7,8-PeCDF	57117-41-6	0.0011 ND	0.030 QJ	< 0.0093	0.05	4.5E-04	6.3E-13
10	2,3,4,7,8-PeCDF	57117-31-4	0.0011 ND	0.021 QJ	< 0.0066	0.5	3.1E-03	4.4E-12
	Total PeCDF	30402-15-4	0.00057 B	0.31 Q	0.093			
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00063 ND	0.013 QJ	< 0.0041	0.1	3.9E-04	5.5E-13
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00058 ND	0.011 QJ	< 0.0035	0.1	3.3E-04	4.6E-13
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00061 ND	0.0061 QJ	< 0.0020	0.1	1.8E-04	2.6E-13
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00067 ND	0.0015 ND	< 0.00065	0.1	0.0E+00	0.0E+00
	Total HxCDF	55684-94-1	0.00062 ND	0.086 QJ	< 0.026			

0400

Table 4-5. PCDD/PCDF Congener and TEQ Emissions Summary-Run 1 (Test 1)

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng) Front Half	Analytical Result (ng) Back Half	Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			PCDFs					
15	1,2,3,4,6,7,8-HpCDF	67562-394	0.00097 ND	0.0077 QJ	< 0.0026	0.01	2.3E-05	3.2E-14
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	0.0012 ND	0.0027 J	< 0.0012	0.01	8.0E-06	1.1E-14
	Total HpCDF	38998-75-3	0.0011 ND	0.013 JQ	< 0.0042			
17	OCDF	39001-02-0	0.0024 QBJ	0.010 QBJ	0.0037	0.001	3.7E-06	5.2E-15
Total PCDFs(e)			< 0.0066	< 0.44	< 0.13		0.025	3.5E-11
Total PCDD/PCDF			< 0.022	< 0.74	< 0		0.026	3.6E-11

NOTE: All concentrations in this table are not corrected for oxygen concentration.

(a) Stack gas sample volume 118.491 dry standard cubic feet
3.356 dry standard cubic meters

(b) Stack gas flow rate 2,983 dry standard cubic feet per minute
1.408 dry standard cubic meters per second

(c) For non-detects, stack concentrations and emissions are calculated using the detection limit. If the sum of the detection limits of the individual isomers for a given dioxin or furan exceeded the detection limit of the total it was assumed that these individual isomers, when added, constituted the entire total so that any contribution to the total by "other" isomers would be zero.

(d) Total PCDDs = Total TCDD + Total PeCDD + Total HxCDD + Total HpCDD + OCDD

(e) Total PCDFs = Total TCDF + Total PeCDF + Total HxCDF + Total HpCDF + OCDF

(f) Non-detects are calculated using zero for the TEQ.

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0401

Table 4-6. PCDD/PCDF Congener and TEQ Emissions Summary-Run 2 (Test 1)

Page 1 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng)		Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			Front Half	Back Half				
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0037 ND	0.0040 ND	< 0.0024	1	0.0E+00	0.0E+00
	Total TCDD	41903-57-5	0.0037 ND	0.075 Q	< 0.025			
2	1,2,3,7,8-PeCDD	40321-76-4	0.0015 ND	0.0018 ND	< 0.0010	0.5	0.0E+00	0.0E+00
	Total PeCDD	36088-22-9	0.0015 ND	0.039 QJ	< 0.013			
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0011 ND	0.0013 ND	< 0.00076	0.1	0.0E+00	0.0E+00
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0011 ND	0.0018 QJ	< 0.00091	0.1	5.7E-05	7.8E-14
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0011 ND	0.0020 J	< 0.00098	0.1	6.3E-05	8.6E-14
	Total HxCDD	34465-46-8	0.0011 ND	0.038 QJ	< 0.012			
6	1,2,3,4,6,7,8-HpCD	35822-39-4	0.0011 ND	0.0091 J	< 0.0032	0.01	2.9E-05	3.9E-14
	Total HpCDD	37871-00-4	0.0011 ND	0.014 QJ	< 0.0048			
7	OCDD	3268-87-9	0.0048 QBJ	0.0090 BJ	0.0043	0.001	4.3E-06	5.9E-15
Total PCDDs(d)			< 0.012	< 0.18	< 0.059		0.00015	2.1E-13
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0017 ND	0.013 Q	< 0.0046	0.1	4.1E-04	5.6E-13
	Total TCDF	55722-27-5	0.0023 J	0.35 Q	0.11			
9	1,2,3,7,8-PeCDF	57117-41-6	0.0010 ND	0.014 QJ	< 0.0047	0.05	2.2E-04	3.0E-13
10	2,3,4,7,8-PeCDF	57117-31-4	0.0010 ND	0.010 QJ	< 0.0035	0.5	1.6E-03	2.2E-12
	Total PeCDF	30402-15-4	0.0010 ND	0.19 Q	< 0.060			
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00057 ND	0.0092 QJ	< 0.0031	0.1	2.9E-04	4.0E-13
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00053 ND	0.0048 QJ	< 0.0017	0.1	1.5E-04	2.1E-13
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00056 ND	0.0039 QJ	< 0.0014	0.1	1.2E-04	1.7E-13
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00062 ND	0.00093 ND	< 0.00049	0.1	0.0E+00	0.0E+00
	Total HxCDF	55684-94-1	0.00057 ND	0.057 QJ	< 0.018			

0402

Table 4-6. PCDD/PCDF Congener and TEQ Emissions Summary-Run 2 (Test 1)

Page 2 of 2

PCDD/PCDF Compound		CAS No.	Analytical Result (ng) Front Half	Analytical Result (ng) Back Half	Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
PCDFs								
15	1,2,3,4,6,7,8-HpCD	67562-394	0.00088 ND	0.0056 QJ	< 0.0020	0.01	1.8E-05	2.4E-14
16	1,2,3,4,7,8,9-HpCD	55673-89-7	0.0011 ND	0.0032 J	< 0.0014	0.01	1.0E-05	1.4E-14
	Total HpCDF	38998-75-3	0.00098 ND	0.010 QJ	< 0.0035			
17	OCDF	39001-02-0	0.0012 ND	0.0078 QBJ	< 0.0028	0.001	2.5E-06	3.4E-15
Total PCDFs(e)			< 0.0061	< 0.61	< 0.20		0.0028	3.8E-12
Total PCDD/PCDF			< 0.018	< 0.79	< 0.25		0.0029	4.0E-12

NOTE: All concentrations in this table are not corrected for oxygen concentration.

(a) Stack gas sample volume 112.229 dry standard cubic feet
3.178 dry standard cubic meters

(b) Stack gas flow rate 2,900 dry standard cubic feet per minute
1.369 dry standard cubic meters per second

(c) For non-detects, stack concentrations and emissions are calculated using the detection limit. If the sum of the detection limits of the individual isomers for a given dioxin or furan exceeded the detection limit of the total it was assumed that these individual isomers, when added, constituted the entire total so that any contribution to the total by "other" isomers would be zero.

(d) Total PCDDs = Total TCDD + Total PeCDD + Total HxCDD + Total HpCDD + OCDD

(e) Total PCDFs = Total TCDF + Total PeCDF + Total HxCDF + Total HpCDF + OCDF

(f) Non-detects are calculated using zero for the TEQ.

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0403

Table 4-7. PCDD/PCDF Congener and TEQ Emissions Summary-Run 3 (Test 1)

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	PCDD/PCDF Compound	CAS No.	Analytical Result (ng)		Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			Front Half	Back Half				
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0034 ND	0.0037 ND	< 0.0021	1	0.0E+00	0.0E+00
	Total TCDD	41903-57-5	0.0060 QBJ	0.097 Q	0.031			
2	1,2,3,7,8-PeCDD	40321-76-4	0.0015 ND	0.0029 QJ	< 0.0013	0.5	4.4E-04	6.2E-13
	Total PeCDD	36088-22-9	0.0015 ND	0.064 QJ	< 0.020			
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0010 ND	0.0013 ND	< 0.00070	0.1	0.0E+00	0.0E+00
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0010 ND	0.0019 J	< 0.00088	0.1	5.8E-05	8.1E-14
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0010 ND	0.0020 QJ	< 0.00091	0.1	6.1E-05	8.5E-14
	Total HxCDD	34465-46-8	0.0048 QJ	0.033 QJ	0.011			
6	1,2,3,4,6,7,8-HpCDD	35822-39-4	0.00085 ND	0.0075 QJ	< 0.0025	0.01	2.3E-05	3.2E-14
	Total HpCDD	37871-00-4	0.00085 ND	0.013 QJ	< 0.0042			
7	OCDD	3268-87-9	0.0040 BJ	0.0064 QBT	0.0031	0.001	3.1E-06	4.4E-15
Total PCDDs(d)			< 0.017	< 0.21	< 0.070		0.00058	8.2E-13
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0013 ND	0.013 Q	< 0.0043	0.1	3.9E-04	5.5E-13
	Total TCDF	55722-27-5	0.0019 J	0.53 Q	0.16			
9	1,2,3,7,8-PeCDF	57117-41-6	0.00090 ND	0.015 QJ	< 0.0048	0.05	2.3E-04	3.2E-13
10	2,3,4,7,8-PeCDF	57117-31-4	0.00090 ND	0.012 QJ	< 0.0039	0.5	1.8E-03	2.6E-12
	Total PeCDF	30402-15-4	0.00090 ND	0.21 Q	< 0.064			
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00058 ND	0.0085 CJ	< 0.0027	0.1	2.6E-04	3.6E-13
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00054 ND	0.0052 QJ	< 0.0017	0.1	1.6E-04	2.2E-13
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00057 ND	0.0035 J	< 0.0012	0.1	1.1E-04	1.5E-13
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00063 ND	0.0011 ND	< 0.00052	0.1	0.0E+00	0.0E+00
	Total HxCDF	55684-94-1	0.00058 ND	0.055 QJ	< 0.017			

0404

Table 4-7. PCDD/PCDF Congener and TEQ Emissions Summary-Run 3 (Test 1)

Page 2 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng) Front Half	Analytical Result (ng) Back Half	Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			PCDFs					
15	1,2,3,4,6,7,8-HpCDF	67562-394	0.0016 QJ	0.0068 J	0.0025	0.01	2.5E-05	3.6E-14
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	0.00094 ND	0.0013 ND	< 0.00068	0.01	0.0E+00	0.0E+00
	Total HpCDF	38998-75-3	0.0016 QJ	0.0080 QJ	0.0029			
17	OCDF	39001-02-0	0.0035 BJ	0.0068 BJ	0.0031	0.001	3.1E-06	4.4E-15
Total PCDFs(e)			< 0.0085	< 0.81	< 0.25		0.0030	4.2E-12
Total PCDD/PCDF			< 0.026	< 1.0	< 0		0.0036	5.0E-12

NOTE: All concentrations in this table are not corrected for oxygen concentration.

(a) Stack gas sample volume 116.628 dry standard cubic feet
3.303 dry standard cubic meters

(b) Stack gas flow rate 2,983 dry standard cubic feet per minute
1.408 dry standard cubic meters per second

(c) For non-detects, stack concentrations and emissions are calculated using the detection limit. If the sum of the detection limits of the individual isomers for a given dioxin or furan exceeded the detection limit of the total it was assumed that these individual isomers, when added, constituted the entire total so that any contribution to the total by "other" isomers would be zero.

(d) Total PCDDs = Total TCDD + Total PeCDD + Total HxCDD + Total HpCDD + OCDD

(e) Total PCDFs = Total TCDF + Total PeCDF + Total HxCDF + Total HpCDF + OCDF

(f) Non-detects are calculated using zero for the TEQ.

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0405

Table 4-8. Boiler No. 4 PCDD/PCDF Emissions Summary-Maximum Production Rate Test (Test 3)

Page 1 of 3

Parameter	Units	Run 7	Run 8	Run 9	Average
Stack Sampling Parameters					
Test Day	Date	28-May-14	28-May-14	30-May-14	
Time Start	24-hr clock	12:27	16:05	12:30	
Time Stop	24-hr clock	15:34	19:08	15:39	
Run Duration	HH:MM	3:07	3:03	3:09	
Sampling Time	Minutes	180	180	180	180
Stack gas flow rate	dscfm	5,800	5,950	5,833	5,861
	dscm/min	164.26	168.51	165.20	165.99
	acfm	9,650	9,890	9,640	9,727
	acm/min	273.3	280.1	273.0	275.5
Stack gas temperature	°F	333	332	328	331
Stack gas sample volume	dscf	103.622	107.219	104.448	105.096
	dscm	2.935	3.037	2.958	2.976
Isokinetic	%	101.2	102.0	102.0	101.7
Stack gas carbon dioxide	vol %, dry	12.97	12.73	11.95	12.55
Stack gas oxygen	vol %, dry	5.02	5.28	5.35	5.22
Total PCDD/PCDFs					
Total PCDD/PCDF	ng/sample	< 12	< 12	< 13	< 12
Stack gas PCDD/PCDFs	ng/dscm	< 4.2	< 4.0	< 4.4	< 4.2
Stack gas PCDD/PCDFs	ng/dscm @7% O_2	< 3.7	< 3.5	< 3.9	< 3.7
PCDD/PCDF emission rate	g/s	< 1.1E-08	< 1.1E-08	< 1.2E-08	< 1.2E-08
PCDD/PCDF Toxicity Equivalents as 2,3,7,8-TCDD					
Stack gas PCDD/PCDFs	ng/dscm	0.065	0.062	0.059	0.062
Stack gas PCDD/PCDFs	ng/dscm @7% O_2	0.057	0.055	0.053	0.055
PCDD/PCDF emission rate	g/s	1.8E-10	1.7E-10	1.6E-10	1.7E-10

0406

Table 4-8. PCDD/PCDF Emissions Summary- Maximum Production Rate Test (Test 3)

PCDD/PCDF Compound		CAS No.	Run 7		Run 8		Run 9	
			Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0036 ND	0.012 Q	0.0039 ND	0.013 Q	0.0034 ND	0.0095 J
	Total TCDD	41903-57-5	0.0025 QBJ	0.80 Q	0.0075 QBJ	0.59 Q	0.0031 BJ	0.52 Q
2	1,2,3,7,8-PeCDD	40321-76-4	0.0016 ND	0.029 QJ	0.0018 ND	0.033 QJ	0.0014 ND	0.029 J
	Total PeCDD	36088-22-9	0.0016 ND	0.74 Q	0.0018 ND	0.67 Q	0.0014 ND	0.58 QS
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0011 ND	0.016 J	0.0011 ND	0.019 QJ	0.0011 ND	0.016 J
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0011 ND	0.036 J	0.0011 ND	0.043 QJ	0.0011 ND	0.045 J
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0011 ND	0.042 CJ	0.0011 ND	0.060 C	0.0010 ND	0.064 C
	Total HxCDD	34465-46-8	0.0070 QJ	0.72 Q	0.0033 QJ	0.82 Q	0.0014 QJ	0.84
6	1,2,3,4,6,7,8-HpCDD	35822-39-4	0.0024 QJ	0.067	0.0015 ND	0.14	0.0014 QJ	0.18
	Total HpCDD	37871-00-4	0.0024 QJ	0.15	0.0020 QJ	0.30	0.0014 QJ	0.43
7	OCDD	3268-87-9	0.0050 QBJ	0.033 BJ	0.0056 BJ	0.066 BJ	0.0040 BJ	0.11 B
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0014 ND	0.11	0.0020 ND	0.10	0.0016 ND	0.11
	Total TCDF	55722-27-5	0.0014 ND	5.9 Q	0.0055 QJ	4.9 Q	0.0016 ND	6.5 Q
9	1,2,3,7,8-PeCDF	57117-41-6	0.0013 QJ	0.20 Q	0.0012 ND	0.20 Q	0.00087 ND	0.22 Q
10	2,3,4,7,8-PeCDF	57117-31-4	0.00085 ND	0.18 Q	0.0012 ND	0.16 Q	0.00088 ND	0.15 Q
	Total PeCDF	30402-15-4	0.0013 QJ	2.7 Q	0.0012 ND	2.8 Q	0.00088 ND	2.5 QS
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00059 ND	0.17 C	0.00077 ND	0.18 C	0.00059 ND	0.11 Q
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00090 QJ	0.12 Q	0.00071 ND	0.12 Q	0.00054 ND	0.12 Q
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00057 ND	0.095 Q	0.00075 ND	0.093 Q	0.00057 ND	0.11 Q
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00063 ND	0.016 QJ	0.00083 ND	0.026 QJ	0.00063 ND	0.020 QJ
	Total HxCDF	55684-94-1	0.00090 QJ	0.94 Q	0.00076 ND	1.5 Q	0.00090 QJ	1.0 Q
15	1,2,3,4,6,7,8-HpCDF	67562-394	0.00087 ND	0.13	0.0018 QJ	0.19	0.0012 QJ	0.24
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	0.0011 ND	0.018 J	0.0013 ND	0.040 J	0.00098 ND	0.031 J
	Total HpCDF	38998-75-3	0.00097 ND	0.20	0.0018 QJ	0.36	0.0012 QJ	0.36
17	OCDF	39001-02-0	0.0039 BJ	0.029 QBJ	0.0012 QJ	0.063 QBJ	0.0013 ND	0.077 QBJ

0407

Table 4-9. PCDD/PCDF Emissions Summary- Maximum Production Rate Test (Test 3)

PCDD/PCDF Compound	CAS No.	Run 7		Run 8		Run 9	
		Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)	Front Half Analytical Result (ng)	Back Half Analytical Result (ng)
13C-2,3,7,8-TCDD (40-135%)	NA	69	69	71	70	70	70
13C-1, 2,3,7,8-PeCDD (40-135%)	NA	79	80	81	80	80	82
13C-1,2,3,6,7,8-HxCDD (40-135%)	NA	76	73	80	75	78	75
13C-1,2,3,4,6,7,8-HpCDD (40-135%)	NA	79	79	76	81	83	68
13C-OCDD (40-135%)	NA	84	89	82	91	89	56
13C-2,3,7,8-TCDF (40-135%)	NA	68	71	71	72	70	71
13C-1,2,3,7,8-PeCDF (40-135%)	NA	68	76	75	74	71	74
13C-1,2,3,6,7,8-HxCDF (40-135%)	NA	79	73	79	75	85	73
13C-1,2,3,4,6,7,8-HpCDF (40-135%)	NA	77	73	76	74	81	64
13C-OCDF (40-135%)	NA	68	80	69	79	71	47
13C-2,3,7,8-TCDF (40-135%) DB-225	NA	NA	73	NA	81	NA	89
Surrogate Recoveries (%)							
37Cl4-2,3,7,8-TCDD (70-130%)		95	95	95	102	95	98
13C-1,2,3,4,7,8-HxCDD (70-130%)		95	96	91	101	91	98
13C-2,3,4,7,8-PeCDF (70-130%)		102	96	100	104	100	101
13C-1,2,3,4,7,8-HxCDF (70-130%)		82	87	87	94	87	91
13C-1,2,3,4,7,8,9-HpCDF (70-130%)		75	89	81	92	81	80
Sample Numbers							
Filter		S-1883		S-1888		S-1893	
Front Half Acetone/MeCl2/Toluene Rinses		S-1884		S-1889		S-1894	
XAD Resin			S-1885		S-1890		S-1895
Back Half Acetone/MeCl2/Toluene Rinses			S-1886		S-1891		S-1896

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0408

Table 4-9. PCDD/PCDF Congener and TEQ Emissions Summary-Run 7 (Test 3)

Page 1 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng)		Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			Front Half	Back Half				
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0036 ND	0.012 Q	< 0.0053	1	4.1E-03	1.1E-11
	Total TCDD	41903-57-5	0.0025 QBJ	0.80 Q	0.27			
2	1,2,3,7,8-PeCDD	40321-76-4	0.0016 ND	0.029 QJ	< 0.010	0.5	4.9E-03	1.4E-11
	Total PeCDD	36088-22-9	0.0016 ND	0.74 Q	< 0.25			
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0011 ND	0.016 J	< 0.0058	0.1	5.5E-04	1.5E-12
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0011 ND	0.036 J	< 0.013	0.1	1.2E-03	3.4E-12
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0011 ND	0.042 CJ	< 0.015	0.1	1.4E-03	3.9E-12
	Total HxCDD	34465-46-8	0.0070 QJ	0.72 Q	0.25			
6	1,2,3,4,6,7,8-HpCDD	35822-39-4	0.0024 QJ	0.067	0.024	0.01	2.4E-04	6.5E-13
	Total HpCDD	37871-00-4	0.0024 QJ	0.15	0.052			
7	OCDD	3268-87-9	0.0050 QBJ	0.033 BJ	0.013	0.001	1.3E-05	3.5E-14
Total PCDDs(d)			< 0.019	2.4	< 0.84		0.012	3.4E-11
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0014 ND	0.11	< 0.038	0.1	3.7E-03	1.0E-11
	Total TCDF	55722-27-5	0.0014 ND	5.9 Q	< 2.0			
9	1,2,3,7,8-PeCDF	57117-41-6	0.0013 QJ	0.20 Q	0.069	0.05	3.4E-03	9.4E-12
10	2,3,4,7,8-PeCDF	57117-31-4	0.00085 ND	0.18 Q	< 0.062	0.5	3.1E-02	8.4E-11
	Total PeCDF	30402-15-4	0.0013 QJ	2.7 Q	0.92			
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00059 ND	0.17 C	< 0.058	0.1	5.8E-03	1.6E-11
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00090 QJ	0.12 Q	0.041	0.1	4.1E-03	1.1E-11
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00057 ND	0.095 Q	< 0.033	0.1	3.2E-03	8.9E-12
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00063 ND	0.016 QJ	< 0.0057	0.1	5.5E-04	1.5E-12
	Total HxCDF	55684-94-1	0.00090 QJ	0.94 Q	0.32			

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Table 4-9. PCDD/PCDF Congener and TEQ Emissions Summary-Run 7 (Test 3)

Page 2 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng) Front Half	Analytical Result (ng) Back Half	Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
PCDFs								
15	1,2,3,4,6,7,8-HpCDF	67562-394	0.00087 ND	0.13	< 0.045	0.01	4.4E-04	1.2E-12
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	0.0011 ND	0.018 J	< 0.0065	0.01	6.1E-05	1.7E-13
	Total HpCDF	38998-75-3	0.00097 ND	0.20	< 0.068			
17	OCDF	39001-02-0	0.0039 BJ	0.029 QBJ	0.011	0.001	1.1E-05	3.1E-14
Total PCDFs(e)			< 0.0085	9.8	< 3.3		0.052	1.4E-10
Total PCDD/PCDF			< 0.027	12	< 4.2		0.065	1.8E-10

NOTE: All concentrations in this table are not corrected for oxygen concentration.

(a) Stack gas sample volume 103.622 dry standard cubic feet
2.935 dry standard cubic meters

(b) Stack gas flow rate 5,800 dry standard cubic feet per minute
2.738 dry standard cubic meters per second

(c) For non-detects, stack concentrations and emissions are calculated using the detection limit. If the sum of the detection limits of the individual isomers for a given dioxin or furan exceeded the detection limit of the total it was assumed that these individual isomers, when added, constituted the entire total so that any contribution to the total by "other" isomers would be zero.

(d) Total PCDDs = Total TCDD + Total PeCDD + Total HxCDD + Total HpCDD + OCDD

(e) Total PCDFs = Total TCDF + Total PeCDF + Total HxCDF + Total HpCDF + OCDF

(f) Non-detects are calculated using zero for the TEQ.

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0410

Table 4-10. PCDD/PCDF Congener and TEQ Emissions Summary-Run 8 (Test 3)

Page 1 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng)		Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			Front Half	Back Half				
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0039 ND	0.013 Q	< 0.0056	1	4.3E-03	1.2E-11
	Total TCDD	41903-57-5	0.0075 QBJ	0.59 Q	0.20			
2	1,2,3,7,8-PeCDD	40321-76-4	0.0018 ND	0.033 QJ	< 0.011	0.5	5.4E-03	1.5E-11
	Total PeCDD	36088-22-9	0.0018 ND	0.67 Q	< 0.22			
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0011 ND	0.019 QJ	< 0.0066	0.1	6.3E-04	1.8E-12
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0011 ND	0.043 QJ	< 0.015	0.1	1.4E-03	4.0E-12
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0011 ND	0.060 C	< 0.020	0.1	2.0E-03	5.5E-12
	Total HxCDD	34465-46-8	0.0033 QJ	0.82 Q	0.27			
6	1,2,3,4,6,7,8-HpCD	35822-39-4	0.0015 ND	0.14	< 0.047	0.01	4.6E-04	1.3E-12
	Total HpCDD	37871-00-4	0.0020 QJ	0.30	0.099			
7	OCDD	3268-87-9	0.0056 BJ	0.066 BJ	0.024	0.001	2.4E-05	6.6E-14
Total PCDDs(d)			< 0.020	2.4	< 0.81		0.014	4.0E-11
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0020 ND	0.10	< 0.034	0.1	3.3E-03	9.2E-12
	Total TCDF	55722-27-5	0.0055 QJ	4.9 Q	1.6			
9	1,2,3,7,8-PeCDF	57117-41-6	0.0012 ND	0.20 Q	< 0.066	0.05	3.3E-03	9.2E-12
10	2,3,4,7,8-PeCDF	57117-31-4	0.0012 ND	0.16 Q	< 0.053	0.5	2.6E-02	7.4E-11
	Total PeCDF	30402-15-4	0.0012 ND	2.8 Q	< 0.92			
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00077 ND	0.18 C	< 0.060	0.1	5.9E-03	1.7E-11
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00071 ND	0.12 Q	< 0.040	0.1	4.0E-03	1.1E-11
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00075 ND	0.093 Q	< 0.031	0.1	3.1E-03	8.6E-12
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00083 ND	0.026 QJ	< 0.0088	0.1	8.6E-04	2.4E-12
	Total HxCDF	55684-94-1	0.00076 ND	1.5 Q	< 0.49			

0411

Table 4-10. PCDD/PCDF Congener and TEQ Emissions Summary-Run 8 (Test 3)

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng) Front Half	Analytical Result (ng) Back Half	Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
	PCDFs							
15	1,2,3,4,6,7,8-HpCD	67562-394	0.0018 QJ	0.19	0.063	0.01	6.3E-04	1.8E-12
16	1,2,3,4,7,8,9-HpCD	55673-89-7	0.0013 ND	0.040 J	< 0.014	0.01	1.3E-04	3.7E-13
	Total HpCDF	38998-75-3	0.0018 QJ	0.36	0.12			
17	OCDF	39001-02-0	0.0012 QJ	0.063 QBJ	0.021	0.001	2.1E-05	5.9E-14
Total PCDFs(e)			< 0.010	9.6	< 3.2		0.048	1.3E-10
Total PCDD/PCDF			< 0.031	12	< 4.0		0.062	1.7E-10

NOTE: All concentrations in this table are not corrected for oxygen concentration.

(a) Stack gas sample volume 107.219 dry standard cubic feet
3.037 dry standard cubic meters

(b) Stack gas flow rate 5,950 dry standard cubic feet per minute
2.808 dry standard cubic meters per second

(c) For non-detects, stack concentrations and emissions are calculated using the detection limit. If the sum of the detection limits of the individual isomers for a given dioxin or furan exceeded the detection limit of the total it was assumed that these individual isomers, when added, constituted the entire total so that any contribution to the total by "other" isomers would be zero.

(d) Total PCDDs = Total TCDD + Total PeCDD + Total HxCDD + Total HpCDD + OCDD

(e) Total PCDFs = Total TCDF + Total PeCDF + Total HxCDF + Total HpCDF + OCDF

(f) Non-detects are calculated using zero for the TEQ.

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0412

Table 4-11. PCDD/PCDF Congener and TEQ Emissions Summary-Run 9 (Test 3)

Page 1 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng)		Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
			Front Half	Back Half				
PCDDs								
1	2,3,7,8-TCDD	1746-01-6	0.0034 ND	0.0095 J	< 0.0044	1	3.2E-03	8.8E-12
	Total TCDD	41903-57-5	0.0031 BJ	0.52 Q	0.18			
2	1,2,3,7,8-PeCDD	40321-76-4	0.0014 ND	0.029 J	< 0.010	0.5	4.9E-03	1.3E-11
	Total PeCDD	36088-22-9	0.0014 ND	0.58 QS	< 0.20			
3	1,2,3,4,7,8-HxCDD	57653-85-7	0.0011 ND	0.016 J	< 0.0058	0.1	5.4E-04	1.5E-12
4	1,2,3,6,7,8-HxCDD	39227-28-6	0.0011 ND	0.045 J	< 0.016	0.1	1.5E-03	4.2E-12
5	1,2,3,7,8,9-HxCDD	19408-74-3	0.0010 ND	0.064 C	< 0.022	0.1	2.2E-03	6.0E-12
	Total HxCDD	34465-46-8	0.0014 QJ	0.84	0.28			
6	1,2,3,4,6,7,8-HpCDD	35822-39-4	0.0014 QJ	0.18	0.061	0.01	6.1E-04	1.7E-12
	Total HpCDD	37871-00-4	0.0014 QJ	0.43	0.15			
7	OCDD	3268-87-9	0.0040 BJ	0.11 B	0.039	0.001	3.9E-05	1.1E-13
Total PCDDs(d)			< 0.011	2.5	< 0.84		0.013	3.6E-11
PCDFs								
8	2,3,7,8-TCDF	51207-31-9	0.0016 ND	0.11	< 0.038	0.1	3.7E-03	1.0E-11
	Total TCDF	55722-27-5	0.0016 ND	6.5 Q	< 2.2			
9	1,2,3,7,8-PeCDF	57117-41-6	0.00087 ND	0.22 Q	< 0.075	0.05	3.7E-03	1.0E-11
10	2,3,4,7,8-PeCDF	57117-31-4	0.00088 ND	0.15 Q	< 0.051	0.5	2.5E-02	7.0E-11
	Total PeCDF	30402-15-4	0.00088 ND	2.5 QS	< 0.85			
11	1,2,3,4,7,8-HxCDF	57117-44-9	0.00059 ND	0.11 Q	< 0.037	0.1	3.7E-03	1.0E-11
12	1,2,3,6,7,8-HxCDF	70648-26-9	0.00054 ND	0.12 Q	< 0.041	0.1	4.1E-03	1.1E-11
13	2,3,4,6,7,8-HxCDF	72918-21-9	0.00057 ND	0.11 Q	< 0.037	0.1	3.7E-03	1.0E-11
14	1,2,3,7,8,9-HxCDF	60851-34-5	0.00063 ND	0.020 QJ	< 0.0070	0.1	6.8E-04	1.9E-12
	Total HxCDF	55684-94-1	0.00090 QJ	1.0 Q	0.34			

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Table 4-11. PCDD/PCDF Congener and TEQ Emissions Summary-Run 9 (Test 3)

Page 2 of 2

	PCDD/PCDF Compound	CAS No.	Analytical Result (ng) Front Half	Analytical Result (ng) Back Half	Stack (a,b,c) Conc. (a,b,c) (ng/dscm)	2,3,7,8-TCDD Toxicity Equivalence Factor	Stack Concentration Toxic Equivalents (ng/dscm) (f)	Emission Rate as 2,3,7,8-TCDD (g/s)
	PCDFs							
15	1,2,3,4,6,7,8-HpCDF	67562-394	0.0012 QJ	0.24	0.082	0.01	8.2E-04	2.2E-12
16	1,2,3,4,7,8,9-HpCDF	55673-89-7	0.00098 ND	0.031 J	< 0.011	0.01	1.0E-04	2.9E-13
	Total HpCDF	38998-75-3	0.0012 QJ	0.36	0.12			
17	OCDF	39001-02-0	0.0013 ND	0.077 QBJ	< 0.026	0.001	2.6E-05	7.2E-14
Total PCDFs(e)			< 0.0059	10	< 3.5		0.046	1.3E-10
Total PCDD/PCDF			< 0.017	13	< 4.4		0.059	1.6E-10

NOTE: All concentrations in this table are not corrected for oxygen concentration.

(a) Stack gas sample volume 104.448 dry standard cubic feet
2.958 dry standard cubic meters

(b) Stack gas flow rate 5,833 dry standard cubic feet per minute
2.753 dry standard cubic meters per second

(c) For non-detects, stack concentrations and emissions are calculated using the detection limit. If the sum of the detection limits of the individual isomers for a given dioxin or furan exceeded the detection limit of the total it was assumed that these individual isomers, when added, constituted the entire total so that any contribution to the total by "other" isomers would be zero.

(d) Total PCDDs = Total TCDD + Total PeCDD + Total HxCDD + Total HpCDD + OCDD

(e) Total PCDFs = Total TCDF + Total PeCDF + Total HxCDF + Total HpCDF + OCDF

(f) Non-detects are calculated using zero for the TEQ.

Analytical Notes:
ND = Non-detect at the minimum level; the minimum level is noted.
Q = Estimated maximum possible concentration (EMPC).
J = Estimated result.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
S = Ion Suppression

0414

Table 4-12. Boiler No. 4 Carbon Monoxide, Oxygen, and Hydrocarbons Emissions Summary

Parameter	Units	HWC MACT Standard	Minimum Combustion Temperature Test (Test 1)			
			Run 1	Run 2	Run 3	Average
Stack gas CO concentration [1, 2]	ppmv, dry	100	10.7	10.0	12.2	11.0
Stack gas O_2 concentration [2]	vol%, dry	NA	11.7	11.6	11.9	11.7
Stack gas O_2 concentration [3]	vol%, dry	NA	11.5	11.6	11.8	11.6
Stack gas THC concentration as propane [3,4]	ppmv, dry	NA	0.20	1.20	0.27	0.56
Stack gas THC concentration as propane [1,3]	ppmv, dry	10	0.30	1.79	0.41	0.83

Parameter	Units	HWC MACT Standard	Maximum Waste Feed Rate Test/Maximum Steam Production Rate Test (Test 2)			
			Run 4	Run 5	Run 6	Average
Stack gas CO concentration [1, 2]	ppmv, dry	100	23.9	23.3	17.4	21.5
Stack gas O_2 concentration [2]	vol%, dry	NA	5.0	4.9	4.9	5.0
Stack gas O_2 concentration [3]	vol%, dry	NA	13.0	12.9	13.0	13.0
Stack gas THC concentration as propane [3,4]	ppmv, dry	NA	0.55	0.46	0.32	0.44
Stack gas THC concentration as propane [1,3]	ppmv, dry	10	0.96	0.80	0.57	0.78

Parameter	Units	HWC MACT Standard	Maximum Waste Feed Rate Test/Maximum Steam Production Rate Test (Test 3)			
			Run 7	Run 8	Run 9	Average
Stack gas CO concentration [1, 2]	ppmv, dry	100	20.3	19.2	17.5	19.0
Stack gas O_2 concentration [2]	vol%, dry	NA	4.9	5.2	5.1	5.1
Stack gas O_2 concentration [3]	vol%, dry	NA	4.9	5.3	5.4	5.2
Stack gas THC concentration as propane [3,4]	ppmv, dry	NA	0.08	0.38	0.52	0.33
Stack gas THC concentration as propane [1,3]	ppmv, dry	10	0.07	0.34	0.46	0.29

Notes:

1. Corrected to 7% oxygen.
2. Value measured by Boiler No. 4 CEMS.
3. Value measured by stack sampling company.
4. Not oxygen corrected.

0415

Table 4-13. Boiler No. 4 Combustion Gas Residence Time

Test 1, Minimum Combustion Temperature Test Average Conditions		
Stack Gas Flow (Method 0023A Sampling Train):	4,190 acfm @ 2,956 dscfm	231 ^{o}F
Combustion Chamber Temperature:		1,393 ^{o}F
Stack Gas Flow @ Combustion Chamber Temperature:		11,230 acfm
Total Combustion Chamber Volume:		488 ft^3
Hazardous Waste Residence Time in the Combustion Zone:		2.6 seconds
Test 2, Maximum Waste Feed Rate Test Average Conditions		
Stack Gas Flow (Method 5/26A Sampling Train):	9,493 acfm @ 5,817 dscfm	311 ^{o}F
Combustion Chamber Temperature:		2,222 ^{o}F
Stack Gas Flow @ Combustion Chamber Temperature:		33,002 acfm
Total Combustion Chamber Volume:		488 ft^3
Hazardous Waste Residence Time in the Combustion Zone:		0.89 seconds
Test 3, Maximum Waste Feed Rate Test Average Conditions		
Stack Gas Flow (Method 0023A Sampling Train):	9,727 acfm @ 5,861 dscfm	331 ^{o}F
Combustion Chamber Temperature:		2,252 ^{o}F
Stack Gas Flow @ Combustion Chamber Temperature:		33,341 acfm
Total Combustion Chamber Volume:		488 ft^3
Hazardous Waste Residence Time in the Combustion Zone:		0.88 seconds

5.0 QUALITY ASSURANCE/QUALITY CONTROL RESULTS

5.1 PROJECT PERSONNEL AND RESPONSIBILITIES

The responsibilities of the key project personnel are noted in Section 4.0 of the CPT Quality Assurance Project Plan (QAPP). The key project personnel during CPT activities were:

Michelle Reese	Albemarle	Albemarle Test Project Manager
Patrick Fischer	Albemarle	Boiler No. 4 Operator
Chris McBride	Focus Environmental, Inc.	Test Coordinator
Craig McKenzie, Gregg Szymkowicz	GEL Engineering, LLC.	Stack Sampling Team Leaders
Scott Neal	Superior Spiking Industries, LLC	Spiking Technician
Teri Bales	Focus Environmental, Inc.	Quality Assurance Officer
Billy Anderson	TestAmerica, Inc.-Knoxville, TN	Laboratory Analysis Coordinator

5.2 QA/QC ACTIVITIES AND IMPLEMENTATION

5.2.1 QA Surveillance

Quality assurance (QA) surveillance for this project included surveillance of activities on-site during testing, reviews of supporting reports and information compiled from on-site activities, and the analytical data. Quality assurance surveillance was provided by Focus.

All samples collected during testing were analyzed by the TestAmerica Laboratories, Inc. laboratory located in Knoxville, TN. As a part of the laboratories' procedures, the analytical data is reviewed prior to being released and a project narrative is included with the analytical data package detailing any variances from the laboratory specified quality assurance and quality control requirements.

5.2.2 Sample Collection

All samples were handled in a manner to minimize contamination, document custody of the samples, to provide adequate preservation, and to be analyzed within the specified holding times as defined in the Quality Assurance Project Plan (QAPP). All samples complied with the holding time and preservation requirements.

During sample collection, care was taken to minimize contamination and there were no instances of concern noted. Samples were managed in a manner to be able to verify traceability from the site to the laboratory. The samples were stored in ice chests and kept in a secure location when sampling personnel were not on site.

5.2.3 Sample Analysis

Samples were analyzed as required by the QAPP. Summary analyses are included in the Appendix J. The full analytical data package/reports are included on the compact disk with the CPT report.

5.2.4 Process Instrumentation

The process monitoring equipment calibration records are included in Appendix E of this report.

5.2.5 Stack Sampling Equipment

Calibration data for the stack sampling equipment and preliminary data obtained prior to sampling is contained in the Stack Sampling Report located in Appendix B of this report. The stack sampling report is presented in two parts. One part presents only the Method 26A sampling results. The second part presents the results for the other sampling trains used during the CPT.

5.3 AUDITS

A chloride audit sample for Method 26A and metals audit samples for Method 29 were obtained from an EPA-approved Stationary Sources Audit Sample Program (SSASP) vendor for this test program. No dioxin/furan audit samples were available at the time of testing. Analysis of the audit samples was performed by TestAmerica. The audit analysis results were submitted to the vendor for scoring. The audit results are included as part of the chloride and metals analytical data packages, respectively.

5.4 ANALYTICAL DATA QUALITY

Each analytical method was evaluated based on the quality control objectives defined in the QAPP. Deviations from the required objectives are noted in the respective analytical data reports.

5.4.1 Detection and Reporting Limit Determination

Detection limits for each analysis are provided in the data packages. Analysis results are reported based on laboratory reported method detection limit (MDL) and the reporting limit (RL) for most analyses, and the estimated detection limit (EDL) and minimum level (ML) for isotope dilution analysis methods. MDLs were determined using the statistical method and calculations provided in SW-846. EDLs were determined as required on a sample specific basis using the SW-846 Method 8290 definition. Positive results between the MDL (the lowest calibration standard) and the reporting limit are reported with a “B” qualifier or flag for inorganic analyses or a “J” qualifier or flag for organic analyses. Positive results between the EDL and the minimum level for PCDD/PCDFs are reported with a “J” qualifier or flag. Positive results reported between the EDL and the minimum level for PCDD/PCDFs may include additional qualifiers or flags.

5.4.2 Evaluation of Completeness

Data completeness represents the valid data collected from the total number of valid tests conducted. The completeness objective of this test program was to generate sufficient data for the regulatory agency

to judge the performance of the system. All of the samples planned for collection and analysis for this project were collected and valid analytical data produced.

5.4.3 Analytical Procedures and Internal QC Check Results

Standard operating procedures for the analysis of the samples were based on EPA, ASTM, or SW-846 methods. Methods used and any deviations are indicated in the Analytical Data Package as part of the Case Narrative.

5.4.4 QAPP Deviations and Corrective Actions

Minor deviations to the QAPP may be encountered during analysis at the laboratory. The Laboratory Analysis Coordinator routinely addresses deviations and corrective actions required during laboratory analysis unless they would significantly impact data quality. Deviations that would significantly impact the project are reported to the Test Coordinator, Quality Assurance Officer (QAO), and Albemarle personnel and addressed accordingly. The noted deviations and corrective actions that would not significantly impact the data quality were documented in the laboratory case narrative. There were no significant deviations and therefore, no Corrective Action Request forms were required to be initiated.

5.5 CALCULATIONS

Sample calculations are provided in Appendix F of this test report.

5.6 CONCLUSIONS

All analytical data packages show the quality objectives provided in the QAPP for the project were satisfactorily met. There was no data found to be unusable and there were no deficiencies that impacted any regulatory compliance determinations.

6.0 ANTICIPATED PERMIT OPERATING CONDITIONS

6.1 CONTROL PARAMETERS

Based on the test results, Albemarle is proposing HWC MACT operating limits for the Boiler No. 4. Some parameters are proposed based on the operating conditions demonstrated during testing. However, other limits are proposed based on established regulatory guidance, manufacturer's recommendations, good operating practice, previous testing, or operating experience. The operating parameters discussed in this section that will have permissible limits associated with them will provide equivalent or better assurance of the compliance of Boiler No. 4 with the applicable HWC MACT performance and emissions standards.

Table 1-3 summarizes the established HWC MACT operating limits for Boiler No. 4. The following sections present a discussion of each parameter. To facilitate review, the control parameters are grouped into the following categories:

- Group 1 parameter limits are established directly from test operating data, and are used to ensure that boiler system operating conditions are not significantly less rigorous than those demonstrated during testing. Most Group 1 parameters are continuously monitored and recorded, and are interlocked with the AWFCO system. Some Group 1 parameters are based on operating records and analyses.
- Group 2 parameter limits are regulatory specified limits, and are not based on the test operating conditions (*e.g.*, the maximum stack CO concentration). Some Group 2 parameters are continuously monitored and recorded, and are interlocked with the AWFCO.
- Group 3 parameter limits are based on manufacturer's recommendations, operational safety, and historical operating practice considerations rather than on the test operating conditions. Group 3 parameter limits may be regulatory specified limits. Some Group 3 parameters may be continuously monitored and recorded, and may be interlocked with the AWFCO system.

6.2 DEVELOPMENT OF PERMIT LIMITS

The following sections describe how each control parameter limit will be established. In addition to establishing specific operating limits, Albemarle anticipates having limits on the types of waste that can be burned in Boiler No. 4. Albemarle previously demonstrated greater than 99.99% DRE using three POHCs: 1) monochlorobenzene, a Class 1 (most thermally stable) compound, 2) toluene a Class 2 (slightly less thermally stable than Class 1 compounds), and 3) perchloroethylene a second Class 2 compound. The HWC MACT rule at 63.1206(b)(7) allows for not repeating DRE testing if the source is not modified after the DRE test in a manner that could affect the ability to achieve the DRE standard. The HWC MACT rule at 63.1207(c)(2)(iv) removes any age restrictions on use of previous DRE data as data-in-lieu of testing. No engineering changes have been made that could adversely impact DRE performance. Albemarle will be permitted to burn all of the wastes represented by the waste codes in the facility's most recent RCRA Part A permit application. Specific prohibitions are expected for wastes containing greater than 50 mg/kg of polychlorinated biphenyls (PCBs) and those wastes listed with the waste codes F020, F021, F022, F023, F026, or F027.

6.2.1 Parameters Demonstrated During the Test (Group 1 Limits)

Group 1 parameter limits are based on the demonstrated operating conditions during the testing. The following parameters are proposed as Group 1 parameters for Boiler No. 4.

6.2.1.1 Maximum Hazardous Waste Feed Rates [40 CFR 63.1209(j)(3), (k)(4)]

Albemarle proposes to retain the previous maximum waste feed rate limit of 26.8 lb/min established by the 2003 RCRA trial burn. Maximum waste feed rate is a DRE performance and PCDD/PCDF emissions related parameter. During CPT Test 3, Boiler No. 4 was operated, as nearly as possible, to the maximum waste feed rate demonstrated in 2003. CPT Test 3 included measurement of PCDD/PCDF, CO, and THC emissions to demonstrate compliance with the HWC MACT performance standards while treating waste at maximum rate. The maximum allowable liquid waste feed rate limit is established as an hourly rolling average limit from the lesser of the average of the average feed rates demonstrated during the three runs of the 2003 RCRA trial burn maximum waste feed rate test, or the average of the maximum hourly rolling average feed rates demonstrated during the three runs of CPT Test 3.

6.2.1.2 Maximum Steam Production Rate [40 CFR 63.1209(j)(2), (k)(3)]

Albemarle proposes to retain the previous maximum steam production rate limit of 22,600 lb/hr established by the 2003 RCRA trial burn. Maximum steam production rate is a DRE performance and PCDD/PCDF emissions related parameter. Test 3 included measurement of PCDD/PCDF, CO, and THC emissions to demonstrate compliance with these HWC MACT performance standards while treating waste at maximum steam production rate. The maximum steam production rate is established as an hourly rolling average limit from the lesser of the average of the average steam production rates demonstrated during the 2003 RCRA trial burn, or the average of the maximum hourly average steam production rates demonstrated during CPT Test 3.

6.2.1.3 Minimum Combustion Temperatures [40 CFR 63.1209(j)(1), (k)(2)]

Albemarle proposes to retain the previous minimum combustion temperature limit of 1,294^{o}F established by the 2003 RCRA trial burn. During CPT Test 1, Boiler No. 4 was operated, as nearly as possible, to the minimum combustion temperature limit established by 2003 RCRA trial burn. CPT Test 1 included measurement of PCDD/PCDF, CO, and THC emissions to demonstrate compliance with these HWC MACT performance standards while treating waste at minimum combustion temperature. The minimum combustion temperature limit is established as an hourly rolling average limit from the greater of the average of the average combustion temperatures demonstrated during the three runs of the 2003 RCRA trial burn minimum combustion temperature test or CPT Test 1.

6.2.1.4 Maximum Baghouse Temperature [40 CFR 63.1209(k)(1), (n)(1)]

The HWC MACT rule requires setting a maximum baghouse temperature based on demonstrated compliance with the PCDD/PCDF, and the LVM and SVM emissions standards. The CPT included demonstration of the maximum baghouse temperature. The CPT plan proposed a maximum baghouse temperature limit/target of 380^{o}F which is less than the maximum baghouse temperature limit previously established by the 2003 RCRA trial burn at 431^{o}F. The economizer and additional associated ducting installed after the 2003 RCRA trial burn results in generally lower overall baghouse temperature. The baghouse temperature was monitored on a continuous basis during the CPT.

During all runs of Test 1 and Test 3, the economizer was bypassed to increase to the baghouse temperature to the maximum value possible at the existing ambient conditions. The Test 1 average baghouse temperature was 296^{o}F. The Test 3 average baghouse temperature was 386^{o}F. HWC MACT-compliant PCDD/PCDF emissions were demonstrated during both the minimum combustion temperature condition (Test 1) and the maximum waste feed rate/maximum steam production rate condition (Test 3).

During Runs 4 and 5 of Test 2, the economizer was operating. During Run 6 of Test 2, the economizer was bypassed to increase to the baghouse temperature to the maximum value possible at the existing ambient conditions. The average baghouse temperatures during Test 2, Runs 4, 5, and 6 were 340^{o}F, 344^{o}F, and 382^{o}F, respectively. HWC MACT-compliant LVM and SVM emissions control was demonstrated at conditions of maximum waste feed rate/maximum steam production rate condition with maximum ash feed rate, maximum chlorine feed rate, and LVM and SVM spiking (Test 2). Refer to Table 4-2. Although the baghouse temperature was higher during Run 6 than Runs 4 and 5, the Run 6 LVM emissions were the lowest of the three test runs, and the Run 6 SVM emissions were less than the average of the three test runs. These data indicate that LVM and SVM emissions are not appreciably impacted by the baghouse temperature in the range of values tested.

Although the economizer lowers baghouse temperature via more efficient heat removal, the ability to control the temperature is limited and seasonally (ambient conditions) dependent. If there was an operational problem with the economizer, bypassing the economizer (stopping water flow to the economizer) may be necessary. Depending upon ambient conditions, particularly during summer months, the baghouse temperature could exceed the Test 2, Run 6 and Test 3 Runs 7, 8, and 9 demonstrated values if the economizer has to be bypassed. On at least one occasion since its installation, the economizer had to be bypassed for a few weeks due to leaking. The economizer was repaired and placed back in service. For such operational situations, Albemarle requests the baghouse temperature limit be set at a value higher than the CPT-demonstrated values.

Refer to Table 2-5. The 2003 RCRA trial burn PCDD/PCDF emissions were demonstrated at an average baghouse temperature of 431^{o}F while operating Boiler No. 4 at maximum waste rate and maximum steam production rate. The PCDD/PCDF emissions during the three test runs were <0.1439, <0.3054, and

<0.3504, respectively. The 2003 RCRA trial burn data demonstrated compliance with the HWC MACT PCDD/PCDF emissions standard of 0.40 ng TEQ/dscm at this higher temperature.

Albemarle proposes the maximum baghouse temperature be set at 400°F. Compliance will be demonstrated as an hourly rolling average limit. This proposed limit is based on demonstrated compliance with the HWC MACT PCDD/PCDF, LVM, and SVM emissions limits. The PCDD/PCDF emissions data from the 2003 RCRA trial burn demonstrate complaint operation of Boiler No. 4 at a baghouse temperature of up to at 431°F. The PCDD/PCDF emissions data from the CPT just conducted demonstrate complaint operation of Boiler No. 4 at a baghouse temperature of only a few degrees under 400°F. The CPT LVM and SVM emissions data demonstrate these emissions are not impacted at temperatures a few degrees less than 400°F. Additionally as presented later in Section 6.2.4, the proposed extrapolated LVM and SVM feed rate limits are capped at five times (5X) the CPT-demonstrated feed rates although the CPT data could allow for extrapolation to six and twenty (6X and 20X) the CPT-demonstrated feed rates, respectively. Limiting the extrapolation of the lVM and SMV feed rates, and setting the maximum baghouse temperature limit at 400°F will allow for complaint operation of Boiler No. 4 when seasonal variations and/or economizer bypass is necessary and might result in higher baghouse temperatures than those demonstrated during the CPT.

6.2.1.5 Maximum Ash Feed Rates [40 CFR 63.1209(m)(3)]

To provide some operational flexibility should the ash content of the wastes vary, Albemarle augmented the native ash content of the waste during CPT Test 2 via spiking of an ash surrogate. The resulting particulate emissions were nearly two (2) orders of magnitude less than the HWC MACT limit. The proposed ash feed rate limit for Boiler No. 4 is the average feed rate demonstrated during CPT Test 2. The total ash feed rate limit for Boiler No. 4 is proposed as a 12-hour rolling average. Records of waste feed analyses, and the electronic waste feed operational data, will be maintained to demonstrate compliance with the ash feed rate limit.

6.2.1.6 Maximum Semivolatile Metals Feed Rate [40 CFR 63.1209(n)(2)(i)(A), (n)(ii)]

During Test 2, Albemarle metered lead (Pb) to the liquid waste feed as a surrogate metal for the SVM group. Lead was metered at a nominal rate of five (5) grams per hour. The wastes did not contain any detectable native amounts of SVM (lead or cadmium). The SVM emissions measured during CPT Test 2 were substantially less than the HWC MACT standard of 8.2E-05 lb/MMBtu. Albemarle proposes a feed rate limit for SVM as a 12-hour rolling average calculated by the lesser of the average CPT Test 2 lead feed rate extrapolated to an emissions concentration equal to the HWC MACT standard, or five (5) times the CPT Test 2 demonstrated average spiking feed rate. The system removal efficiency determined for spiked lead only during Test 2 is used as the basis for extrapolation. SVM feed rate extrapolation is discussed in more detail in Section 6.2.4. Records of waste feed analyses, and the electronic waste feed operational data, will be maintained to demonstrate compliance with the SVM feed rate limit.

6.2.1.7 Maximum Low Volatility Metal Feed Rate [40 CFR 63.1209(n)(2)(i)(B)-(C), (n)(ii)]

During Test 2, Albemarle metered chromium (Cr) to the liquid waste feed as a surrogate metal for the LVM group. Chromium was metered at a nominal rate of three (3) grams per hour. The wastes did contain some detectable native amounts of chromium. The chromium emissions measured during CPT Test 2 were substantially less than the HWC MACT standard of 1.3E-04 lb/MMBtu. Albemarle proposes a feed rate limit for LVM (chromium) as a 12-hour rolling average calculated by the lesser of the average CPT Test 2 chromium feed rate extrapolated to an emissions concentration equal to the HWC MACT standard, or five (5) times the CPT Test 2 demonstrated average spiking feed rate (no credit is taken for detectable native chromium). The system removal efficiency determined for the spiked chromium only during Test 2 is used as the basis for extrapolation. Chromium feed rate extrapolation is discussed in more detail in Section 6.2.4. Records of waste feed analyses, and the electronic waste feed operational data, will be maintained to demonstrate compliance with the chromium feed rate limit.

6.2.2 Parameters Established by Regulatory Requirements (Group 2 Limits)

Group 2 parameter limits are based on regulatory requirements.

6.2.2.1 Maximum Mercury Feed Rate [40 CFR 63.1209(l)(1), 63.1207(m)(2) & (m)(3)]

The liquid waste treated is historically non-detect for mercury. Therefore, Albemarle proposes to demonstrate compliance with the HWC MACT mercury emissions standard of 4.2E-05 lb/MMBtu of waste fired as a 12-hour rolling average via continuous calculation by the Boiler No. 4 control system based on the waste feed rate, waste feed mercury concentration, and waste heat content data. Records of waste feed analyses, and the electronic waste feed operational data, will be maintained to demonstrate compliance with the mercury emissions limit.

6.2.2.2 Maximum Total Chlorine Feed Rate [40 CFR 63.1209(o)(1), (n)(4); 63.1215]

Albemarle augmented the native chlorine content of the waste during CPT Test 2 via metering of perchloroethylene (C_2Cl_4) to the liquid waste feed. The target chlorine feed rate was the HBCA limit of 16.3 lb/hr. Test 2 will include measurement of HCl/Cl_2 emissions. Test 2 will also include measurement of non-mercury metals emissions (LVM and SVM). The concurrent perchloroethylene spiking during Test 2 provided maximum chlorine feed rate as required by 63.1209(n)(4). The LVM and SVM metals emissions results during CPT Test 2 were in compliance with the HWC MACT emissions standards. The total chlorine feed rate limit is proposed as the lesser of the CPT Test 2 demonstrated feed rate or the HBCA limit of 16.3 lb/hr expressed as a 12-hour rolling average. Records of waste feed analyses, and the electronic waste feed operational data, will be maintained to demonstrate compliance with the chlorine feed rate limit.

6.2.2.3 Fugitive Emissions [40 CFR 63.1206(c)(5)(i)(A), (B)]

The HWC MACT regulations require controlling combustion system leaks to prevent fugitive emissions. A forced draft fan provides air to the burner assembly for combustion of waste and auxiliary fuel. Boiler No. 4 is a sealed combustion system and therefore complies with 40 CFR 63.1206(c)(5)(i)(A).

An induced draft fan provides pressure control for the boiler combustion zone and the baghouse. The induced draft fan maintains a slight vacuum on the boiler combustion zone and draft through the baghouse. Boiler No. 4 therefore also complies with 40 CFR 63.1206(c)(5)(i)(B).

A maximum combustion chamber pressure limit of 0.0 inches water column (inwc) is proposed. If the combustion chamber pressure exceeds atmospheric pressure, waste feed will be immediately discontinued.

6.2.2.4 Maximum Stack CO Concentration [40 CFR 63.1217(a)(5)(i)]

Boiler No. 4 is equipped with carbon monoxide and oxygen CEMS. Boiler No. 4 will comply with the maximum allowable stack gas carbon monoxide concentration of 100 ppmv hourly rolling average corrected to 7% oxygen, dry basis.

6.2.3 Parameters Established by Manufacturer's Recommendations, Operational Safety and Good Operating Practice (Group 3 Limits)

Group 3 parameter limits are based on manufacturer's recommendations, operational safety and good operating practice considerations. The following parameters are proposed as Group 3 parameters.

6.2.3.1 Minimum Waste Atomization Air Pressure [40 CFR 63.1209(j)(4)]

Based on operating experience, the final permit should include a limit on the minimum waste atomization air pressure. Low atomization pressure will trigger a low-pressure mechanical switch that instantaneously stops waste feed. This compliance methodology exceeds the requirement for continuous monitoring and compliance via any rolling average limit.

6.2.3.2 Baghouse Operation and Maintenance [40 CFR 63.1209(c)(8)]

The baghouse is equipped with a bag leak detection system that complies with the detection limit requirement of 1 mg/dscm as specified at 63.1206(c)(8)(ii). Albemarle will comply with the corrective measures and notification requirements of 63.1206(c)(8)(iii) and (iv) when a bag leak is detected. Albemarle will maintain the baghouse as required by § 63.1206(c)(7).

6.2.4 Extrapolation of Metals Feed Rate Limits [40 CFR 63.1207(f)(1)(x) & 63.1209(l)(1)(i), (n)(2)(ii)]

6.2.4.1 Extrapolation Methodology and Rationale [40 CFR 63.1207(f)(1)(x)(A)]

Table 6-1 summarizes the extrapolation methodology based on the CPT Test 2 demonstrated lead (SVM) and chromium (LVM) spiking rates to establish the proposed final feed rate operating limits for these HWC MACT constituents. Albemarle metered lead and chromium to the liquid waste feed during CPT Test 2 to demonstrate system removal efficiency (SRE) values for LVM and SVM, respectively. The SREs were calculated the documented spiking rates of lead and chromium, and Method 29 measured emission rates of lead and chromium. The SREs were calculated using the following equation:

$$SRE_i = \left[1 - \frac{\dot{m}_{i,out}}{\dot{m}_{i,in}}\right] \times 100\%$$

Where:

$\dot{m}_{i,in}$ = Mass feed rate of metal i.

$\dot{m}_{i,out}$ = Mass emission rate of metal i.

SRE_i = Demonstrated system removal efficiency of metal i.

Albemarle has used the demonstrated SRE for each metal volatility group to assess the maximum allowable mass feed rate limits for each metal volatility group using the following equation:

$$\dot{m}_{g,in,\max} = \frac{\dot{m}_{g,out,MACT}}{\left(1 - \frac{SRE_i}{100}\right)}$$

Where:

$\dot{m}_{g,in,\max}$ = Maximum allowable mass feed rate of metal group g

$\dot{m}_{g,out,MACT}$ = Maximum allowable mass emission rate of metal group g based on the MTEC analysis

SRE_i = Demonstrated system removal efficiency of metal i designated to be the metal representative of metal group g.

Because metals SREs are non-linear relative to the metals feed rates[1], proposed upward extrapolation of the demonstrated metals feed rates to the HWC MACT allowable emission standard assures ongoing compliance with the HWC MACT standards. Albemarle proposes the SVM and LVM feed rate limits

[1] *Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations*, Section 10.5.2, EPA-530-R-92-011 (PB92-154 947), March, 1992

based on the lesser of: 1) the extrapolation of the demonstrated SVM and LVM SREs up to the respective HWC MACT LVM and SVM emissions limits, or 2) five times (5X) the CPT Test 2 demonstrated feed rates. These lesser proposed feed rate values will allow for the accuracy and precision in test measurements, and corresponding variability in system removal efficiency.

6.2.4.2 Documentation of Historical Metals Feed Rates [40 CFR 63.1207(f)(1)(x)(B)]

Historical average and maximum liquid waste feed concentrations of SVM and LVM were provided in the CPT plan.

Based on historical maximum data for chromium (LVM) 3.7 mg/kg. The minimum liquid waste heating value noted is 12,800 Btu/lb. This equates to a waste feed thermal concentration of 2.9E-04 lb/MMBtu, which is just slightly more than twice (2X) the HWC MACT standard of 1.3E-04 lb/MMBtu. The proposed limit of 5X the test demonstrated chromium feed rate is 1.5E-03 lb/MMBtu which is nominally 5X the maximum historical value. The proposed maximum LVM feed rate limit should be adequate to allow treatment of the Albemarle liquid waste in Boiler No. 4.

Based on historical combined maximum data for cadmium and lead (SVM) 1.1 mg/kg. The minimum liquid waste heating value noted is 12,800 Btu/lb. This equates to a waste feed thermal concentration of 8.6E-05 lb/MMBtu, which is just over than the HWC MACT standard of 8.2E-05 lb/MMBtu. The proposed limit of 5X the test demonstrated lead feed rate is 2.4E-03 lb/MMBtu which is nominally 28X the maximum historical value. The proposed maximum LVM feed rate limit should be adequate to allow treatment of the Albemarle liquid waste in Boiler No. 4.

6.2.4.3 Documentation of the Adequacy of Test Metals Feed Rates [40 CFR 63.1207(f)(1)(x)(C)]

Table 3-4 presents summaries of the waste feed analyses. Table 3-6 presents the spiking material analyses. Table 4-2 presents a summary of the metals emissions results. Documentation in the CPT plan as to the adequacy of spiking rates to demonstrate that the level of metals spiking during the test are consistent with the sampling and analysis imprecision and accuracy is borne out by the test results. SREs were effectively demonstrated for SVM and LVM at the test spiking rates and demonstrated stack flow conditions.

6.2.5 Wastes Treated [40 CFR 63.1217(c)]

The test demonstrated greater than 99.99% DRE using monochlorobenzene, a Class 1 (most thermally stable) compound. Albemarle expects to be permitted to burn all of the wastes represented by the waste codes in the facility's most recent RCRA Part A permit application. Specific prohibitions are expected for wastes containing greater than 50 mg/kg of polychlorinated biphenyls (PCBs), and those wastes listed with the waste codes F020, F021, F022, F023, F026, or F027. Albemarle does not generate or handle these wastes.

Table 6-1. Boiler No. 4 Metals Feed Rate Limit Extrapolation

Metal Group	Parameter	Units	Run 4	Run 5	Run 6	Average
Waste Heat Input Data	Average Liquid Waste Feed Rate (Note 1)	lb/min	21.88	21.87	21.97	21.91
	Liquid Waste Heating Value (Note 2)	Btu/lb	17,500	17,500	17,500	17,500
	Average Liquid Waste Heat Input (Note 3)	MMBtu/hr	22.97	22.97	23.07	23.00
Total LVM (Cr Only)	Spiked Cr to Liquid Waste Feed per SSI Data (Note 4)	lb/hr	0.006822	0.006661	0.006699	0.006727
		g/hr	3.09	3.02	3.04	3.05
		lb/MMBtu	3.0E-04	2.9E-04	2.9E-04	2.9E-04
	Cr Emission Rate via EPA Method 29 (Note 5)	lb/hr	2.9E-04	1.0E-04	5.6E-05	1.5E-04
		g/hr	0.130	0.046	0.025	0.067
		lb/MMBtu	1.2E-05	4.4E-06	2.4E-06	6.4E-06
	Cr SRE (Note 6)	%	95.80%	98.49%	99.17%	97.82%
	HWC MACT LVM Emissions Standard	lb/MMBtu	1.3E-04			
	Cr Emissions as Percent of HWC MACT LVM Standard	% of Std.	9.6%	3.4%	1.9%	4.9%
	Maximum Allowable LVM Emission Rate at HWC MACT Standard (Note 7)	lb/hr	2.99E-03	2.99E-03	3.00E-03	2.99E-03
		g/hr	1.35	1.35	1.36	1.36
	Extrapolated LVM Feed Rate Limit (Note 8)	g/hr	32	90	163	95
		lb/MMBtu	3.1E-03	8.6E-03	1.6E-02	9.1E-03
	Proposed Maximum LVM Feed Rate Limit (Note 9)	g/hr	15	15	15	15
		lb/MMBtu	1.5E-03	1.4E-03	1.5E-03	1.5E-03
Total SVM (Cd+Pb)	Spiked Pb to Liquid Waste Feed per SSI Data (Note 4)	lb/hr	0.0113	0.0111	0.0111	0.0112
		g/hr	5.1	5.0	5.1	5.1
		lb/MMBtu	4.9E-04	4.8E-04	4.8E-04	4.9E-04
	Pb Emission Rate via EPA Method 29 (Note 5)	lb/hr	9.5E-06	4.3E-05	2.6E-05	2.6E-05
		g/hr	0.0043	0.019	0.01181	0.012
		lb/MMBtu	4.2E-07	1.9E-06	1.1E-06	1.1E-06
	Pb SRE (Note 6)	%	99.916%	99.61%	99.77%	99.77%
	HWC MACT SVM Emissions Standard	lb/MMBtu	8.2E-05			
	Pb Emissions as Percent of HWC MACT Standard	% of Std.	0.51%	2.3%	1.4%	1.4%
	Maximum Allowable SVM Emission Rate at HWC MACT Standard (Note 7)	lb/hr	1.88E-03	1.88E-03	1.89E-03	1.89E-03
		g/hr	0.854	0.854	0.858	0.856
	Maximum Possible Extrapolated SVM Feed Rate (Note 8)	g/hr	1,015	222	367	535
		lb/MMBtu	9.7E-02	2.1E-02	3.5E-02	5.1E-02
	Proposed Maximum SVM Feed Rate Limit (Note 9)	g/hr	26	25	25	25
		lb/MMBtu	2.5E-03	2.4E-03	2.4E-03	2.4E-03

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Table 6-1. Boiler No. 4 Metals Feed Rate Limit Extrapolation

Notes:
1. Average liquid waste feed rate during test run.
2. Liquid waste feed heating value from analysis data.
3. Calculated waste feed heat input rate.
4. Documented feed rate via spiking to the waste feed.
5. Emission rate measured using EPA Method 29.
6. System removal efficiency (SRE) calculated as difference between the spiked feed rate and measure emission rate.
7. Maximum extrapolated mass emission rate based on waste feed heat input.
8. Maximum extrapolated mass feed rate based on demonstrated SRE rounded to two significant figures.
9. The proposed maximum metals feed rate is the lesser of five (5) times the demonstrated feed rate or the maximum extrapolated feed rate based on demonstrated SRE.

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Appendix D-9.5
GEL Engineering, January 2012

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725 Cannon Bridge Road
P.O. Box 1028
Orangeburg, SC 29116

Re: Particulate Matter Emissions Testing of the Boiler No. 4 Exhaust Stack (Unit ID 04) at Albemarle Corporation in Orangeburg, SC - Conducted November 9, 2011

Dear Mr. Kerr,

The results of the referenced source test have been reviewed by the Department, and the emission rates and operating parameters are summarized below:

Boiler No. 4 Exhaust

Pollutant	Emission Rate (lbs/hr)	Emission Concentration (mg/dscm @ 7% O_2)	Emission Concentration (gr/dscf @ 7% O_2)	Emission Limit (gr/dscf @ 7% O_2)
PM	0.048	2.73	1.20E-03	0.08

Operating Parameters recorded during the testing event:

1.) The Waste Feed Rate one minute average values ranged from ranged from 17.1 lbs/min to 17.8 lbs/min and averaged ~17.5 lbs/min.;
2.) The Boiler Operating Temperature one minute average values ranged from 1780°F to 1787°F and averaged ~1784°F;
3.) The Baghouse Inlet Temperature one minute average values ranged from 351°F to 357°F and averaged ~355°F;
4.) Steam Production Rate one minute average values ranged from 11.7 klbs/hr to 16.3 klbs/hr and averaged ~13.5 klbs/hr;
5.) Baghouse Pressure Drop one minute average values ranged from 3.61 in. H_2O to 3.77 in. H_2O and averaged ~3.67 in. H_2O.

Compliance Status for Boiler No. 4: PM (TV-1860-0004).....**Compliance**

Department records indicate that the periodic retest date for PM emissions is to be no later than November 30, 2014 for Boiler #4.

If I can be of further assistance, please call me at (803) 898-4163 or e-mail me at shephamh@dhec.sc.gov.

Sincerely,

Morgan H. Shephard
Environmental Health Manager
Source Evaluation Section
SC DHEC Bureau of Air Quality

Cc: Compliance File: 1860-0004
Tim Pearson, Region 5 – Aiken EQC

Ec: Michael Shroup
Sara Fenzel
Carol Boney
Melissa Poage
Dawn Jordan
Linda Morgan
Tim Pearson, Region 5 – Aiken EQC
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ALBEMARLE® CORPORATION

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January 11, 2012

Manager
Source Evaluation Section
Bureau of Air Quality
South Carolina Department of Health
and Environmental Control
2600 Bull Street
Columbia, SC 29201

Re: #4 Boiler – PM Source Test Results

Dear Manager:

Enclosed is the Source Test Report with the results of our November 2011 #4 Boiler Source Test for Particulate Matter. The test was conducted pursuant to requirements in our permit TV-1860-0004 Part 6.0, Section B.8.b. The test shows compliance with 40 CFR 266 Subpart H as specified in our Title V permit, Table 5.30. The test was conducted per the Site Specific Test Plan approved on September 26, 2011.

Please feel free to contact me at 803-539-5404 if you have any questions.

Sincerely,

Tom Kerr

Tom Kerr
Regulatory Advisor

enclosure

Copy of cover letter only:
M. R. Brown
T. L. Windsor

GEL Engineering LLC

Environmental | Engineering | Surveying

Results of the November 2011 Particulate Matter Emissions Testing of Boiler No. 4

Albemarle Corporation
Orangeburg, South Carolina

Submitted to:

Tom Kerr
Albemarle Corporation
725 Cannon Bridge Road
Orangeburg, South Carolina 29116

Submittal Date: January 4, 2012

RESULTS OF THE NOVEMBER 2011 PARTICULATE MATTER EMISSIONS TESTING OF BOILER No. 4

Albemarle Corporation
Orangeburg, South Carolina

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1	Stationary Source Test Log
2	Capture Summary
3	Concentration Summary
4	Emissions Summary

Appendices

I	Summary of Test Results
II	Test Method Formulas and Nomenclature
III	Field Data Sheets
IV	Particulate Matter Data Sheets
V	Production Data
VI	Equipment Calibration Data

RESULTS OF THE NOVEMBER 2011 PARTICULATE MATTER EMISSIONS TESTING OF BOILER No. 4

Albemarle Corporation
Orangeburg, South Carolina

1.0 INTRODUCTION

GEL Engineering, LLC (GEL) performed stationary source sampling of the Boiler No. 4 Exhaust Stack on November 9, 2011, for Albemarle Corporation (Albemarle) located in Orangeburg, South Carolina. The purpose of the stack testing was to demonstrate compliance with the terms of Albemarle's Permit Number 1860-0004, issued by the South Carolina Department of Health and Environmental Control (DHEC).

The following Table summarizes the participants in the testing event:

Name	Job Title	Affiliation
Gregg Szymkowicz	Field Team Leader	GEL
Sean Huber	Sampling Technician	GEL
Charles Rice	Sampling Technician	GEL
Kirk Alexander	Project Manager	GEL
Tom Kerr	Regulatory Advisor	Albemarle
Chris McBride	Consultant	Focus Environmental

The testing was observed by Urva Patel of DHEC. The testing was performed in accordance with the site specific test plan submitted to DHEC by Focus Environmental. Test parameters and sampling methods for the test program are summarized in Table 1.

2.0 DISCUSSION OF TEST RESULTS

Three 1-hour test runs measuring PM emissions were conducted on November 9, 2011. The test results obtained for this sampling program are summarized in Tables 2 through 4. Table 2 contains the total PM catch from the exhaust stack of the baghouse. Table 3 contains the measured concentrations of PM in grains per dry standard cubic foot (gr/dscf), gr/dscf corrected to 7 percent oxygen (@7% O_2), milligrams per dry standard cubic meter (mg/dscm), and mg/dscm@7% O_2. Table 4 presents the calculated emission rates in pounds per hour (lbs/hr). The accompanying stack gas flow rates are included in Appendix I.

Emission measurements for PM were conducted during the normal production workload at Albemarle. As shown in Table 3, the average concentration of PM measured during the test runs was 0 0012 gr/dscf@7% O_2, which is below Albemarle's permit limitation of 0.08 gr/dscf@7% O_2. Based on the concentration of PM in the stack, the average emissions of PM were calculated to be 0.048 lbs/hr.

A summary of the test results from the source testing, test method formulas and nomenclature, field data sheets, particulate matter data sheets, production data, and equipment calibrations records are included as Appendices I through VI, respectively.

3.0 PROCESS DESCRIPTION AND OPERATION

Boiler No. 4 is a Cleaver-Brooks 800 hp packaged fire tube boiler with a maximum design capacity of 32.2 MMBtu/hr of heat input. The boiler is designed to burn waste fuel, fuel oil, and natural gas. The boiler exhaust gases are routed through a baghouse to control particulate emissions. The waste fuel that Albemarle Corporation burns is derived from a combination of by-products from several chemical processes within the plant. The boiler is regulated under the EPA Boiler and Industrial Furnace (BIF) regulations. The Boiler No. 4 operational log is included in Appendix V.

4.0 SAMPLING METHODS AND ANALYTICAL PROCEDURES

On November 9, 2011, three emissions tests were performed to determine the PM emissions for the Baghouse Stack at a normal production rate. Sampling and analytical procedures recommended by the United States Environmental Protection Agency (EPA) were used for this test program. The sampling and analytical procedures that were used are described below.

4.1 Sampling Locations

EPA Method 1 was employed to determine the number and location of the sampling points used for velocity measurements during the test program. As specified by Method 1, a horizontal cross section of the stack was divided into 12 equal areas with 6 points located on each of two traverses.

4.2 Velocity and Volumetric Flow Rates

EPA Method 2 was used to determine the stack gas velocity and volumetric flow rate of the stack exhaust for each test run. Velocity measurements were performed during each test run. As specified by Method 2, the calculated mean of the velocity measurements performed at the 12 sampling points was used to calculate the volumetric

flow rate.

4.3 Dry Molecular Weight

Continuous O_2 measurements were taken in accordance with EPA Method 3A using a California Analytics Model 100F electrochemical analyzer. Continuous carbon dioxide (CO_2) measurements were recorded using a Servomex Model 1440D infrared analyzer. O_2 and CO_2 measurements were conducted simultaneously with the PM tests. One-minute rolling averages were recorded for processing by a computerized data acquisition system.

The analyzer was calibrated initially, and drift checks were performed after each test run using EPA Protocol calibration gas. Method 3A calibration gases were generated using an Environics Gas Dilution System in accordance with EPA Method 205.

4.4 Moisture Content

EPA Method 4 was used to determine the moisture content of the stack gas. Following the protocol given in Method 4, the volume of the condensed water vapor collected in the impingers and the silica gel was weighed before and after sample collection. The difference in the two weights of the silica gel, the difference in the two weights of condensed water vapor captured in the impingers, and the volume of air sampled with the impingers train were used to calculate the moisture content of the stack gas.

4.5 Particulate Emissions Determinations

Three test runs were conducted using EPA Method 5 to determine the emission rates for PM. Particulate emissions were collected isokinetically through a heated sampling probe onto a heated high purity quartz fiber filter. The sample train nozzle and probe liner were rinsed and scrubbed with acetone until clean in the field, the cyclone bypass and front half of the filter housing were rinsed and scrubbed with acetone until clean upon return to the laboratory. The acetone rinse from each run was collected and analyzed with the collected filters to determine particulate emissions.

5.0 CALIBRATIONS PROCEDURES

5.1 Nozzles

Each nozzle is purchased from a stack testing equipment supplier and inspected and calibrated before putting it into field use. Thereafter, it is inspected prior to use and if damaged, the nozzle is not used. A set of three measurements is made prior to use and

must be within 0.004 inches. Nozzles are checked prior and after each source test. This data is recorded on the back of all field data sheets.

5.2 Pitot Tubes

All pitot tubes used by GEL are purchased along with the probe assembly from a stack testing equipment supplier. Prior to being used, the pitot tubes are calibrated as per Method 2. Pitot tubes are checked before each source test and receive a complete calibration once per year. This information is included in Appendix VI.

5.3. Dry Gas Meter

Complete dry gas meter calibrations are performed annually. After a source test, a single point calibration is conducted using a critical orifice nearest the average meter box ΔH readings encountered during the test. If the dry gas meter calibration factor differs from the annual calibration by more than +/- 0.05, it is repaired and given another annual calibration. The post-test and annual calibrations are included in Appendix VI.

5.4 Thermocouples

Each new thermocouple purchased by GEL is checked and calibrated prior to use. Prior to each source test, all temperature-sensing devices used receive a one-point calibration check as per Method 2. This information is recorded on the back of the field data sheets.

5.5 Balance

GEL technicians utilize an Ohaus Model E-12140 balance Serial No. G2391121320111P, located in the laboratory. A calibration is performed on this balance each day it is used with weight set Serial No. 39325. This information is logged in a laboratory notebook and can be provided upon request.

5.6 Barometer

GEL utilizes the National Weather Service to determine the current barometric pressure. This is obtained either by telephone or using the Internet.

0440

TABLE 1

STATIONARY SOURCE TEST LOG
Boiler No. 4 Exhaust

Albemarle
Orangeburg, South Carolina

Parameter	Duration	EPA Methods	Dates
Gas Flow Rates &	3 Runs	1 & 2	11/9/2011
Dry Molecular Weight	3 Runs	3A	11/9/2011
Moisture Content	3 Runs	4	11/9/2011
Particulate Matter	3 Runs	5	11/9/2011

TABLE 2

CAPTURE SUMMARY
Boiler No. 4 Exhaust

Albemarle
Orangeburg, South Carolina

		Run Number			
Parameter	**Units**	**1**	**2**	**3**	**Average**
Particulate Matter	milligrams	4.3	2.0	1.6	2.6

TABLE 3

CONCENTRATION SUMMARY
Boiler No. 4 Exhaust

Albemarle
Orangeburg, South Carolina

Parameter	Units	Run Number 1	2	3	Average
Particulate Matter	gr/dscf	0.0018	0.0009	0.0007	0.0011
Particulate Matter	gr/dscf @ 7%O2	0.0019	0.0009	0.0008	0.0012
Particulate Matter	mg/dscm	4.2	2.0	1.6	2.6
Particulate Matter	mg/dscm @ 7%O2	4.4	2.1	1.7	2.7

gr/dscf = grains per dry standard cubic foot (@ 29.92" Hg and 68°F)
mg/dscm = milligrams per dry standard cubic meter

TABLE 4

EMISSIONS SUMMARY
Boiler No. 4 Exhaust

Albemarle
Orangeburg, South Carolina

Parameter	Units	Run Number 1	2	3	Average
Particulate Matter	lbs/hr	0.075	0.037	0.031	0.048

lbs/hr = pounds per hour

APPENDIX I

SUMMARY OF TEST RESULTS

SUMMARY OF TEST RESULTS

Method 5 - Total Particulate

Boiler No. 4 Exhaust

[Raw Data]

Albemarle
Orangeburg, South Carolina

		Run Number			
		1	2	3	Mean
Date	Date of Test	11/9/2011	11/9/2011	11/9/2011	-
Start	Start Time	11:16 AM	12:45 PM	2:16 PM	-
Stop	Stop Time	12:21 PM	1:53 PM	3:25 PM	-
θ	Total Sampling Time	60.0	60.0	60.0	60.0
Pbar	Barometric Pressure, in. Hg	29.85	29.85	29.80	29.83
Ds(w)	Stack Diameter (width), inches	23.25	23.25	23.25	23.25
Ds(d)	Stack Diameter (Depth), inches	0.00	0.00	0.00	0.00
Dn	Nozzle Diameter, inches	0.250	0.250	0.250	0.250
DP	Average Velocity Head of Stack Gas, in. H2O	0.456	0.429	0.434	0.440
SQDP	Average Squareroot Velocity Head of Stack Gas, in. H2O	0.623	0.653	0.658	0.640
DH	Average Pressure Differential Across the Orifice Meter, in. H2O	1.236	1.173	1.184	1.200
Tm	Average Dry Gas Meter Temperature, °F	71.3	76.0	77.0	75.0
Ts	Average Stack Gas Temperature, °F	298.0	297.1	299.6	298.0
Pg	Stack Static Pressure, in. H2O	-0.23	-0.24	-0.22	-0.23
Vlc	Total Volume of Water Vapor Condensed in Impingers, ml	54.9	54.6	51.8	53.8
Vwsg	Total Volume of Water Vapor Condensed in Silica Gel, g	10.5	8.0	8.4	9.0
%CO2	Percent CO2 by Volume, Dry Basis	10.18	10.18	10.11	10.16
%O2	Percent O2 by Volume, Dry Basis	7.62	7.55	7.63	7.60
Vm	Volume of Gas Sample as measured by Dry Gas Meter, dcf	35.884	35.314	34.671	35.290
Y	Dry Gas Meter Calibration Factor	1.0053	1.0053	1.0053	1.0053
Cp	Pitot Coefficient	0.84	0.84	0.84	0.84
Tstd	Standard Temperature, °R	528	528	528	528
Pstd	Standard Pressure, in. Hg	29.92	29.92	29.92	29.92
Mn(PM)	Particulate Matter Catch, g	0.0043	0.0020	0.0016	0.0026

SUMMARY OF TEST RESULTS

Method 5 - Total Particulate

Boiler No. 4 Exhaust

[Calculations]

Albemarle
Orangeburg, South Carolina

		Run Number			
		1	2	3	Mean
As	Cross Sectional Area of Stack, square feet	2.95	2.95	2.95	2.95
An	Cross Sectional Area of Nozzle, square feet	0.000341	0.000341	0.000341	0.000341
Tm	Absolute Dry Gas Meter Temperature, °R	531	536	537	535
Ts	Absolute Stack Temperature, °R	758	757	760	758
Vmstd	Volume of Gas Sample Measured by the Dry Gas Meter, corrected to Standard Conditions, dscf	35.895	34.990	34.233	35.04
Vwcstd	Volume of Water Vapor Condensed in the Impingers, Corrected to Standard Conditions	2.58	2.57	2.44	2.53
Vwsgstd	Volume of Water Vapor Condensed in the Silica Gel, Corrected to Standard Conditions	0.50	0.38	0.40	0.43
Bws	Water Vapor in the Gas Stream, proportion by volume	0.08	0.08	0.08	0.08
%N2	Percent N2 by Volume, Dry Basis	82.2	82.3	82.3	82.3
Md	Molecular Weight of Stack Gas, Dry Basis, lb/lb-mole	29.93	29.94	29.93	29.94
Ms	Molecular Weight of Stack Gas, Wet Basis, lb/lb-mole	28.98	28.98	28.98	28.98
Ps	Absolute Stack Gas Pressure, in. Hg	29.83	29.83	29.78	29.81
Vs	Average Stack Gas Velocity, ft/sec	41.89	43.88	44.34	43.37
Qa	Wet Volumetric Stack Gas Flow Rate at Actual Conditions, acfm	7,410	7,770	7,850	7,680
Qa	Wet Volumetric Stack Gas Flow Rate at Actual Conditions, acf/hour	445,000	466,000	471,000	461,000
Qs	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions, dscf/min	4,730	4,970	5,000	4,900
Qs	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions, dscf/hour	284,000	298,000	300,000	294,000
I	Isokinetics, %	109.3	101.5	98.9	103.2

SUMMARY OF TEST RESULTS

Method 5 - Total Particulate

Boiler No. 4 Exhaust

[Concentration and Emissions Data]

Albemarle
Orangeburg, South Carolina

		Run Number			
		1	2	3	Mean
Csd(PM)	Particulate Matter Concentration, grains/dscf	1.84E-03	8.70E-04	7.20E-04	1.14E-03
Csd(PM)	Particulate Matter Concentration, grains/dscf @ 7%O2	1.93E-03	9.06E-04	7.54E-04	1.20E-03
Csd(PM)	Particulate Matter Concentration, mg/dscm	4.21	1.99	1.64	2.61
Csd(PM)	Particulate Matter Concentration, mg/dscm @ 7%O2	4.41	2.07	1.72	2.73
Mp(PM)	Particulate Matter Emissions Rate, lbs/hour	0.075	0.037	0.031	0.048

II

APPENDIX II

TEST METHOD FORMULAS AND NOMENCLATURE

GEL Engineering, LLC
A Member of The GEL Group, Inc.

TEST METHODS FORMULAS FOR STACK TESTING
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[last updated February 13, 2009]

1. AREAS

1.1 Area of Stack, Square feet (Round Stack)

$$A_s = \left(\frac{D_{s(\text{width})}^2 \pi}{4}\right)\left(\frac{\text{ft}^2}{144\ \text{in}^2}\right)$$

1.2 Area of Stack, Square feet (Square Stack)

$$A_s = (D_{s(\text{width})})(D_{s(\text{depth})})\left(\frac{\text{ft}^2}{144\ \text{in}^2}\right)$$

1.3 Area of Nozzle, Square feet

$$A_n = \left(\frac{D_n^2 \pi}{4}\right)\left(\frac{\text{ft}^2}{144\ \text{in}^2}\right)$$

2. TEMPERATURE CONVERSIONS

2.1 Temperature, Degrees Celsius—> Degrees Fahrenheit

$$T^\circ F = (T^\circ C)(9/5) + 32$$

2.2 Dry Gas Meter Temperature, Degrees Fahrenheit—>Degrees Rankin

$$T_m{}^\circ R = T_m{}^\circ F + 460$$

2.3 Stack Temperature, Degrees Fahrenheit—> Degrees Rankin

$$T_s{}^\circ R = T_s{}^\circ F + 460$$

3. VOLUME OF AIR COLLECTED

3.1 Volume of Dry Gas Sample, Corrected to Standard Conditions (cubic feet)

$$V_{m(std)} = (V_m)(Y)\left(\frac{T_{std}}{T_m \circ R}\right)\frac{\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{P_{std}}$$

3.2 Volume of Dry Gas Sample, Corrected to Standard Conditions (liters)

$$V_{m(std)} = \frac{(V_m)(Y)(P_{bar})(T_{std})}{(T_m \circ R)(P_{std})}$$

4. MOISTURE DETERMINATION

4.1 Volume of Water Vapor Condensed in Impingers, Corrected to Standard Conditions

$$V_{wc(std)} = (V_{lc})(0.04707)$$

4.2 Volume of Water Vapor Collected in Silica Gel, Corrected to Standard Conditions

$$V_{wsg(std)} = (V_{wsg})(0.04715)$$

4.3 Water Vapor in the Stack Gas, Proportion by Volume

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

4.4 Dry Mole Fraction of Flue Gas

$M_{fd} = 1 - B_{ws}$

5. MOLECULAR WEIGHT OF STACK GAS

5.1 Nitrogen Content of Stack Gas, Percent

$$\%N_{2dry} = 100 - \%CO_{2dry} - \%O_{2dry} - \%CO_{dry}$$

5.2 Dry Molecular Weight of the Stack Gas

$$M_d = 0.44(\%CO_{2dry}) + 0.32(\%O_{2dry}) + 0.28(\%N_{2dry} + \%CO_{dry})$$

5.3 Wet Molecular Weight of the Stack Gas

$$M_s = (M_d)(M_{fd}) + 18(B_{ws})$$

5.4 Sample Gas Density, pounds per cubic foot

$$P_{s(sgd)} = \frac{(M_d)(M_{fd}) + (18)(1 - M_{fd})}{385.3}$$

5.5 Total Weight of Gas Sampled, pound

$$W_{sg} = (V_{m(std)} + V_{wc(std)} + V_{wsg(std)})(P_{s(std)})$$

5.6 Excess Air, percent

$$\%EA = \left(\frac{\%O_{2dry} - (0.5)(\%CO_{dry})}{(0.264)(\%N_{2dry}) - (\%O_{2dry} - (0.5)(\%CO_{dry}))} \right) 100$$

6. FLOW DETERMINATIONS

6.1 Absolute Stack Gas Pressure

$$P_s = P_{bar} + \frac{P_g}{13.6}$$

6.2 Average Stack Gas Velocity, feet per second

$$V_s = (K_p)(C_p)\left(\sqrt{\Delta P}\right)\sqrt{\frac{T_s{}^\circ R}{(P_s)(M_s)}}$$

6.3 Wet Volumetric Stack Gas Flow Rate, Actual Conditions, cubic feet per minute

$$Q_a = (V_s)(A_s)\left(\frac{60sec}{min}\right)$$

6.4 Dry Volumetric Stack Gas Flow Rate, Corrected to Standard Conditions, cubic feet per hour

$$Q_s = (V_s)(A_s)\left(\frac{3600\ \text{sec}}{\text{hr}}\right)(M_{fd})\left(\frac{P_s}{T_s}\right)\left(\frac{T_{std}}{P_{std}}\right)$$

7. ISOKINETICS DETERMINATION

7.1 Raw Isokinetic Variation, Percent

$$\text{Raw \%I} = \left(\frac{(T_s°R)\left((K4)(V_{lc})+\left(\frac{V_m}{T_m°R}\right)\right)\left(P_{bar}+\left(\frac{\Delta H}{13.6}\right)\right)}{(60)(V_s)(P_s)(\theta)(A_n)}\right)100$$

$K4 = 0.002676$

7.2 Isokinetic Variation, Percent

$$\text{\%I} = \left(\frac{(T_s°R)(V_{m(std)})(P_{std})}{(60)(V_s)(P_s)(\theta)(A_n)(M_{fd})(T_{std})}\right)100$$

7.3 Determining K-Factor

$$K = (846.72)(D_n^4)(\Delta H@)(C_p^2)(M_{fd}^2)\left(\frac{(M_d)(T_m°R)(P_s)}{(M_s)(T_s°R)(P_m)}\right)$$

7.4 Determining DH

$\Delta H = [K]\Delta P$

8. POLLUTANT DETERMINATIONS

8.1 Concentration of Pollutant, Grains per Dry Standard Meter

$$C_{sd} = \left(\frac{M_n}{V_{mstd}}\right)\left(\frac{g}{1{,}000{,}000\ \mu g}\right)\left(\frac{15.432\ \text{grains}}{g}\right)$$

8.2 Concentration of Pollutant, Milligrams per Dry Standard Cubic Meter

$$C_{sd} = \left(\frac{M_n}{V_{mstd}}\right)\left(\frac{g}{1{,}000\ \mu g}\right)\left(\frac{35.315\ ft^3}{m^3}\right)$$

8.3 Emission Rate for Pollutant, Grains per Dry Standard Cubic Foot —> Pounds per Hour

$$M_p = (C_{sd})(Q_s)\left(\frac{lb}{7000\ gr}\right)$$

8.4 Emission Rate for Pollutant, Pounds per Hour—> Pounds per Million BTU

$$M_{pBtu} = \left(\frac{M_p}{Qs}\right)(F)\left(\frac{20.9}{20.9 - \%O_2}\right)$$

8.5 Emission Rate of Pollutant based on Production Rate, Pounds per Hour—> Pounds per Ton

$$M_{pro} = \left(\frac{M_p}{P}\right)$$

8.6 Emission Rate of Pollutant, Actual Flowrate, Parts per Million -> Pounds per Hour

$$M_p = \left(\frac{M_n}{1{,}000{,}000}\right)(Q_a)\left(\frac{m^3}{35.315\ dscf}\right)\left(\frac{mole}{0.02404\ m^3}\right)\left(\frac{P_s}{T_s{}^\circ R}\right)\left(\frac{T_{std}}{P_{std}}\right)\left(\frac{MW\ g}{mole}\right)\left(\frac{lb}{453.6\ g}\right)$$

8.7 Emission Rate of Pollutant, Standard Flowrate, Parts per Million -> Pounds per Hour

$$M_p = \left(\frac{M_n}{1{,}000{,}000}\right)(Q_s)\left(\frac{m^3}{35.315\ dscf}\right)\left(\frac{mole}{0.02404\ m^3}\right)\left(\frac{MW\ g}{mole}\right)\left(\frac{lb}{453.6\ g}\right)$$

9. POLLUTANT CORRECTIONS

9.1 Concentration Correction to 12% Carbon Dioxide

$$C_{s12} = (C_s)\left(\frac{12}{\%CO_{2dry}}\right)$$

9.2 Concentration Correction to 50% Excess Air Concentration

$$C_{s50} = (C_s)\left(\frac{100 + \%EA}{150}\right)$$

9.3 Concentration Correction to 50% Excess Air Concentration using Raw ORSAT Data

$$C_{s50} = \frac{C_s}{1 - \left(\frac{(1.5)(\%O_{2dry}) - (0.133)(\%N_{2dry}) - (0.75)(\%COdry)}{21}\right)}$$

9,4 Leak Rate Adjustment

$$Vm = \left[Vm - (L_1 - L_a)\right]\theta - \sum_{i=2}^{N}(L_1 - L_a)\theta_i - (L_p - L_a)\theta_p$$

9.5 Concentration of Pollutant, Corrected for Moisture, ppm

$$M_n = \left(\frac{M_n}{M_{fd}}\right)$$

9.6 Concentration of Volatile Organic Compounds, Corrected to Standard Conditions, ppm as Carbon

$$M_n[VOC] = \left(\frac{(M_{np})\left(\frac{3\ Carbon}{Propane}\right)}{M_{fd}}\right)$$

9.7 Concentration of Pollutant, Corrected for Oxygen, ppm

$$M_n = (M_n)\left(\frac{20.9 - \%O_{2Corr}}{20.9 - \%O_{2dry}}\right)$$

9.8 Concentration of Pollutant (CO, NOx), Corrected for Carbon Dioxide, ppm

$$M_n = (M_n)\left(1 - \frac{\%CO_{2dry}}{100}\right)$$

10. EFFICIENCY EQUATIONS

10.1 Capture Efficiency, percent

$$\%C = \left(\frac{M_{p(outlet)}}{M_{p(inlet)}}\right)100$$

10.2 Destruction Reduction Efficiency, percent

$$\%DRE = \left(\frac{M_{p(inlet)} - M_{p(outlet)}}{M_{p(inlet)}}\right)100$$

11. METHOD 8 EQUATIONS

11.1 Emission Rate of Pollutant (SO_2), pounds/cubic foot

$$C_{SO2} = (K_3)\left(\frac{N(V_t - V_{tb})\left(\frac{V_{solution}}{V_{aliquot}}\right)}{Vm_{std}}\right)$$

$$K3 = 7.061 \times 10^{-5} \text{ lb / meq}$$

11.2 Emission Rate of Pollutant (H_2SO_4), pounds/cubic foot

$$C_{H2SO4} = (K_2)\left(\frac{N(V_t - V_{tb})\left(\frac{V_{solution}}{V_{aliquot}}\right)}{V_{mstd}}\right)$$

$$K2 = 1.081 \times 10^{-4} \text{ lb / meq}$$

12. NOMINAL NOZZLE SIZE

12.1 Nozzle Determination, inches

$$D_n = \sqrt{\frac{(0.0358)(Q_m)(P_m)}{(T_m°R)(C_p)(M_{fd})}} \sqrt{\frac{(T_s°R)(M_s)}{(P_s)(\overline{\Delta P})}}$$

12.2 PM10 Nozzle Determination, inches

$$Dn = \sqrt{\frac{Qa}{Cp(\sqrt{DP})\left(\frac{85.49 * 3.1416 * 60}{576}\right)\left(\sqrt{\frac{Ts°R}{(Ps)(Ms)}}\right)}}$$

Qa is obtained from PM10 manual (acfm)

13. F-FACTOR EQUATIONS

Note: All Cs values must be in pounds per standard cubic foot (lbs/scf)
See EPA 40 CFR 60, App. A, Method 9, Sec. 2.0.

Conversion Factors for Concentration

From	To	Multiply by
g/scm	ng/scm	1.00E+09
mg/scm	ng/scm	1.00E+06
lb/scf	ng/scm	1.60E+13
ppm SO2	ng/scm	2.66E+06
ppm NOx	ng/scm	1.91E+06
ppm SO2	lb/scf	1.66E-07
ppm NOx	lb/scf	1.19E-07

13.1 Oxygen-Based F Factor, Dry Basis

$$E = (C_d)(F_d)\left(\frac{20.9}{20.9 - \%O_{2dry}}\right)$$

13.1a Oxygen-Based F Factor, Dry Basis, correcting to 7% Oxygen

$$E = (C_d)(F_d)\left(\frac{20.9 - 7.0}{20.9 - \%O_{2dry}}\right)$$

13.2 Oxygen-Based F Factor, Wet Basis

$$E = (C_w)(F_d)\left(\frac{20.9}{20.9 - \%O_{2dry}}\right)$$

13.3 Oxygen-Based F Factor, Dry/Wet Basis

$$E = \frac{(C_w)(F_w)}{(M_{fd})}\left(\frac{20.9 - \%O_{2dry}}{20.9}\right)$$

Note: When pollutant is measured on wet basis and %O2 is measured on a dry basis.

13.4 Oxygen-Based F Factor, Dry/Wet Basis

$$E = (C_w)(F_d)(20.9)\left(\frac{(M_{fd})}{20.9 - \%O_{2wet}}\right)$$

Note: When pollutant is measured on dry basis and %O2 is measured on a wet basis.

$$E = (C_{dry})(F_c)\left(\frac{100}{\%CO_{2dry}}\right)$$

13.5 Carbon Dioxide-Based Factor, Wet Basis

$$E = (F_c)(C_{wet})\left(\frac{100}{\%CO_{2wet}}\right)$$

13.6 Carbon Dioxide-Based Factor, Dry/Wet Basis

$$E = \left[\frac{(C_w)(F_c)}{M_{fd}}\right]\left(\frac{100}{\%CO_{2dry}}\right)$$

Note: When pollutant is measured on wet basis and %O2 is measured on a dry basis.

13.7 Carbon Dioxide-Based Factor, Dry/Wet Basis

$$E = \left(\frac{(C_{dry})(M_{fd})(F_c)100}{\%CO_{2wet}}\right)$$

Note: When pollutant is measured on dry basis and %O2 is measured on a wet basis.

14. CYCLONIC FLOW

14.1 Average Stack Gas Velocity, feet per second (Cyclonic), used for Isokinetic Determination Only

$$V_{s[cyc]} = (K_p)(C_p)\left(\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$

14.2 Average Stack Gas Velocity, feet per second (Laminar)

$$V_{s[lam]} = (K_p)(C_p)\left(\sqrt{\cos\phi(\Delta P)}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$

Note: When using Microsoft Excel, the Cosine function is in Radians. To convert Degrees to Radians multiply by $\pi/180$ (where π=3.1416).

14.3 Determination of Sampling Time

$$\text{Minutes / Point} = \cos\phi(\text{Base Time})$$

14.4 Average Differential Pressure

$$\Delta P_{vavg} = \left[\frac{\sum \cos\phi\sqrt{\Delta P}}{n}\right]^2$$

14.5 Axial Volumetric Flow Rate

$$Q_s = K_p C_p A_s \sqrt{\frac{T_s}{P_s M_s}} \frac{\sum_i^n \left(\sqrt{\Delta P_i}\cos\phi_i\right)}{n}$$

15. METHOD 5 POST TEST CALIBRATION

15.1 Alternative Method 5 Post-Test Calibration

$$Y_{qa} = \left(\frac{\theta}{V_m}\right)\left(\sqrt{\Delta H_{avg}}\right)\sqrt{\frac{\left(\frac{P_{std}}{T_{std}}\right)(Q_m)^2(T_m{}^\circ R)(M_{d(AMB)})}{(\Delta H@)\left(P_{bar}+\frac{\Delta H_{avg}}{13.6}\right)(M_d)}}$$

15.2 CRITICAL ORIFICE

$$V_{mstd} = (K1)(V_m)\left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m°R}\right) \qquad V_{cr(std)} = (K_{co})(\theta)\left(\frac{P_{bar}}{\sqrt{T_{amb}}}\right) \qquad Y = \left(\frac{V_{cr(std)}}{V_{m(std)}}\right)$$

16. WET BULB/DRY BULB

16.1 %Moisture at Saturation As a Function of Temperature

$$W_2 = \frac{10^{\left(6.6911 - \left(\frac{3144}{T_w + 390.86}\right)\right)}}{P_b + \left(\frac{P_s}{13.6}\right)}$$

W_2=Value in %Moisture at Saturation As a Function of Temperature Table

* Note: Use Equation when Stack Temperature is greater than 211°F or less than 50°F. Also use Equation if the absolute value of the Static Stack Pressure is greater than 1.

16.2 Percent Moisture in Stack Gas

$$\%H_2O = \left[W_2 - (0.000367)(T_d - T_w)\left(1 + \frac{T_w - 32}{1571}\right)\right](100)$$

16.3 Water Vapor in the Stack Gas, Proportion by Volume

$$Bws = \frac{\%H_2O}{100}$$

17. VOLUME PER POINT (ISOKINETIC TESTING)

17.1 Volume per Point

$$\frac{Vm}{Point} = \frac{60\ (V_s)(P_s)(\theta)(A_n)(M_{fd})(T_m°R)}{(Y)\left(P_{bar} + \frac{\Delta H}{13.6}\right)(T_s°R)}$$

18. INSTRUMENT TESTING

18.1 EFFLUENT GAS CONCENTRATION

$$C_{gas} = (C_{avg} - C_o)\left(\frac{C_{ma}}{C_m - C_o}\right)$$

[EPA 40 CFR 60, App. A, Method 6C, 8.0; Method 7E, 8.0]

18.2 Concentration of Carbon Monoxide, Corrected for Carbon Dioxide, ppm

$$M_n[co] = (M_n[co])\left(1 - \frac{\%CO_2}{100}\right)$$

[EPA 40 CFR 60, App. A, Method 10, 9.0]

18.3 SYSTEM CALIBRATION BIAS

$$\text{System Calibration Bias} = \left(\frac{\text{System Cal. Response - Analyzer Cal. Response}}{\text{Span}}\right)100$$

18.4 DRIFT CHECK

$$\%\text{Drift} = \left(\frac{|\text{Final System Cal. Response - Initial System Cal. Response}|}{\text{Span}}\right)100$$

19. HEAT INPUT

19.1 Heat Input Rate

$$HI = \left(\frac{Q_s}{F}\right)\left(\frac{20.9 - \%O_2}{20.9}\right)$$

20. CONVERSION FACTORS

Conversion Factors for Concentration			
From	To	Multiply By	Reference
g/scm	ng/scm	1.00E+09	EPA 40 CFR 60, App. A, Method 19
mg/scm	ng/scm	1.00E+06	EPA 40 CFR 60, App. A, Method 19
lb/scf	ng/scm	1.60E+13	EPA 40 CFR 60, App. A, Method 19
ppm SO2	ng/scm	2.66E+06	EPA 40 CFR 60, App. A, Method 19
ppm NOx	ng/scm	1.91E+06	EPA 40 CFR 60, App. A, Method 19
ppm SO2	lb/scf	1.66E-07	EPA 40 CFR 60, App. A, Method 19
ppm NOx	lb/scf	1.19E-07	EPA 40 CFR 60, App. A, Method 19
scf	m^3	0.02832	EPA 40 CFR 60, App. A, Method 5
g/ft^3	gr/ft^3	15.43	EPA 40 CFR 60, App. A, Method 5
g/ft^3	lb/ft^3	2.205×10^{-3}	EPA 40 CFR 60, App. A, Method 5
g	mg	0.001	EPA 40 CFR 60, App. A, Method 5

21. CONSTANTS

Constants				
Abbreviation	Name	Value	Units	Reference
Kp	Pitot Constant	85.49		EPA 40 CFR 60, App. A, Method 2
Mw	Molecular Weight of Water	18.0	lb/lb-mole	EPA 40 CFR 60, App. A, Method 5
P(std)	Standard Pressure	29.92	In. Mercury	EPA 40 CFR 60, App. A, Method 2
T(std)	Standard Temperature	528	degrees Rankin	EPA 40 CFR 60, App. A, Method 2
R	Ideal gas constant	21.85	ft3/lb-mole	EPA 40 CFR 60, App. A, Method 5
%O2(amb)	Ambient Percent Oxygen	20.9	%O2 by volume	EPA 40 CFR 60, App. A, Method 3B
%CO2(amb)	Ambient Percent Carbon Dioxide	0.03	%O2 by volume	EPA 40 CFR 60, App. A, Method 3B
$\rho\omega$	Density of Water	0.002201	lb/ml	EPA 40 CFR 60, App. A, Method 5
π	PI	3.1416		

22. NOMENCLATURE

Symbol	Description	Unit
A_n	Area of the Nozzle	Square feet (ft^2)
A_s	Area of the Stack	Square feet (ft^2)
B_{ws}	Water vapor in the stack gas	Proportion by volume
B_{wa}	Moisture content of ambient air	Proportion by volume
Cdry	Particulate concentration, dry basis	Mass/Volume
C_{H2SO4}	Emission Rate of Hydrogen Sulfide	Milligrams per cubic foot
C_p	Pitot Coefficient	Dimensionless
C_s	Particulate concentration	Mass/Volume
C_{s12}	Concentration correction to 12% Carbon Dioxide	Mass/Volume
C_{s50}	Concentration correction to 50% Excess Air	Mass/Volume
C_{sd}	Particulate concentration	Grains per dry standard cubic feet (gr/dscf)
C_{wet}	Particulate concentration	Mass/Volume, wet basis
D_n	Diameter of the Nozzle	Inches (in.)
dscf	Unit of Flow measurement	Dry standard cubic feet
$D_{s(depth)}$	Depth of the stack	Inches (in.)
$D_{s(width)}$	Width of the stack	Inches (in.)
E	Emission rate	Mass per heat BTU input

Symbol	Description	Unit
F	F-Factor	Using F_c or F_d
F_c	F-Factor, wet basis	Using C_s and $\%CO_2$ on a wet or dry basis
F_d	F-Factor, dry basis	Using C_s and $\%O_2$ on a dry basis
F_w	F-Factor	Using C_{ws} and $\%O_2$ on a wet basis
ft	Unit of measurement	Feet
g	Unit of measurement	Grams
gr	Unit of measurement	Grains
HI	Heat Input	mmBTU/hr
hr	Unit of time measurement	Hour
in	Unit of measurement	Inch
K	Constant	Constant used for DGM
K2	Constant used for H_2SO_4 titrations	7.061 X 10-5 lb/meq
K3	Constant used for SO_2 titrations	7.061 X 10-5 lb/meq
K4	Constant used for Raw Isokinetics	2.676 X 10^{-3} lb/meq
Kcf	Constant Correction Factor	Constant
Kco	Constant for Critical Orifice	Constant
Kp	Unit Conversion Constant for Velocity	85.49
L_a	Average Leakrate	Cubic feet
lbs	Unit of Weight measurement	Pounds
L_i	Initial Leakrate	Cubic feet

Symbol	Description	Unit
L_p	Post Leakrate	Cubic feet
M_d	Molecular weight of stack gas, dry basis	Pound per pound-mole (lb/lb-mole)
M_{fd}	Mole fraction dry basis of stack gas	Percent
min	Unit of time measurement	Minutes
mg	Unit of weight measurement	Milligrams
M_n	Mass pollutant found in sampling train	Micrograms (µg)
M_{nVOC}	Mass pollutant (VOC) determined with FID (as carbon)	parts per million (ppm)
M_{nP}	Mass pollutant (VOC) determined with FID (as propane)	parts per million (ppm)
M_p	Total pollutant mass emissions rate	Pounds per hour (lb/hr)
M_{pro}	Total pollutant mass emissions rate based on production rate	Pounds per ton (lb/ton)
$M_{p(Off)}$	Total pollutant mass emissions rate, while the scrubber is Off	Pounds per hour (lb/hr)
$M_{p(On)}$	Total pollutant mass emissions rate while the scrubber is On	Pounds per hour (lb/hr)
$M_{p(inlet)}$	Total pollutant mass emissions rate, inlet	Pounds per hour (lb/hr)
$M_{p(outlet)}$	Total pollutant mass emissions rate, outlet	Pounds per hour (lb/hr)
M_s	Molecular weight of stack gas, wet basis	Pound per pound-mole (lb/lb- mole)
MW	Molecular weight of pollutant	Grams per mole (g/mole)
n	Number of sampling points	Number

Symbol	Description	Unit
P_{bar}	Barometric pressure	Inches of mercury (in. of Hg)
P_g	Pressure of stack gas (static pressure)	Inches of water (in. of H_2O)
PMR	Pollutant Mass Rate	Mass per volume
ppm	Unit of Measurement	Parts per Million
P_s	Absolute stack gas pressure	Inches of mercury (in. of Hg)
$P_{s(sgd)}$	Sample Gas Density	Pounds per cubic foot
$P_{s(std)}$	Absolute stack gas pressure,	Inches of mercury (in. of Hg)
P_{std}	Standard pressure, 29.92 in. Hg	Inches of mercury (in. of Hg)
Qa	Wet volumetric stack gas flow rate at actual conditions	Actual cubic feet/hour (acf/hr)
Qm	Orifice Meter Calibration (Q_m=0.75 cfm) [at standard conditions]	Dry standard cubic feet per minute (dscf/min)
Qs	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions	Dry standard cubic feet per hour (dscf/hr)
Qs(avg)	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions Average flow before and after flow measurement	Dry standard cubic feet per hour (dscf/hr)
T_d	Absolute dry gas stack temperature Dry Bulb Temperature	Degrees Rankin (°R)
T_m°R	Absolute dry gas meter temperature	Degrees Rankin (°R)
T_s°R	Absolute stack temperature	Degrees Rankin (°R)
T_{std}	Standard temperature (528°R)	Degrees Rankin (°R)

Symbol	Description	Unit
T_w	Absolute wet gas stack temperature Wet Bulb Temperature	Degrees Rankin (°R)
T°C	Temperature in Celsius	Degrees Celsius (°C)
T°F	Temperature in Fahrenheit	Degrees Fahrenheit (°F)
T°R	Temperature in Rankin	Degrees Rankin (°R)
sec	Unit of time measurement	Seconds
$V_{aliquot}$	Volume of Aliquot	Milliliter (ml)
$V_{cr(std)}$	Volume of gas passed through the critical orifice, correct to standard conditions.	Dry standard cubic feet (dcf)
V_{lc}	Volume of water vapor condensed in the impingers	Milliliter (ml)
V_m	Volume of gas sample as measured by the dry gas meter	Dry cubic feet (dcf)
$V_{m(std)}$	Volume of gas sample as measured by the dry gas meter, corrected to standard conditions	Dry standard cubic feet (dscf)
$V_{m(std)(Total)}$	Volume of gas sample as measured by the dry gas meter, corrected to standard conditions	Dry standard cubic feet (dscf)
V_s	Average stack gas velocity	Feet per second (ft/sec)
$V_{solution}$	Volume of Solution (Sample)	Milliliter (ml)
V_{wsg}	Weight of water vapor condensed in silica gel	Grams (g)
$V_{w(std)}$	Volume of water vapor in the gas sample, corrected to standard conditions	Standard cubic feet (scf)
$V_{wc(std)}$	Volume of water vapor condensed in impingers, corrected to standard conditions	Standard cubic feet (scf)

Symbol	Description	Unit
V_t	Volume of Titrant used	Milliliters (ml)
V_{tb}	Volume of Titrant used on Blank	Milliliters (ml)
$V_{wsg(std)}$	Volume of water vapor condensed in silica gel, corrected to standard conditions	Standard cubic feet (scf)
W_{sg}	Total weight of Gas sampled	Pounds
W_2	Calculated constant, saturation $\%H_2O$ at Tw	Pounds
Y	Dry gas meter calibration factor	Dimensionless
Y_{aq}	Dry gas meter calibration check value	Dimensionless
$\Delta H@$	Pressure drop across orifice meter of dry gas meter	Inches of water (in. of H_2O)
ΔH	Average pressure differential across the orifice	Inches of water (in. of H_2O)
ΔP	Average velocity head of stack gas	Inches of water (in. of H_2O)
$\sqrt{\Delta P}$	Average squareroot velocity head of stack gas	Inches of water (in. of H_2O)
%C	Percent Capture Efficiency	Percent (%)
$\%CO_{dry}$	Percent carbon monoxide by volume, dry basis	Percent (%)
$\%CO_{2dry}$	Percent carbon dioxide by volume, dry basis	Percent (%)
$\%CO_{2wet}$	Percent carbon dioxide by volume, wet basis	Percent (%)
%DRE	Percent Destruction Reduction Efficiency	Percent (%)
%EA	Percent Excess Air	Percent (%)

Symbol	Description	Unit
%I	Isokinetic Variation	Percent (%)
Raw %I	Raw Isokinetic Variation	Percent (%)
$\%N_2$	Percent nitrogen by volume, dry basis	Percent (%)
$\%O_{2dry}$	Percent oxygen by volume, dry basis	Percent (%)
$\%O_{2wet}$	Percent oxygen by volume, wet basis	Percent (%)
$\%O_{2Corr}$	Percent oxygen Correction Factor	Percent (%)
%Scrubber	Percent Scrubber Efficiency	Percent (%)
θ	Total sampling time	Minutes (min)
θi	Initial sampling time	Minutes (min)
θp	Final sampling time	Minutes (min)
π	pi, $\pi = 3.1416$	Constant
ø	Angle between velocity vector and stack axis	Degrees

III

APPENDIX III

FIELD DATA SHEETS

Method 1 Data Sheet

Plant	Albemarle	Date	11/7/2011
City/State	Orangeburg, SC	Job Number	ALBE00211
Sampling Location	Boiler #4	Technican	GMS

Ports		Diameters (in.)	
Number of Ports Available	4	Distance from far wall to outside of port	30.25
Number of Ports Used	2	Nipple length and/or wall thickness	7.00
Port Inside Diameter	4.0	Depth of Stack or Duct	23.25
		Stack or Duct width (if rectangular)	

	Distance (in.)	Diameters	Equivalent Diameter (if rectangular)
Upstream from disturbance	360	15.5	$D_e = \frac{2\,(\text{Depth})\ (\text{Width})}{(\text{Depth} + \text{Width})} =$
Downstream from disturbance	120	5.2	

ROUND STACK OR DUCT

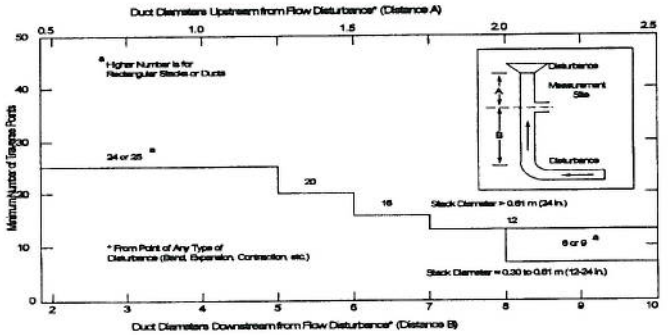
	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.5	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	6.7	4.3	4.4	3.9	3.5	3.2
3	75.0	29.4	19.4	14.6	11.5	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.8
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.8	80.6	65.8	35.5	26.9	22.0	18.8	16.5	14.5	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.4	85.4	75.0	63.4	37.5	29.5	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	78.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.3	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									96.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

SQUARE STACK OR DUCT

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.1
11										95.5	87.4
12											95.7

Decimal to Fraction Conversion Table

Decimal Inches	Fraction	Decimal Inches Range	Use These Fraction Inches
		0.0000-0.0625	0
0.125	1/8	0.0625-0.1874	1/8
0.250	1/4	0.1875-0.3125	1/4
0.375	3/8	0.3125-0.4375	3/8
0.500	1/2	0.4375-0.5625	1/2
0.625	5/8	0.5625-0.6875	5/8
0.750	3/4	0.6875-0.8125	3/4
0.875	7/8	0.8125-0.9375	7/8
		0.9375-1.0000	1



Point	Percent of Duct	Distance from Inside Wall	Distance from Outside of Port
1	4.4	1.02	8.02
2	14.6	3.39	10.39
3	29.4	6.84	13.84
4	70.4	16.37	23.37
5	85.4	19.86	26.86
6	95.8	22.27	29.27
7			
8			
9			
10			
11			
12			

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Cyclonic Flow Determinations

Client	Albemarle	Date	11/8/2011
Plant Site	Orangeburg, SC	Run Number	1
Sampling location	Boiler #4	Project Number	ALBE00211
Condition	normal	Observer	
GEL Test Personnel	GMH	Agency	

Data

Barometric Pressure	30.00	Type of Pitot	S
Manometer Number	MB 6	Pitot Number	P-601
Duct Dimensions (inches)	23.25	Pitot Coeffient	0.84

Preliminary Traverse

Start Time	9:25 AM
Stop Time	9:35 AM

Point Number	Sample Point	ΔP @ 90° (0° reference)	Rotation Angle (α) for null ΔP
1	A1	negative	12
2	A2	negative	10
3	A3	negative	5
4	A4	0.00	0
5	A5	0.01	2
6	A6	0.08	5
7	B1	0.00	0
8	B2	0.00	0
9	B3	0.00	0
10	B4	0.05	8
11	B5	0.08	15
12	B6	0.10	20
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
Mean			6.4

Note: The mean of the angle must be less than 20 degrees

EPA Method 5 Data Sheet

Plant	Albemarle	Date	11/9/2011
City/State	Orangeburg, SC	Run Number	Run 1
Sampling Location	Boiler #4	Time Start	11:16 AM
Condition of Source	Normal	Time Stop	12:21 PM
Method	5	Job Number	ALBE00211
Operator	GMS	Observer	Urva Patel
Assistant	SAH	Agency	SCDHEC

LINE	Sample Point	Clock Time [Time] Minutes	Dry Gas Meter Reading [Vm] Cubic Feet	Pitot Reading In. H2O [ΔP] [Red]	Orifice Setting In. H2O [ΔH] [Yellow]	Gas Temperatures °F Stack [Ts] [1]	Probe [2]	Filter [3]	Impinger [4]	Meter [Tm] [6]	Gauge Vaccuum In. Hg
1	A1	0	52.064	0.45	1.22	294	240	254	58	67	2
2	A2	5	54.8	0.49	1.32	298	256	251	50	68	2
3	A3	10	58.0	0.50	1.35	300	257	252	49	69	2
4	A4	15	61.1	0.50	1.34	303	253	252	47	69	2
5	A5	20	64.2	0.45	1.21	302	255	252	47	70	2
6	A6	25	67.1	0.40	1.08	297	253	254	46	70	2
			69.834								
1	B1	30	70.418	0.44	1.19	296	252	252	48	70	2
2	B2	35	73.3	0.49	1.33	296	253	251	43	71	3
3	B3	40	76.4	0.47	1.28	300	254	252	43	74	3
4	B4	45	79.40	0.47	1.28	300	254	252	44	75	3
5	B5	50	82.5	0.45	1.23	300	254	253	46	76	3
6	B6	55	85.6	0.36	1.00	290	255	253	47	77	3
		60	88.532								
Avg			35.884	0.456	1.236	298.0				71.3	
			Avg. $\sqrt{\Delta P}$	0.623							

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Method 5 Back Datasheet

Equipment Checks			Run Time			Filter Box		
1	TEST NUMBER		Time per Point	5		Type of Box (Lg/Sm)	Lg	
X	Pitot Pretest (Visual, leakcheck)		Total Run Time	60		Type of Filter	quartz	
X	Pitot Post test (Visual, leakcheck)		Pressures			Filter Number	11Q-150	
X	Nozzle, Pretest (Visual)		Barometer Number	weather station				
X	Nozzle, Post test (Visual)		Pbar at Site	29.85				
NA	ORSAT System (leakcheck)		Static Stack Pressure	-0.23				
X	Method 1 Data Sheet		Meter Box			Probe		
X	Cyclonic Flow Data Sheet		Meter Box Number	MB 6		Probe Number	P-504	
X	Stack Dimensions:	23.25"	ΔH@ of DGM	1.8957		Pitot Type	S	
X	Assumed Moisture (%)	8	Gamma of DGM	1.0053		Pitot Coefficient	0.84	
Molecular Weight of Stack Gas			Pitot Tube Leak Check (Pretest)			Pitot Tube Leak Check (Post Test)		
	Source is Ambient; Md=29		Post Test LC Side	A	B	Post Test LC Side	A	B
X	Method 3A Performed		Pressure Tap (in. H2O)	>= 3.0	>= 3.0	Pressure Tap (in. H2O)	>= 3.0	>= 3.0
	Assumed Mol. Wt.	30.1	Stable for 15 sec (Y/N)	Y	Y	Stable for 15 secs(Y/N)	Y	Y
Nozzle Size			System Leakcheck (Pretest)			System Leakcheck (Post test)		
	Pretest	Nozzle Type	Leakrate	0.006	0.004	Leakrate	0.003	0.003
1	0.250		Vaccuum (In. Hg)	15	12	Vaccuum (In. Hg)	16	10
2	0.250	Glass	Pass/Fail	Pass	Pass	Pass/Fail	Pass	Pass
3	0.250							
Avg	0.250							

Impinger Control Numbers

	Reagent	Control Number	Initial Weight	Final Weight	Weight Difference	Weight Total
1	DI		268.5	323.4	54.9	
2						
3						
4						
SG	Silica Gel		274	284.5	10.5	65.4

Nomenclature / Notes

Pbar - Barometric Pressure; in. Hg

MB - Meterbox

SSP - Static Stack Pressure, in. H2O

Ta - Ambient Temperature

Tf - Filter Box Temperature

Tm - Meter Temperature

Tp - Probe Temperature

Ts - Stack Temperature

(Y/N) -Yes or No

STACK DIAGRAM

EPA Method 5 Data Sheet

Plant	Albemarle	Date	11/9/2011
City/State	Orangeburg, SC	Run Number	Run 2
Sampling Location	Boiler #4	Time Start	12:45 PM
Condition of Source	Normal	Time Stop	1:53 PM
Method	5	Job Number	ALBE00211
Operator	GMS	Observer	Urva Patel
Assistant	SAH	Agency	SCDHEC

LINE	Sample Point	Clock Time [Time] Minutes	Dry Gas Meter Reading [Vm] Cubic Feet	Pitot Reading In. H2O [ΔP] [Red]	Orifice Setting In. H2O [ΔH] [Yellow]	Gas Temperatures °F Stack [Ts] [1]	Probe [2]	Filter [3]	Impinger [4]	Meter [Tm] [6]	Gauge Vaccuum In. Hg
1	A1	0	89.000	0.52	1.41	298	254	248	54	72	2
2	A2	5	92.2	0.51	1.38	299	253	248	46	73	2
3	A3	10	95.3	0.49	1.33	300	253	255	47	75	2
4	A4	15	98.4	0.47	1.28	300	255	256	47	76	2
5	A5	20	101.4	0.33	0.91	298	254	251	47	78	2
6	A6	25	103.8	0.30	0.84	285	253	254	48	77	2
			106.832								
1	B1	30	107.090	0.44	1.20	294	254	250	49	74	2
2	B2	35	110.1	0.41	1.12	296	253	248	46	75	2
3	B3	40	112.9	0.49	1.34	299	256	252	47	76	2
4	B4	45	115.8	0.47	1.28	301	255	253	48	78	2
5	B5	50	118.8	0.37	1.02	298	254	250	49	79	2
6	B6	55	121.7	0.35	0.96	297	256	256	50	79	2
		60	124.572								
Avg			35.314	0.429	1.173	297.1				76.0	
			Avg. $\sqrt{\Delta P}$	0.653							

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Method 5 Back Datasheet

Equipment Checks			Run Time			Filter Box	
2	TEST NUMBER		Time per Point	5		Type of Box (Lg/Sm)	Lg
X	Pitot Pretest (Visual, leakcheck)		Total Run Time	60		Type of Filter	quartz
X	Pitot Post test (Visual, leakcheck)		Pressures			Filter Number	11Q-154
X	Nozzle, Pretest (Visual)		Barometer Number	weather station			
X	Nozzle, Post test (Visual)		Pbar at Site	29.85			
NA	ORSAT System (leakcheck)		Static Stack Pressure	-0.24			
X	Method 1 Data Sheet		Meter Box			Probe	
X	Cyclonic Flow Data Sheet		Meter Box Number	MB 6		Probe Number	P-501
X	Stack Dimensions:	23.25"	ΔH@ of DGM	1.8957		Pitot Type	S
X	Assumed Moisture (%)	8	Gamma of DGM	1.0053		Pitot Coefficient	0.84
Molecular Weight of Stack Gas			Pitot Tube Leak Check (Pretest)			Pitot Tube Leak Check (Post Test)	
	Source is Ambient; Md=29		Post Test LC Side	A	B	Post Test LC Side	A B
X	Method 3A Performed		Pressure Tap (in. H2O)	>= 3.0	>= 3.0	Pressure Tap (in. H2O)	>= 3.0 >= 3.0
	Assumed Mol. Wt.	30.1	Stable for 15 sec (Y/N)	Y	Y	Stable for 15 secs(Y/N)	Y Y

Nozzle Size			System Leakcheck (Pretest)			System Leakcheck (Post test)		
	Pretest	Nozzle Type	Leakrate	0.003	0.002	Leakrate	0.003	0.003
1	0.250		Vaccuum (In. Hg)	12	6	Vaccuum (In. Hg)	10	7
2	0.250	Glass	Pass/Fail	Pass	Pass	Pass/Fail	Pass	Pass
3	0.250							
Avg	0.250							

Impinger Control Numbers

	Reagent	Control Number	Initial Weight	Final Weight	Weight Difference	Weight Total
1	DI		273.5	328.1	54.6	
2						
3						
4						
SG	Silica Gel		266.1	274.1	8	62.6

Nomenclature / Notes

Pbar - Barometric Pressure; in. Hg

MB - Meterbox

SSP - Static Stack Pressure, in. H2O

Ta - Ambient Temperature

Tf - Filter Box Temperature

Tm - Meter Temperature

Tp - Probe Temperature

Ts - Stack Temperature

(Y/N) -Yes or No

STACK DIAGRAM

EPA Method 5 Data Sheet

Plant	Albemarle	Date	11/9/2011
City/State	Orangeburg, SC	Run Number	Run 3
Sampling Location	Boiler #4	Time Start	2:16 PM
Condition of Source	Normal	Time Stop	3:25 PM
Method	5	Job Number	ALBE00211
Operator	GMS	Observer	Urva Patel
Assistant	SAH	Agency	SCDHEC

LINE	Sample Point	Clock Time [Time] Minutes	Dry Gas Meter Reading [Vm] Cubic Feet	Pitot Reading In. H2O [ΔP] [Red]	Orifice Setting In. H2O [ΔH] [Yellow]	Gas Temperatures °F Stack [Ts] [1]	Probe [2]	Filter [3]	Impinger [4]	Meter [Tm] [6]	Gauge Vaccuum In. Hg
1	A1	0	124.948	0.36	0.98	296	230	253	54	74	2
2	A2	5	127.6	0.45	1.22	299	255	253	49	74	2
3	A3	10	130.6	0.47	1.28	300	256	252	50	77	2
4	A4	15	133.4	0.46	1.25	302	252	256	50	76	2
5	A5	20	136.7	0.42	1.15	303	256	250	51	78	3
6	A6	25	139.2	0.36	0.98	301	255	251	51	78	3
			141.815								
1	B1	30	142.121	0.42	1.15	293	255	247	53	75	3
2	B2	35	145.0	0.48	1.31	299	254	254	54	77	4
3	B3	40	148.1	0.47	1.28	301	255	251	54	78	4
4	B4	45	151.1	0.49	1.34	302	255	254	55	79	4
5	B5	50	154.2	0.45	1.23	301	255	254	55	79	4
6	B6	55	157.2	0.38	1.04	298	254	254	56	79	4
		60	159.925								
Avg			34.671	0.434	1.184	299.6				77.0	
			Avg. $\sqrt{\Delta P}$	0.658							

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Method 5 Back Datasheet

Equipment Checks			Run Time			Filter Box	
3	TEST NUMBER		Time per Point	5		Type of Box (Lg/Sm)	Lg
X	Pitot Pretest (Visual, leakcheck)		Total Run Time	60		Type of Filter	quartz
X	Pitot Post test (Visual, leakcheck)		Pressures			Filter Number	11Q-164
X	Nozzle, Pretest (Visual)		Barometer Number	weather station			
X	Nozzle, Post test (Visual)		Pbar at Site	29.80			
NA	ORSAT System (leakcheck)		Static Stack Pressure	-0.22			
X	Method 1 Data Sheet		Meter Box			Probe	
X	Cyclonic Flow Data Sheet		Meter Box Number	MB 6		Probe Number	P-504
X	Stack Dimensions:	23.25"	ΔH@ of DGM	1.8957		Pitot Type	S
X	Assumed Moisture (%)	8	Gamma of DGM	1.0053		Pitot Coefficient	0.84
Molecular Weight of Stack Gas			Pitot Tube Leak Check (Pretest)			Pitot Tube Leak Check (Post Test)	
	Source is Ambient; Md=29		Post Test LC Side	A	B	Post Test LC Side	A B
X	Method 3A Performed		Pressure Tap (in. H2O)	>= 3.0	>= 3.0	Pressure Tap (in. H2O)	>= 3.0 >= 3.0
	Assumed Mol. Wt.	30.1	Stable for 15 sec (Y/N)	Y	Y	Stable for 15 secs(Y/N)	Y Y

Nozzle Size			System Leakcheck (Pretest)			System Leakcheck (Post test)		
	Pretest	Nozzle Type	Leakrate	0.004	0.002	Leakrate	0.005	0.002
1	0.250		Vaccuum (In. Hg)	15	7	Vaccuum (In. Hg)	12	10
2	0.250	Glass	Pass/Fail	Pass	Pass	Pass/Fail	Pass	Pass
3	0.250							
Avg	0.250							

Impinger Control Numbers

	Reagent	Control Number	Initial Weight	Final Weight	Weight Difference	Weight Total
1	DI		269.8	321.6	51.8	
2						
3						
4						
SG	Silica Gel		253.6	262	8.4	60.2

Nomenclature / Notes

Pbar - Barometric Pressure; in. Hg

MB - Meterbox

SSP - Static Stack Pressure, in. H2O

Ta - Ambient Temperature

Tf - Filter Box Temperature

Tm - Meter Temperature

Tp - Probe Temperature

Ts - Stack Temperature

(Y/N) -Yes or No

STACK DIAGRAM

Albemarle Boiler #4
11/09/11, Method 3A
Run 12 (R-1 Method 5)

Time	CO ppm	O2 %	CO2 %
11:16	4.4	7.50	10.33
11:17	4.5	7.44	10.34
11:18	4.6	7.52	10.29
11:19	4.7	7.53	10.29
11:20	4.6	7.50	10.32
11:21	4.7	7.41	10.33
11:22	4.6	7.34	10.39
11:23	4.5	7.39	10.34
11:24	4.5	7.71	10.11
11:25	4.5	7.78	10.10
11:26	4.5	7.53	10.29
11:27	4.6	7.45	10.33
11:28	4.6	7.51	10.29
11:29	4.5	7.53	10.28
11:30	4.7	7.54	10.28
11:31	4.9	7.50	10.32
11:32	4.8	7.40	10.39
11:33	4.8	7.59	10.22
11:34	4.5	7.80	10.35
11:35	4.4	7.79	10.11
11:36	4.5	7.55	10.30
11:37	4.5	7.46	10.35
11:38	4.5	7.50	10.31
11:39	4.6	7.51	10.27
11:40	4.1	11.43	7.24
11:41	4.6	7.69	10.22
11:42	4.7	7.41	10.35
11:43	4.4	7.63	10.14
11:44	4.3	8.31	9.69
11:45	4.3	8.45	9.59
11:46	4.6	7.67	10.23
11:47	4.7	7.49	10.31
11:48	4.8	7.53	10.28
11:49	4.6	7.61	10.22
11:50	4.6	7.59	10.24
11:51	4.5	7.54	10.28
11:52	4.4	7.48	10.33
11:53	4.5	7.49	10.28
11:54	4.4	7.82	10.06
11:55	4.7	7.78	10.11
11:56	4.5	7.52	10.28
11:57	4.5	7.51	10.28
11:58	4.6	7.53	10.29
11:59	4.3	7.55	10.28
12:00	4.4	7.51	10.30
12:01	4.3	7.47	10.33
12:02	4.3	7.41	10.37
12:03	4.1	7.61	10.20
12:04	3.9	7.86	10.04
12:05	3.9	7.80	10.10
12:06	4.0	7.55	10.29
12:07	4.0	7.52	10.30
12:08	4.0	7.59	10.25
12:09	4.2	7.57	10.26
12:10	4.0	7.56	10.28
12:11	4.1	7.45	10.35
12:12	3.9	7.44	10.36
12:13	3.7	7.51	10.30
12:14	3.6	7.81	10.08
12:15	3.7	7.85	10.07
12:16	3.9	7.61	10.27
12:17	3.7	7.52	10.30
12:18	3.5	7.57	10.23
12:19	3.7	7.58	10.23
12:20	3.7	7.54	10.27
12:21	3.5	7.45	10.35
AVG	**4.3**	**7.65**	**10.20**

Albemarle Boiler #4
11/09/11, Method 3A
Run 13 (R-2 Method 5)

Time	CO ppm	O2 %	CO2 %
12:45	2.6	7.57	10.27
12:46	2.7	7.51	10.32
12:47	2.7	7.45	10.35
12:48	2.5	7.47	10.24
12:49	2.4	7.77	10.01
12:50	2.4	7.72	10.09
12:51	2.5	7.46	10.29
12:52	2.3	7.49	10.27
12:53	2.3	7.53	10.24
12:54	2.2	7.55	10.23
12:55	2.3	7.55	10.23
12:56	2.4	7.50	10.28
12:57	2.5	7.39	10.34
12:58	2.5	7.46	10.28
12:59	2.1	7.78	10.06
13:00	2.2	7.77	10.08
13:01	2.0	7.53	10.26
13:02	1.8	7.47	10.29
13:03	1.5	7.51	10.26
13:04	1.5	7.56	10.22
13:05	1.5	7.55	10.25
13:06	1.5	7.48	10.30
13:07	1.5	7.44	10.32
13:08	1.5	7.52	10.24
13:09	1.5	7.81	10.05
13:10	1.6	7.78	10.09
13:11	1.9	7.53	10.27
13:12	1.7	7.54	10.25
13:13	1.4	7.51	10.24
13:14	1.4	7.57	10.21
13:15	1.4	7.53	10.25
13:16	1.3	7.55	10.17
13:17	1.3	9.06	9.17
13:18	1.2	7.78	10.05
13:19	1.2	7.88	9.99
13:20	1.4	7.93	9.97
13:21	1.5	7.73	10.13
13:22	1.8	7.56	10.23
13:23	1.7	7.58	10.21
13:24	1.6	7.57	10.22
13:25	1.6	7.55	10.24
13:26	1.8	7.45	10.30
13:27	1.7	7.44	10.31
13:28	1.6	7.53	10.23
13:29	1.5	7.82	10.01
13:30	1.7	7.75	10.09
13:31	1.8	7.49	10.27
13:32	2.0	7.49	10.26
13:33	1.9	7.57	10.20
13:34	1.9	7.57	10.20
13:35	1.9	7.53	10.24
13:36	2.0	7.47	10.29
13:37	2.1	7.41	10.32
13:38	2.2	7.53	10.21
13:39	2.1	7.83	10.00
13:40	2.1	7.79	10.06
13:41	2.4	7.53	10.25
13:42	2.5	7.53	10.22
13:43	2.4	7.59	10.18
13:44	2.6	7.57	10.16
13:45	2.7	7.54	10.20
13:46	2.8	7.45	10.27
13:47	2.9	7.40	10.30
13:48	2.9	7.58	10.15
13:49	2.9	7.80	10.01
13:50	3.1	7.70	10.11
13:51	3.3	7.46	10.25
13:52	3.5	7.51	10.22
13:53	3.5	7.51	10.21
AVG	**2.1**	**7.60**	**10.19**

Albemarle Boiler #4
11/09/11, Method 3A
Run 14 (R-3 Method 5)

Time	CO ppm	O2 %	CO2 %
14:16	6.0	7.64	10.05
14:17	6.1	7.42	10.21
14:18	6.1	7.44	10.18
14:19	6.0	7.45	10.18
14:20	6.2	7.46	10.18
14:21	6.1	7.43	10.21
14:22	6.3	7.34	10.28
14:23	6.0	7.37	10.25
14:24	5.9	7.65	10.04
14:25	5.6	7.74	9.99
14:26	5.8	7.69	10.05
14:27	5.6	7.47	10.22
14:28	5.6	7.39	10.27
14:29	5.4	7.39	10.25
14:30	5.1	7.35	10.26
14:31	5.1	7.34	10.30
14:32	5.0	7.27	10.35
14:33	4.9	7.26	10.37
14:34	4.7	7.37	10.27
14:35	4.4	7.69	10.06
14:36	4.4	7.56	10.19
14:37	4.2	7.40	10.28
14:38	4.3	7.47	10.26
14:39	4.0	7.52	10.19
14:40	3.9	7.50	10.21
14:41	3.9	7.44	10.26
14:42	3.7	7.38	10.30
14:43	3.4	7.44	10.23
14:44	3.3	7.73	10.02
14:45	2.3	15.53	3.59
14:46	3.4	8.70	9.82
14:47	3.4	7.44	10.22
14:48	3.3	7.43	10.22
14:49	3.3	7.46	10.21
14:50	3.1	7.48	10.20
14:51	3.1	7.43	10.25
14:52	3.2	7.37	10.30
14:53	2.8	7.39	10.27
14:54	2.7	7.70	10.05
14:55	2.5	7.77	10.02
14:56	2.6	7.57	10.19
14:57	2.5	7.41	10.28
14:58	2.3	7.46	10.25
14:59	2.2	7.49	10.22
15:00	2.3	7.46	10.25
15:01	2.2	7.45	10.26
15:02	2.3	7.35	10.33
15:03	2.2	7.37	10.30
15:04	1.8	7.70	10.06
15:05	1.8	7.77	10.02
15:06	1.8	7.65	10.13
15:07	1.6	7.45	10.26
15:08	1.6	7.51	10.20
15:09	1.5	7.55	10.18
15:10	1.5	7.55	10.18
15:11	1.6	7.49	10.24
15:12	1.5	7.41	10.29
15:13	1.3	7.59	10.14
15:14	1.0	7.76	10.05
15:15	1.0	7.76	10.05
15:16	1.1	7.59	10.19
15:17	1.1	7.47	10.26
15:18	1.2	7.47	10.26
15:19	1.1	7.49	10.24
15:20	0.7	7.44	10.25
15:21	0.8	7.41	10.26
15:22	0.9	7.39	10.29
15:23	0.7	7.45	10.25
15:24	0.5	7.71	10.07
15:25	0.5	7.76	10.05
AVG	**3.2**	**7.63**	**10.10**

IV

APPENDIX IV

PARTICULATE MATTER DATA SHEETS

Boiler #4

Filter Weights

RUN No.	Filter No.	Pre Weights (1)	Pre Weights (2)	Pre Weights Average	Post Weights (1)	Post Weights (2)	Post Weights Average	Total Catch Filter
1	11Q-150	8.4884 g	8.4887 g	8.4886 g	8.4903 g	8.4907 g	8.4905 g	0.0019 g
2	11Q-154	8.4617 g	8.4621 g	8.4619 g	8.4637 g	8.4632 g	8.4635 g	0.0016 g
3	11Q-164A	8.4642 g	8.4644 g	8.4643 g	8.4642 g	8.4644 g	8.4643 g	0.0000 g

	Date	Time	Balance	Temperature	Humidity	Analyst
Pre - Weighing (1)	9/22/2011	10:15 AM	FC-C-001	76	54	GMS
Pre - Weighing (2)	9/23/2011	6:35 AM	FC-C-001	73	53	SAH
Post - Weighing (1)	11/18/2011	3:15 PM	FC-C-001	69	28	CER
Post - Weighing (2)	11/21/2011	9:15 AM	FC-C-001	71	47	CER

Probe Rinse Weights

RUN No.	Pan No.	Tare Weight	Rinse Volume		Final Weights (1)	Final Weights (2)	Final Weights Average	Total Catch Probe Wash
1	PW-579	3.8143 g	125 ml		3.8166 g	3.8170 g	3.8168 g	0.0025 g
2	PW-580	3.8264 g	130 ml		3.8267 g	3.8271 g	3.8269 g	0.0005 g
3	PW-594	3.7570 g	110 ml		3.7585 g	3.7588 g	3.7587 g	0.0017 g
Blank	PW-595	3.7814 g	100 ml		3.7815 g	3.7814 g	3.7815 g	0.0001 g
							maximum allowable blank subraction =	0.0008 g

	Date	Time	Balance	Temperature	Humidity	Analyst
Tare Weight	11/7/2011	12:00 PM	FC-C-001	71	60	CER
Post - Weighing (1)	11/16/2011	3:00 PM	FC-C-001	74	52	CER
Post - Weighing (2)	11/17/2011	9:15 AM	FC-C-001	73	46	CER

Total Weights

RUN No.		Filter Weights		Filter Weights Average	Probe Rinse Weights (minus blank weight)		Probe Rinse Weights Average	Total Catch PM Train
1				0.0019 g			0.0024 g	0.0043 g
2				0.0016 g			0.0004 g	0.0020 g
3				0.0000 g			0.0016 g	0.0016 g

APPENDIX V

PRODUCTION DATA

	CO-OMA	O2-OMA	feed OMA	temp OMA	exit BHI-OMA	pph Stm-OMA	enter BHX-OMA
11/9/11 11:16							
11/9/11 11:17							
11/9/11 11:18							
11/9/11 11:19							
11/9/11 11:20							
11/9/11 11:21							
11/9/11 11:22							
11/9/11 11:23							
11/9/11 11:24							
11/9/11 11:25							
11/9/11 11:26							
11/9/11 11:27							
11/9/11 11:28							
11/9/11 11:29							
11/9/11 11:30							
11/9/11 11:31							
11/9/11 11:32							
11/9/11 11:33			DATA NOT AVAILABLE				
11/9/11 11:34							
11/9/11 11:35							
11/9/11 11:36							
11/9/11 11:37							
11/9/11 11:38							
11/9/11 11:39							
11/9/11 11:40							
11/9/11 11:41							
11/9/11 11:42							
11/9/11 11:43							
11/9/11 11:44							
11/9/11 11:45							
11/9/11 11:46							
11/9/11 11:47							
11/9/11 11:48							
11/9/11 11:49							
11/9/11 11:50							
11/9/11 11:51							
11/9/11 11:52							
11/9/11 11:53							
11/9/11 11:54	5.1	7.7	17.7	1,781	354	14.467	352
11/9/11 11:55	5.1	7.8	17.8	1,781	354	14.094	352
11/9/11 11:56	5.1	7.8	17.7	1,781	354	13.741	352
11/9/11 11:57	5.1	7.7	17.3	1,781	354	13.513	352
11/9/11 11:58	5.1	7.6	17.3	1,781	354	14.084	352
11/9/11 11:59	5.1	7.8	17.6	1,781	354	15.767	352
11/9/11 12:00	5.1	8.0	17.7	1,781	354	14.960	351
11/9/11 12:01	5.1	8.0	17.6	1,781	354	14.510	351
11/9/11 12:02	5.2	7.9	17.6	1,781	354	13.039	351
11/9/11 12:03	5.2	7.7	17.6	1,781	354	13.484	351
11/9/11 12:04	5.2	7.7	17.7	1,781	354	12.817	351
11/9/11 12:05	5.2	7.7	17.8	1,781	354	13.223	352
11/9/11 12:06	5.2	7.7	17.6	1,782	354	13.785	352
11/9/11 12:07	5.2	7.7	17.1	1,782	354	13.583	352
11/9/11 12:08	5.2	7.6	17.2	1,782	354	13.228	352
11/9/11 12:09	5.2	7.9	17.5	1,782	354	12.785	352
11/9/11 12:10	5.2	8.0	17.6	1,782	354	13.827	352
11/9/11 12:11	5.3	8.0	17.5	1,782	355	14.789	352
11/9/11 12:12	5.3	7.9	17.5	1,782	355	13.250	352
11/9/11 12:13	5.3	7.7	17.6	1,782	355	14.692	352
11/9/11 12:14	5.3	7.8	17.7	1,782	355	14.955	352
11/9/11 12:15	5.3	7.8	17.7	1,782	355	15.381	352
11/9/11 12:16	5.3	7.8	17.7	1,782	355	14.452	352
11/9/11 12:17	5.3	7.6	17.3	1,782	355	11.681	352
11/9/11 12:18	5.3	7.6	17.2	1,782	355	12.698	352
11/9/11 12:19	5.4	7.8	17.5	1,782	355	12.742	352
11/9/11 12:20	5.4	8.0	17.6	1,782	355	12.909	352
11/9/11 12:21	5.4	8.0	17.6	1,782	355	16.313	352
11/9/11 12:22	5.4	7.9	17.5	1,782	355	14.971	352
11/9/11 12:23	5.4	7.7	17.5	1,782	355	13.320	352
11/9/11 12:24	5.4	7.8	17.7	1,782	355	12.650	352
11/9/11 12:25	5.4	7.8	17.7	1,782	355	12.732	353
11/9/11 12:26	5.4	7.8	17.4	1,782	355	13.738	353
11/9/11 12:27	5.4	7.7	17.2	1,783	355	14.448	353
11/9/11 12:28	5.5	7.7	17.2	1,783	355	16.232	353
11/9/11 12:29	5.5	7.9	17.5	1,783	355	14.582	352
11/9/11 12:30	5.5	8.0	17.6	1,783	355	12.667	352
11/9/11 12:31	5.5	8.0	17.6	1,783	355	11.935	353
11/9/11 12:32	5.5	7.9	17.5	1,783	355	13.383	353
11/9/11 12:33	5.5	7.7	17.6	1,783	355	13.404	353
11/9/11 12:34	5.5	7.8	17.7	1,783	355	15.274	353
11/9/11 12:35	5.5	7.8	17.7	1,783	355	13.985	353
11/9/11 12:36	5.5	7.7	17.3	1,783	355	13.025	353
11/9/11 12:37	5.6	7.6	17.3	1,783	355	12.359	353
11/9/11 12:38	5.6	7.8	17.3	1,783	355	12.829	353

	CO-OMA	O2-OMA	feed OMA	temp OMA	BHI-OMA	Stm-OMA	BHX-OMA
11/9/11 14:03	6.6	7.6	17.5	1,785	356	13.658	353
11/9/11 14:04	6.6	7.7	17.5	1,785	356	13.319	353
11/9/11 14:05	6.6	7.7	17.7	1,785	356	13.345	354
11/9/11 14:06	6.6	7.7	17.6	1,785	356	13.863	354
11/9/11 14:07	6.6	7.7	17.6	1,785	356	13.586	354
11/9/11 14:08	6.6	7.6	17.6	1,785	356	14.075	354
11/9/11 14:09	6.6	7.6	17.5	1,785	356	14.173	354
11/9/11 14:10	6.6	7.6	17.4	1,785	356	14.067	354
11/9/11 14:11	6.6	7.7	17.4	1,785	356	13.512	354
11/9/11 14:12	6.7	7.8	17.4	1,785	356	13.431	354
11/9/11 14:13	6.7	7.8	17.5	1,785	356	13.162	354
11/9/11 14:14	6.7	7.7	17.6	1,785	356	12.593	354
11/9/11 14:15	6.7	7.7	17.6	1,785	356	13.447	354
11/9/11 14:16	6.7	7.7	17.3	1,784	356	14.256	354
11/9/11 14:17	6.7	7.6	17.2	1,784	356	13.697	354
11/9/11 14:18	6.7	7.7	17.2	1,784	356	13.411	354
11/9/11 14:19	6.7	7.9	17.5	1,784	356	13.126	354
11/9/11 14:20	6.7	8.0	17.5	1,784	356	12.939	354
11/9/11 14:21	6.8	7.9	17.5	1,784	356	13.346	354
11/9/11 14:22	6.8	7.8	17.5	1,785	356	13.852	354
11/9/11 14:23	6.8	7.7	17.5	1,785	356	14.076	354
11/9/11 14:24	6.8	7.7	17.6	1,785	356	13.778	354
11/9/11 14:25	6.8	7.7	17.7	1,785	356	13.477	354
11/9/11 14:26	6.8	7.7	17.4	1,785	356	13.202	354
11/9/11 14:27	6.8	7.6	17.2	1,785	356	12.929	354
11/9/11 14:28	6.8	7.7	17.3	1,785	356	12.656	354
11/9/11 14:29	6.9	7.9	17.5	1,785	356	13.368	353
11/9/11 14:30	6.9	8.0	17.6	1,785	356	14.506	354
11/9/11 14:31	6.9	8.0	17.6	1,785	356	14.516	354
11/9/11 14:32	6.9	7.8	17.6	1,785	356	13.720	354
11/9/11 14:33	6.9	7.6	17.6	1,785	356	13.487	354
11/9/11 14:34	6.9	7.6	17.7	1,785	356	13.388	354
11/9/11 14:35	6.9	7.6	17.8	1,785	356	13.656	353
11/9/11 14:36	6.9	7.6	17.7	1,785	356	13.953	354
11/9/11 14:37	6.9	7.5	17.3	1,785	356	14.241	354
11/9/11 14:38	7.0	7.5	17.4	1,785	356	14.468	354
11/9/11 14:39	7.0	7.7	17.6	1,785	356	13.372	354
11/9/11 14:40	7.0	7.9	17.6	1,785	356	13.258	354
11/9/11 14:41	7.0	7.9	17.4	1,785	356	13.456	354
11/9/11 14:42	7.0	7.6	17.5	1,785	356	13.650	354
11/9/11 14:43	7.0	7.7	17.5	1,785	356	13.715	354
11/9/11 14:44	7.0	7.7	17.7	1,785	356	14.408	354
11/9/11 14:45	7.0	7.7	17.7	1,785	356	13.586	354
11/9/11 14:46	7.1	7.7	17.3	1,785	356	13.126	354
11/9/11 14:47	7.1	7.6	17.2	1,785	356	13.390	354
11/9/11 14:48	7.1	7.7	17.2	1,786	356	13.654	354
11/9/11 14:49	7.1	7.9	17.6	1,786	356	13.918	354
11/9/11 14:50	7.1	8.0	17.7	1,786	356	14.735	354
11/9/11 14:51	7.1	8.0	17.6	1,786	356	14.609	354
11/9/11 14:52	7.1	7.8	17.6	1,786	356	13.984	354
11/9/11 14:53	7.1	7.6	17.5	1,786	356	13.360	354
11/9/11 14:54	7.1	7.7	17.6	1,786	356	12.803	354
11/9/11 14:55	7.2	7.7	17.7	1,786	356	13.116	354
11/9/11 14:56	7.2	7.7	17.3	1,786	356	13.337	354
11/9/11 14:57	7.2	7.6	17.2	1,786	356	14.214	354
11/9/11 14:58	7.2	7.6	17.4	1,786	356	13.863	354
11/9/11 14:59	7.2	7.9	17.7	1,786	356	13.359	354
11/9/11 15:00	7.2	8.0	17.5	1,786	356	13.042	354
11/9/11 15:01	7.2	7.9	17.6	1,786	356	13.329	354
11/9/11 15:02	7.2	7.7	17.6	1,786	356	13.662	354
11/9/11 15:03	7.2	7.6	17.6	1,786	356	14.873	354
11/9/11 15:04	7.3	7.7	17.7	1,786	356	15.232	354
11/9/11 15:05	7.3	7.6	17.7	1,786	356	14.381	354
11/9/11 15:06	7.3	7.6	17.4	1,786	356	13.566	354
11/9/11 15:07	7.3	7.6	17.3	1,786	356	12.968	354
11/9/11 15:08	7.3	7.6	17.3	1,786	356	12.602	354
11/9/11 15:09	7.3	7.9	17.6	1,786	356	12.871	354
11/9/11 15:10	7.3	7.9	17.6	1,787	356	13.252	354
11/9/11 15:11	7.3	7.9	17.5	1,787	356	13.935	354
11/9/11 15:12	7.4	7.7	17.5	1,787	356	13.042	354
11/9/11 15:13	7.4	7.7	17.6	1,787	356	13.480	354
11/9/11 15:14	7.4	7.7	17.7	1,787	356	13.815	354
11/9/11 15:15	7.4	7.7	17.5	1,787	357	13.901	354
11/9/11 15:16	7.4	7.7	17.3	1,787	357	13.350	353
11/9/11 15:17	7.4	7.6	17.2	1,787	357	13.627	354
11/9/11 15:18	7.4	7.8	17.3	1,787	356	13.603	354
11/9/11 15:19	7.4	7.9	17.6	1,787	356	13.186	354
11/9/11 15:20	7.4	7.9	17.6	1,787	357	12.769	354
11/9/11 15:21	7.5	7.9	17.6	1,787	357	12.689	354
11/9/11 15:22	7.5	7.7	17.6	1,787	357	12.948	354
11/9/11 15:23	7.5	7.6	17.6	1,787	357	13.317	354
11/9/11 15:24	7.5	7.6	17.6	1,787	357	14.661	354
11/9/11 15:25	7.5	7.6	17.7	1,787	357	14.941	355

APPENDIX VI

EQUIPMENT CALIBRATION DATA

DRY GAS METER ANNUAL CALIBRATION USING CRITICAL ORIFICES

DATE : 11/21/2011
GM SERIAL # : 13858008

UNIT ID # : MB6
CRITICAL ORIFICE SET SERIAL # : 1302

BAROMETRIC PRESSURE (in Hg) : INITIAL 30.16 # FINAL 30.16 AVG (Pbar) 30.16
TECHNICIAN : CER

IF Y (VAR) EXCEEDS 0.02 OR DH@ (VAR) EXCEEDS 0.2 ORIFICE SHOULD BE RECALIBRATI

ORIFICE #	RUN	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT3) INITIAL	DGM READINGS (FT3) FINAL	DGM READINGS (FT3) NET (Vm)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM DH (in H2O)	(1) Vm (STD)	(2) Vcr (STD)	(3) Y	Y (VAR)	(4) DH@	DH@ (VAR)
#12 Brass	1	0.3026	19	472.860	476.810	3.950	81	73	73	73	73	73	10.00	0.50	3.9499	3.9249	0.9937	-0.0199	1.8296	-0.096
	2	0.3026	19	476.810	480.720	3.910	81	73	73	73	73	73	10.00	0.50	3.9099	3.9249	1.0038	-0.0098	1.8298	-0.095
	3	0.3026	19	480.720	484.668	3.948	81	73	73	73	73	73	10.00	0.50	3.9479	3.9249	0.9942	-0.0194	1.8296	-0.096
																AVG =	0.9972		1.8297	
#17 Brass	1	0.4317	18	534.550	539.832	5.282	79	64	65	61	62	63	10.00	0.97	5.3890	5.6098	1.0410	0.0274	1.7747	-0.151
	2	0.4317	18	539.832	545.133	5.301	79	64	65	62	63	64	10.00	0.97	5.3981	5.6098	1.0392	0.0256	1.7715	-0.154
	3	0.4317	18	545.133	550.453	5.320	79	65	66	63	64	65	10.00	0.97	5.4071	5.6098	1.0375	0.0239	1.7680	-0.157
																AVG =	1.0392		1.7714	
#23 Brass	1	0.6172	15	432.971	440.904	7.933	80	72	72	72	72	72	10.00	2.30	7.9825	8.0128	1.0038	-0.0098	2.0409	0.116
	2	0.6172	16	440.904	448.826	7.922	82	72	72	72	74	73	10.00	2.30	7.9564	7.9980	1.0052	-0.0084	2.0447	0.120
	3	0.6172	16	448.826	456.725	7.899	82	74	74	72	72	73	10.00	2.30	7.9333	7.9980	1.0082	-0.0054	2.0445	0.119
																AVG =	1.0057		2.0434	
#29 Brass	1	0.7602	14	484.668	494.328	9.660	81	73	74	73	73	73	10.00	3.50	9.7302	9.8602	1.0134	-0.0002	2.0589	0.134
	2	0.7602	14	494.328	504.010	9.682	81	74	74	73	73	74	10.00	3.50	9.7341	9.8602	1.0130	-0.0006	2.0550	0.130
	3	0.7602	14	504.010	513.714	9.704	81	74	74	73	73	74	10.00	3.50	9.7562	9.8602	1.0107	-0.0029	2.0551	0.130
																AVG =	1.0124		2.0563	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, Vm (std), and the critical orifice, Vcr (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVG DRY GAS METER CALIBRATION FACTOR, Y = 1.0136
Meter Critical Orifice, DH@= 1.9252

(1) $$Vm(std) = (K1)(Vm)\left(\frac{Pbar + \frac{DH}{13.6}}{Tm}\right)$$

Net volume of gas sample passed through DGM, corrected to standard conditions
K1 = 17.64 °R/in. Hg (English), 0.3858 oK/mm Hg (Metric)
Tm = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr(std) = (K')\left(\frac{Pbar(\theta)}{\sqrt{Tm}}\right)$$

Volume of gas sample passed through the critical orifice, corrected to standard conditions
Tamb = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr(std)}{Vm(std)}$$ DGM calibration factor

(4) $$\Delta H@ = \frac{(0.0319)(\Delta H)(Tm°R)(\theta)^2}{(Pbar)(Y)^2(Vm)^2}$$ Meter Orifice Check

QA/QC CHECK

Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓ Reasonableness ✓

Checked by : Charles Lee 11/21/11
Personnel (Signature/Date)

Jon Jon 11/28/11
Team Leader (Signature/Date)

0495

Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

MB-6

DRY GAS METER CALIBRATION REPORT

Customer: G.E.L. Engineering Date: 12/8/2010

Console Serial # 1635 MB-6 Console Model # C-5000 SF

DGM Model # S-275 MB-6 DGM SN # 13858008 Reference Meter S/N 16300942

Barometric Pressure, P_b: 29.66 in. Hg Tested at: 0 in. Hg - Vacuum

Standard Pressure : 29.92 in. Hg Standard Temperature : 528 °R

	1	2	3	Units
Orifice Manometer Setting, ΔH	2.00	0.75	6.00	in. H_2O
Elapsed Time	14	22	8	min.
Reference Meter				
Final Volume Reading	64.118	75.355	86.552	ft^3
Initial Volume Reading	53.335	64.439	76.056	ft^3
Total Gas Volume, V_w	10.783	10.916	10.496	ft^3
Temperature, Initial	66.5	66.6	66.7	°F
Temperature, Final	66.7	66.7	66.8	°F
Avg Temperature, T_w	66.6	66.7	66.8	°F
Dry Gas Meter				
Final Volume Reading	664.597	675.671	686.613	ft^3
Initial Volume Reading	654.036	664.916	676.336	ft^3
Total Gas Volume, V_m	10.561	10.755	10.277	ft^3
Average Temperature, Initial	67.4	67.4	67.5	°F
Average Temperature, Final	67.4	67.5	67.8	°F
Avg Temperature, T_m	67.4	67.5	67.6	°F
ΔH (a)	1.9359	1.7494	2.0018	**Avg. ΔH(a) 1.8957**
ΔH (a) Tolerance Check	OK	OK	OK	
Gamma, Y	1.0094	1.0065	0.9999	**Avg. Y 1.0053**
Gamma Tolerance Check	OK	OK	OK	

Calibration Performed By: Tony Ellen

$$\Delta H_{(a)} = \frac{0.0319\,\Delta H}{P_b\,(T_m + 460)}\left[\frac{(T_w + 460)\,\theta}{V_w}\right]^2 \qquad Y = \frac{V_w P_b\,(T_m + 460)}{V_m\,(P_b + \Delta H / 13.6)(T_w + 460)}$$

2142 E. Geer Street, Durham, North Carolina 27704 www.environsupply.com 919-956-9688 FAX: 919-682-0333

Pitot Calibration

Annual calibration date: 1/21/2011

Pitot	Positive Leg ΔP						Negative Leg ΔP						ΔP (standard)			Avg.	Cp	Type S AVG Cp
Runs----------	R1	Cp	R2	Cp	R3	Cp	R1	Cp	R2	Cp	R3	Cp						
P-201	0.510	**0.820**	0.500	**0.828**	0.500	**0.828**	0.500	**0.828**	0.480	**0.845**	0.470	**0.854**	0.350	0.340	0.360	0.350	0.990	**0.834**
P-202	0.480	**0.845**	0.480	**0.845**	0.490	**0.837**	0.490	**0.837**	0.500	**0.828**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.837**
P-302	0.460	**0.864**	0.460	**0.864**	0.460	**0.864**	0.500	**0.828**	0.520	**0.812**	0.520	**0.812**	0.350	0.340	0.360	0.350	0.990	**0.841**
P-306	0.470	**0.854**	0.470	**0.854**	0.450	**0.873**	0.510	**0.820**	0.510	**0.820**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.842**
P-501	0.480	**0.845**	0.490	**0.837**	0.490	**0.837**	0.500	**0.828**	0.490	**0.837**	0.490	**0.837**	0.350	0.340	0.360	0.350	0.990	**0.837**
P-502	0.490	**0.837**	0.480	**0.845**	0.500	**0.828**	0.470	**0.854**	0.490	**0.837**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.838**
P-503	0.470	**0.854**	0.460	**0.864**	0.510	**0.820**	0.490	**0.837**	0.490	**0.837**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.840**
P-504	0.500	**0.828**	0.470	**0.854**	0.500	**0.828**	0.500	**0.828**	0.480	**0.845**	0.490	**0.837**	0.350	0.340	0.360	0.350	0.990	**0.837**
P-505	0.490	**0.837**	0.500	**0.828**	0.470	**0.854**	0.490	**0.837**	0.500	**0.828**	0.490	**0.837**	0.350	0.340	0.360	0.350	0.990	**0.837**
P-507	0.470	**0.854**	0.470	**0.854**	0.450	**0.873**	0.510	**0.820**	0.510	**0.820**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.842**
P-601	0.510	**0.820**	0.480	**0.845**	0.490	**0.837**	0.490	**0.837**	0.480	**0.845**	0.480	**0.845**	0.350	0.340	0.360	0.350	0.990	**0.838**
P-602	0.500	**0.828**	0.470	**0.854**	0.460	**0.864**	0.480	**0.845**	0.500	**0.828**	0.510	**0.820**	0.350	0.340	0.360	0.350	0.990	**0.840**
P-603	0.450	**0.873**	0.440	**0.883**	0.450	**0.873**	0.550	**0.790**	0.540	**0.797**	0.540	**0.797**	0.350	0.340	0.360	0.350	0.990	**0.835**
P-701	0.470	**0.854**	0.490	**0.837**	0.480	**0.845**	0.480	**0.845**	0.490	**0.837**	0.480	**0.845**	0.350	0.340	0.360	0.350	0.990	**0.844**
P-702 (inc)	0.450	**0.873**	0.460	**0.864**	0.450	**0.873**	0.500	**0.828**	0.530	**0.805**	0.550	**0.790**	0.350	0.340	0.360	0.350	0.990	**0.839**
P-705	0.450	**0.873**	0.450	**0.873**	0.440	**0.883**	0.540	**0.797**	0.530	**0.805**	0.520	**0.812**	0.350	0.340	0.360	0.350	0.990	**0.840**
P-901	0.450	**0.873**	0.450	**0.873**	0.440	**0.883**	0.510	**0.820**	0.530	**0.805**	0.530	**0.805**	0.350	0.340	0.360	0.350	0.990	**0.843**
P-1001	0.480	**0.845**	0.490	**0.837**	0.490	**0.837**	0.640	**0.732**	0.630	**0.738**	0.640	**0.732**	0.350	0.340	0.360	0.350	0.990	**0.787**
PTC-301	0.490	**0.837**	0.500	**0.828**	0.480	**0.845**	0.480	**0.845**	0.460	**0.864**	0.470	**0.854**	0.350	0.340	0.360	0.350	0.990	**0.846**
PTC-501	0.510	**0.820**	0.500	**0.828**	0.520	**0.812**	0.500	**0.828**	0.490	**0.837**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.826**
PTC-502	0.490	**0.837**	0.490	**0.837**	0.480	**0.845**	0.500	**0.828**	0.490	**0.837**	0.500	**0.828**	0.350	0.340	0.360	0.350	0.990	**0.835**
PTC-701	0.560	**0.783**	0.570	**0.776**	0.560	**0.783**	0.540	**0.797**	0.550	**0.790**	0.540	**0.797**	0.350	0.340	0.360	0.350	0.990	**0.787**
PTC-702	0.520	**0.812**	0.520	**0.812**	0.500	**0.828**	0.530	**0.805**	0.540	**0.797**	0.530	**0.805**	0.350	0.340	0.360	0.350	0.990	**0.810**
PTC-1001	0.440	**0.883**	0.440	**0.883**	0.450	**0.873**	0.520	**0.812**	0.530	**0.805**	0.550	**0.790**	0.350	0.340	0.360	0.350	0.990	**0.841**
SP-1	0.490	**0.837**	0.500	**0.828**	0.500	**0.828**	0.480	**0.845**	0.500	**0.828**	0.510	**0.820**	0.350	0.340	0.360	0.350	0.990	**0.831**
WC-1	0.495	**0.832**	0.490	**0.837**	0.490	**0.837**	0.490	**0.837**	0.485	**0.841**	0.490	**0.837**	0.350	0.340	0.360	0.350	0.990	**0.837**
WC-2	0.490	**0.837**	0.495	**0.832**	0.495	**0.832**	0.490	**0.837**	0.485	**0.841**	0.490	**0.837**	0.350	0.340	0.360	0.350	0.990	**0.836**

Client Albemarle

City, State Orangeburg, SC

Source Boiler #4 Exhaust

Project No. albe00211

Date 11/9/2011

Pitot Tubes Used

R-1 P-504

R-2 P-504

R-3 P-504

Post Inspection OK

Y N

Y N

Y N

Operator Signature

0497

O2 Value Corrections
Albemarle Boiler #4 PM Test

RUN 1 (11/9/11)

Raw Data	
O2	7.65

Corrected Data	
O2	7.62

O2			
Span Values			
Cma	10.00	O2 raw	7.65
Coi	0.01	Co	0.02
Cof	0.02		
Cui	10.02	Cm	10.03
Cuf	10.04		
Corrected Value			7.62

RUN 2 (11/9/11)

Raw Data	
O2	7.60

Corrected Data	
O2	7.55

O2			
Span Values			
Cma	10.00	O2 raw	7.60
Coi	0.02	Co	0.03
Cof	0.03		
Cui	10.04	Cm	10.05
Cuf	10.06		
Corrected Value			7.55

RUN 3 (11/9/11)

Raw Data	
O2	7.63

Corrected Data	
O2	7.63

O2			
Span Values			
Cma	10.00	O2 raw	7.63
Coi	0.00	Co	-0.01
Cof	-0.01		
Cui	10.00	Cm	10.00
Cuf	9.99		
Corrected Value			7.63

Cm = average of the upscale calibration gas checks
Co = average of the zero calibration gas checks
Cma = upscale calibration gas value
Coi = initial zero gas reading
Cof = final zero gas reading
Cui = initial upscale gas reading
Cuf = final upscale gas reading

CO2 Value Corrections
Albemarle Boiler #4 PM Test

RUN 1 (11/9/11)

Raw Data	
CO2	10.20

Corrected Data	
CO2	10.18

CO2			
Span Values			
Cma	9.25	CO2 raw	10.20
Coi	0.01	Co	0.01
Cof	0.01		
Cui	9.26	Cm	9.27
Cuf	9.27		
Corrected Value			10.18

RUN 2 (11/9/11)

Raw Data	
CO2	10.19

Corrected Data	
CO2	10.18

CO2			
Span Values			
Cma	9.25	CO2 raw	10.19
Coi	0.01	Co	0.02
Cof	0.02		
Cui	9.27	Cm	9.26
Cuf	9.25		
Corrected Value			10.18

RUN 3 (11/9/11)

Raw Data	
CO2	10.10

Corrected Data	
CO2	10.11

CO2			
Span Values			
Cma	9.25	CO2 raw	10.10
Coi	0.02	Co	0.03
Cof	0.03		
Cui	9.25	Cm	9.24
Cuf	9.23		
Corrected Value			10.11

Cm = average of the upscale calibration gas checks
Co = average of the zero calibration gas checks
Cma = upscale calibration gas value
Coi = initial zero gas reading
Cof = final zero gas reading
Cui = initial upscale gas reading
Cuf = final upscale gas reading

LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer	G.E.L. Engineering (Charleston, SC)
Date	January 25, 2011
Delivery Receipt	DR-31988
Gas Standard	19.0% CO2, 20.0% Oxygen/Nitrogen-EPA PROTOCOL
Final Analysis Date	January 18, 2011
Expiration Date	January 18, 2014
Component	Carbon Dioxide, Oxygen
Balance Gas	Nitrogen

Analytical Data: **DO NOT USE BELOW 150 psig**

EPA Protocol, Section No. 2.2, Procedure G-1

Reported Concentrations

Carbon Dioxide: 18.5% +/- 0.18%

Oxygen: 20.0% +/- 0.20%

Nitrogen: Balance

Reference Standards:

SRM/GMIS:	GMIS	GMIS
Cylinder Number:	CC-115915	CC-85458
Concentration:	19.581% CO2/Nitrogen	20.97% Oxygen/Nitrogen
Expiration Date:	10/14/12	04/15/11

Certification Instrumentation

Component:	Carbon Dioxide	Oxygen
Make/Model:	Horiba - VIA 510	Servomex 244a
Serial Number:	SN075GSF	1847
Principal of Measurement:	NDIR	Paramagnetic
Last Calibration:	January 03, 2011	January 03, 2011

Cylinder Data

Cylinder Serial Number:	EB-0029174	Cylinder Outlet:	CGA 590
Cylinder Volume:	140 Cubic Feet	Cylinder Pressure:	2000 psig, 70°F

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-97/121.

Certified by:

Adam Strickland

"UNMATCHED EXCELLENCE"

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WWW.LIQUIDTECHCORP.COM

AIR LIQUIDE Air Liquide America Specialty Gases LLC SCOTT™

RATA CLASS

Dual-Analyzed Calibration Standard

6141 EASTON ROAD, BLDG 1, PLUMSTEADVILLE, PA 18949-0310 Phone: 800-331-4953 Fax: 215-766-7226

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

SCOTT SPECIALTY GASES
6141 EASTON ROAD, BLDG 1
PLUMSTEADVILLE, PA 18949-0310

P.O. No.: 70007
Project No.: 01-48617-002

Customer

GENERAL ENGINEERING LABS
PO 70007
2040 SAVAGE ROAD
CHARLESTON SC 29407

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM039971 **Certification Date:** 17Feb2009 **Exp. Date:** 17Feb2012
Cylinder Pressure*:** 2000 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
CARBON DIOXIDE	10.0	%	+/- 1%	Direct NIST and NMi
OXYGEN	10.0	%	+/- 1%	Direct NIST and NMi
NITROGEN		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1675	02Oct2012	K001509	13.93 %	CARBON DIOXIDE
NTRM 2658	02Oct2010	ALM065242	9.930 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
MTI/M200/160502	12Feb2009	GC-TCD
MTI/M200/160502	13Feb2009	GC-TCD

ANALYZER READINGS

(Z = Zero Gas R = Reference Gas T = Test Gas r = Correlation Coefficient)

First Triad Analysis | Second Triad Analysis | Calibration Curve

CARBON DIOXIDE

Date: 17Feb2009	Response Unit:AC	
Z1 = 0.00000	R1 = 608126.0	T1 = 434802.0
R2 = 604861.0	Z2 = 0.00000	T2 = 434364.0
Z3 = 0.00000	T3 = 434312.0	R3 = 604184.0
Avg. Concentration:	10.00 %	

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999
Constants: A = -.01241285
B = 0.000000237 C =
D = E =

OXYGEN

Date: 17Feb2009	Response Unit:AC	
Z1 = 0.00000	R1 = 293552.0	T1 = 295849.0
R2 = 293495.0	Z2 = 0.00000	T2 = 295726.0
Z3 = 0.00000	T3 = 295878.0	R3 = 293094.0
Avg. Concentration:	10.00 %	

Concentration = A + Bx + Cx2 + Dx3 + Ex4
r = 0.999999
Constants: A = -.008328
B = 0.000003377 C =
D = E =

APPROVED BY: JOHN OSHEA

Thermocouple Temperature Calibrations

	Number	Temp °F	Difference	Correction *
Reference Thermometer T-4		66		
Ts (1)	MB-6	65	-1	NA
Tp (2)	MB-6	66	0	NA
Tf (3)	MB-6	66	0	NA
Ti (4)	MB-6	67	1	NA
Spare (5)	MB-6	67	1	NA
Tm (In) (6)	MB-6	66	0	NA
Tm (Out) (7)	MB-6	65	-1	NA

* No correction necessary if TC is +/- 2°F from Reference Thermometer

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Oxygen Instrumental Method Data Sheet

Client	Albemarle	Date	11/(8-9)/11
Plant Site	Orangeburg, SC	Project Number	albe00211
Location	Boiler #4	Instrument #	CAI-100F
Test Method	EPA Method 3A (40 CFR 60, Appendix A)	Observer	Patel
GEL Personnel	AKA	Agency	SCDHEC

Calibration Gas

Pretest O2 (%)	7.50	High-Level (Span) Gas Concentration %	20.00
Calibration Gas Value (%)	20.00	Drift Check Gas Concentration (%)	10.00
Method 205 conducted? (YES/NO)	No	perfomed during RATA on 11-8-11	

Analyzer Calibration

Directions

Note: The span of the monitoring system shall be selected such that the average O2 concentration is not less that 20% of the span gas.

I. Analyzer Calibration Error (ACE)

(1) Introduce zero gas and high-range calibration gas at instrument.
(2) Adjust the analyzer output to the appropriate level, if necessary.
(3) Introduce zero gas, mid-range and high-range calibration gas at the instrument. Record responses below.
(4) The analyzer calibration error check may be considered invalid if the gas concentration displayed by the analyzer exceeds +/- 2 percent of the span for any of the calibration gases.

ACE = Direct (back of analyzer) Calibration Response - Calibration Gas Value (Absolute Value)

II. Sampling System Bias Check (SB)

(1) Introduce either mid or high range calibration gases to the calibration valve installed on the out of the sampling probe. (Which ever one more closely resembles actual concentration of stack gas). Record value.
(2) Introduce zero gas, and record the gas concentration displayed by analyzer.
(3) Bias check shall be considered invalid if the difference between the gas concentrations displayed by the measurement system for the analyzer calibration error check and for the sampling system bias check exceeds +/- 5% of the span for either the zero or upscale calibration gas. If invalid, repeat the sampling system bias check until acceptable performance is achieved.

SB = (Response of Analyzer in System Calibration Mode - Direct Calibration Response) / Calibration Span Gas Value x 100

Type of Gas	Actual Value of Calibration Gas (%)	Analyzer Response at Back of Analyzer (%)	Analyzer Calibration Error (ACE) (%)	Allowable ACE 2% of Span Gas (%)	Sampling System Response (%)	Sampling System Bias (SB) (%)	Allowable SB % of Span (%)
Zero (<0.01 %)	0.00	0.00	0.00	0.40	0.01	0.05	5.0
Span (< 5X of actual)	20.00	20.00	0.00	0.40	20.02	0.10	5.0
Mid (40% to 60% of span)	10.00	10.01	0.01	0.40	10.03	0.10	5.0
Low (Optional)							5.0

Response Time Test

Directions

(1) Alternately introduce zero gas and upscale gases until a stable response is achieved.
(2) Determine and record the measurement system response time.
(3) Note/record the longer of the two times as the response time.
Note: Sampling time will include twice the response time.

Done during other test -> Test Name:

Type of Calibration Gas	Trial 1 [seconds]	Trial 2 [seconds]	Average of Trials [seconds]	Longer of 2 Trials [Response Time] [seconds]
Zero	20	20	20	
Upscale	25	25	25	25

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Oxygen Instrumental Method
Drift Data Sheet

Client	Albemarle	Date	11/(8-9)/11
Source	Boiler #4	Project Number	albe00211

Drift Determination

Directions

(1) Immediately following each test run, repeat the calibration error and the sampling system bias check procedure.
(2) Record the analyzer response. (Do not correct analyzer)
(3) If either the zero or upscale values exceed the calibration drift or sampling system bias check specifications, then the run is considered invalid.

Test Period	Type of Gas	Value of Calibration Gas %	Beginning of Run Instrument Response System Bias	End of Run Instrument Response System Bias	Performance % Drift	Performance % Bias	Limits Drift % of span	Limits Bias % of span	Pass/Fail Drift	Pass/Fail Bias
Post Run 10	Zero	0.00	0.01	0.01	0.0	0.1	3.0	5.0	Pass	Pass
Post Run 10	Upscale	10.00	10.03	10.03	0.0	0.1	3.0	5.0	Pass	Pass
Post Run 11	Zero	0.00	0.01	0.01	0.0	0.1	3.0	5.0	Pass	Pass
Post Run 11	Upscale	10.00	10.03	10.02	0.0	0.0	3.0	5.0	Pass	Pass
Post Run 12	Zero	0.00	0.01	0.02	0.1	0.1	3.0	5.0	Pass	Pass
Post Run 12	Upscale	10.00	10.02	10.04	0.1	0.1	3.0	5.0	Pass	Pass
Post Run 13	Zero	0.00	0.02	0.03	0.1	0.2	3.0	5.0	Pass	Pass
Post Run 13	Upscale	10.00	10.04	10.06	0.1	0.3	3.0	5.0	Pass	Pass
Post Run 14	Zero	0.00	0.00	-0.01	0.1	-0.1	3.0	5.0	Pass	Pass
Post Run 14	Upscale	10.00	10.00	9.99	0.0	-0.1	3.0	5.0	Pass	Pass

Comments

Cal adjustment made after Run 13 drift check

R12 = R1 of PM Test
R13 = R2 " "
R14 = R3 " "

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Carbon Dioxide Instrumental Method
Data Sheet

Client	Albemarle	Date	11/(8-9)/11
Plant Site	Orangeburg, SC	Project Number	albe00211
Location	Boiler #4	Instrument #	Sevomex 1440D
Test Method	EPA Method 3A (40 CFR 60, Appendix A)	Observer	Patel
GEL Personnel	AKA	Agency	SCDHEC

Calibration Gas

Pretest CO2 (%)	10.00	High-Level (Span) Gas Concentration %	18.50
Calibration Gas Value (%)	18.50	Drift Check Gas Concentration (%)	9.25
Method 205 conducted? (YES/NO)	No		

Analyzer Calibration

Directions

Note: The span of the monitoring system shall be selected such that the average CO2 concentration is not less that 20% of the span gas.

I. Analyzer Calibration Error (ACE)

(1) Introduce zero gas and high-range calibration gas at instrument.
(2) Adjust the analyzer output to the appropriate level, if necessary.
(3) Introduce zero gas, mid-range and high-range calibration gas at the instrument. Record responses below.
(4) The analyzer calibration error check may be considered invalid if the gas concentration displayed by the analyzer exceeds +/- 2 percent of the span for any of the calibration gases.

ACE = Direct (back of analyzer) Calibration Response - Calibration Gas Value (Absolute Value)

II. Sampling System Bias Check (SB)

(1) Introduce either mid or high range calibration gases to the calibration valve installed on the out of the sampling probe. (Which ever one more closely resembles actual concentration of stack gas). Record value.
(2) Introduce zero gas, and record the gas concentration displayed by analyzer.
(3) Bias check shall be considered invalid if the difference between the gas concentrations displayed by the measurement system for the analyzer calibration error check and for the sampling system bias check exceeds +/- 5% of the span for either the zero or upscale calibration gas. If invalid, repeat the sampling system bias check until acceptable performance is achieved.

SB = (Response of Analyzer in System Calibration Mode - Direct Calibration Response) / Calibration Span Gas Value x 100

Type of Gas	Actual Value of Calibration Gas (%)	Analyzer Response at Back of Analyzer (%)	Analyzer Calibration Error (ACE) (%)	Allowable ACE 2% of Span Gas (%)	Sampling System Response (%)	Sampling System Bias (SB) (%)	Allowable SB % of Span (%)
Zero (<0.01 %)	0.00	0.00	0.00	0.37	0.01	0.05	5.0
Span (< 5X of actual)	18.50	18.50	0.00	0.37	18.48	-0.11	5.0
Mid (40% to 60% of span)	9.25	9.23	0.02	0.37	9.21	-0.11	5.0
Low (Optional)							5.0

Response Time Test

Directions

(1) Alternately introduce zero gas and upscale gases until a stable response is achieved.
(2) Determine and record the measurement system response time.
(3) Note/record the longer of the two times as the response time.
Note: Sampling time will include twice the response time.

Done during other test -> Test Name:

Type of Calibration Gas	Trial 1 [seconds]	Trial 2 [seconds]	Average of Trials [seconds]	Longer of 2 Trials [Response Time] [seconds]
Zero	25	20	23	
Upscale	25	25	25	25

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Carbon Dioxide Instrumental Method
Drift Data Sheet

Client	Albemarle	Date	11/(8-9)/11
Source	Boiler #4	Project Number	albe00211

Drift Determination

Directions

(1) Immediately following each test run, repeat the calibration error and the sampling system bias check procedure.
(2) Record the analyzer response. (Do not correct analyzer)
(3) If either the zero or upscale values exceed the calibration drift or sampling system bias check specifications, then the run is considered invalid.

Test Period	Type of Gas	Value of Calibration Gas %	Beginning of Run Instrument Response System Bias	End of Run Instrument Response System Bias	Performance % Drift	Performance % Bias	Limits Drift % of span	Limits Bias % of span	Pass/Fail Drift	Pass/Fail Bias
Post Run 10	Zero	0.00	0.01	0.00	0.1	0.0	3.0	5.0	Pass	Pass
Post Run 10	Upscale	9.25	9.21	9.19	0.1	-0.2	3.0	5.0	Pass	Pass
Post Run 11	Zero	0.00	0.00	0.01	0.1	0.1	3.0	5.0	Pass	Pass
Post Run 11	Upscale	9.25	9.25	9.26	0.1	0.2	3.0	5.0	Pass	Pass
Post Run 12	Zero	0.00	0.01	0.01	0.0	0.1	3.0	5.0	Pass	Pass
Post Run 12	Upscale	9.25	9.26	9.27	0.1	0.2	3.0	5.0	Pass	Pass
Post Run 13	Zero	0.00	0.01	0.02	0.1	0.1	3.0	5.0	Pass	Pass
Post Run 13	Upscale	9.25	9.27	9.25	0.1	0.1	3.0	5.0	Pass	Pass
Post Run 14	Zero	0.00	0.02	0.03	0.1	0.2	3.0	5.0	Pass	Pass
Post Run 14	Upscale	9.25	9.25	9.23	0.1	0.0	3.0	5.0	Pass	Pass

Comments

Cal adjustment made after Run 10 drift check

Run 12 = R1 of PM Test
R13 = R2 " " "
R14 = R3

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O2 Value Corrections
Albemarle Boiler #4 PM Test

RUN 1 (11/9/11)

Raw Data	
O2	7.65

Corrected Data	
O2	7.62

O2			
Span Values			
Cma	10.00	O2 raw	7.65
Coi	0.01	Co	0.02
Cof	0.02		
Cui	10.03	Cm	10.03
Cuf	10.03		
Corrected Value			7.62

RUN 2 (11/9/11)

Raw Data	
O2	7.60

Corrected Data	
O2	7.56

O2			
Span Values			
Cma	10.00	O2 raw	7.60
Coi	0.02	Co	0.03
Cof	0.03		
Cui	10.03	Cm	10.04
Cuf	10.05		
Corrected Value			7.56

RUN 3 (11/9/11)

Raw Data	
O2	7.63

Corrected Data	
O2	7.61

O2			
Span Values			
Cma	10.00	O2 raw	7.63
Coi	0.03	Co	0.01
Cof	-0.01		
Cui	10.05	Cm	10.03
Cuf	10.00		
Corrected Value			7.61

Cm = average of the upscale calibration gas checks
Co = average of the zero calibration gas checks
Cma = upscale calibration gas value
Coi = initial zero gas reading
Cof = final zero gas reading
Cui = initial upscale gas reading
Cuf = final upscale gas reading

CO2 Value Corrections
Albemarle Boiler #4 PM Test

RUN 1 (11/9/11)

Raw Data	
CO2	10.20

Corrected Data	
CO2	10.18

CO2			
Span Values			
Cma	9.25	CO2 raw	10.20
Coi	0.01	Co	0.01
Cof	0.01		
Cui	9.26	Cm	9.27
Cuf	9.27		
Corrected Value			10.18

RUN 2 (11/9/11)

Raw Data	
CO2	10.19

Corrected Data	
CO2	10.17

CO2			
Span Values			
Cma	9.25	CO2 raw	10.19
Coi	0.01	Co	0.02
Cof	0.02		
Cui	9.27	Cm	9.27
Cuf	9.26		
Corrected Value			10.17

RUN 3 (11/9/11)

Raw Data	
CO2	10.10

Corrected Data	
CO2	10.10

CO2			
Span Values			
Cma	9.25	CO2 raw	10.10
Coi	0.02	Co	0.03
Cof	0.03		
Cui	9.26	Cm	9.25
Cuf	9.24		
Corrected Value			10.10

Cm = average of the upscale calibration gas checks
Co = average of the zero calibration gas checks
Cma = upscale calibration gas value
Coi = initial zero gas reading
Cof = final zero gas reading
Cui = initial upscale gas reading
Cuf = final upscale gas reading

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Gas Dilution System Check
Method 205 Data Sheet

Client	Albemarle	Date	8-Nov-11
Plant Site	Orangeburg, SC	Project Number	albe00211
Source	Boiler #4	Gas Dilution System	Environics 2020
Test Method	EPA Method 205	Observer	Patel
GEL Personnel	AKA	Agency	SCDHEC
Original Gas			
Type of Gas	O2 EPA protocol	Analyzer	CAI 100F
Concentration	20.00% O2	Operating Range	0-25%

Calibration Requirements

Directions

(1) The Gas Dilution System (GDS) must be evaluated at the test site with an analyzer or monitor to be used during the test.
(2) The operator may choose a precalibrated instrument with a high level of precision and accuracy for the purposes of the test.
(3) This method is not meant to replace the calibration requirements of test methods.
(4) All of the calibration requirements of the applicable test method must be met.
(5) Prepare five gas dilutions that will be used in the field test using the high level supply gas. [Divider Mode]
(6) Calculate the predicted concentration for each of five dilutions based on the flow rates through the GDS and the certified concentration of the high level supply gas. [Done automatically by instrument]
(7) Introduce each of the gases from below into the analyzer or monitor one at a time and determine the instrument response for each of the five dilutions.
(8) Repeat the procedure three (3) times, i.e., until three (3) injections are made at each dilution level.
(9) Calculate the average instrument reponse for each tripliacte injection at each dilution. No single injection shall differ by more than 2% from the average instrument response for that dilution. The average response shall differ by no more than 2% from the predicted dilution value.
(10) Introduce a known supply gas directly into the analyzer, bypassing the gas dilution system.

GDS Dilution Value	Predicted Response	Trial 1	Trial 2	Trial 3	Average	Greatest Difference from Average	All Trials Within 2 Percent of Average	Average Within 2 Percent of Predicted
17.50	same	17.54	17.54	17.52	17.53	0.01	OK	OK
15.00		15.02	15.03	15.01	15.02	0.01	OK	OK
10.00		10.02	10.02	10.00	10.01	0.01	OK	OK
5.00		4.98	4.97	4.96	4.97	0.01	OK	OK
2.50		2.46	2.47	2.46	2.46	0.01	OK	OK

GDS vs. Protocol Gas

Directions

(1) Introduce Protocol gas directly to the analyzer, bypassing the gas dilution system.
(2) Introduce a gas mixture from the GDS to the measurement device of similar concentration.
(3) The difference between the certified (protocol) concentration and the gas mixture and the instrument response shall be less than 2 percent.

Value of Protocol Gas	Value of Diluted Gas Mixture	Instrument Response to Protocol Gas Trial 1	Instrument Response to Protocol Gas Trial 2	Instrument Response to Protocol Gas Trial 3	Instrument Response to Protocol Gas Average	Instrument Response to Gas Dilution	Allowable (2 percent of protocol gas)	Check (within 2%)
10.00	10.00	9.92	9.93	9.94	9.93	10.01	0.20	OK

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SECTION E
PERFORMANCE STANDARDS AND EMISSION LIMITATIONS

As part of this Application, a technical memorandum was prepared by SI Group in February 2018 addressing the applicability of using data from the 2003 trial/risk burn and 2005 RA to demonstrate SI Group's ability to meet current performance standards and emission limitations. A copy of this memorandum is provided in Appendix E-1.

E.1 Performance Standards and Emission Limitations in the Current RCRA Permit

The performance standards and emission limitations for SI Group's Boiler No. 4 in the current RCRA Permit (Hazardous Waste Permit SCD 043 384 072) are based on the requirements of 40 CFR 266, Subpart H, South Carolina Board of Health and Environmental Control, Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities, Hazardous Waste Burned in Boilers and Industrial Furnaces, R 61-79.266, Subpart H (hereinafter referred to as the BIF Rule), a trial/risk burn conducted in 2003 (refer to *Trial Burn/Risk Burn Report For Boiler HE-3800-1*, February 2004) and a long-term, multi-pathway risk assessment (refer to *Final Preliminary Hazardous Waste Combustion Risk Assessment, Albemarle Corporation*, March 18, 2005). Tables E-1 and E-2, located in Appendix E-2, provide a summary of the performance standards and the emission limitations in the current RCRA Permit along with a comparison with the BIF rule requirements. (It should be noted that the trial burn/risk burn was conducted in November 2003 but the final report was not submitted until February 2004).

As can be seen from Table E-2, the emission limitations for the metals, chloride, chlorine, polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzo-p-furans (PCDFs) are based on the comprehensive long-term, multi-pathway risk assessment, while the emission limitations for destruction and removal efficiency (DRE), particulate matter, and CO are directly from the BIF Rule.

E.1.1 Trial and Risk Burns

The trial burn/risk burn demonstrated that Boiler No. 4 is capable of controlling emissions of three principal organic hazardous constituents (POHCs) in excess of the 99.99% DRE required by the BIF Rule. The three POHCs tested were chlorobenzene, toluene, and perchloroethylene. These three POHCs were selected to be representative of the types of wastes to be burned in the Boiler No. 4 and to demonstrate the capability of the boiler to adequately destroy and remove highly thermally stable organic hazardous constituents. The Trial Burn Plan recommended two POHCs — chlorobenzene and toluene. Chlorobenzene is ranked by U.S. EPA as the 19th most thermally stable organic hazardous constituent, while toluene is ranked 35th (refer to *Guidance on Setting Permit*

Conditions and Reporting Trial Burn Results: Volume II of the Hazardous Waste Incineration Guidance Series, EPA/625/6-89/019, January 1989, Appendix D, Table D-1).

The Trial Burn Plan was approved by U.S. EPA Region 4 and the SCDHEC in June 2003 and the trial burn was conducted November 4-8, 2003.

The trial burn demonstrated that Boiler No. 4 controlled the three POHCs in excess of 99.99%, when the boiler was operating at its maximum steam production rate, waste feed rate, ash feed rate, and chlorine feed rate, as well as when it was operating at its minimum combustion temperature. In addition, the trial burn demonstrated that when operating at its minimum combustion temperature, emissions of PCDDs and PCDFs were below the emission limits established by the long-term, multi-pathway risk assessment in 2005 (0.27 nanograms of toxic equivalency factors per dry standard cubic meter). The risk burn portion of these tests was conducted at maximum waste feed rates to obtain emission data for semi-volatile organic compounds, PCDDs, PCDFs, polynuclear aromatic hydrocarbons, volatile organic compounds, total organics, particle size distribution, aldehydes, and ketones for use in the subsequent long-term multi-pathway risk assessment.

E.1.2 Comprehensive Long-Term, Multi-Pathway Risk Assessment

In 2005, a comprehensive long-term, multi-pathway risk assessment was conducted for U.S. EPA. The risk assessment estimated potential human health — carcinogenic and noncarcinogenic, and ecological risks associated with emissions from both Boiler No. 4 and fugitives from the associated waste storage tanks. The boiler emissions were evaluated at both the BIF rule levels and levels proposed for the Maximum Achievable Control Technology (MACT) standard at 40 CFR Part 63, Subpart EEE, the National Emission Standards for Hazardous Air Pollutants for Hazardous Waste Combustors (HWC), (at the time the comprehensive long-term, multi-pathway risk assessment was conducted, the HWC MACT had not been finalized). In addition to these two risk scenarios, a third risk evaluation was performed. The purpose of the third evaluation, termed the "RCRA permit" assessment, was to determine the emission rates of regulated pollutants that are protective of human health and the environment on a site-specific basis. (This "RCRA permit" scenario was used by Albemarle to recommend the current health-based compliance alternative (HBCA) for total chlorine (see Section E.2.1., below).

In the risk assessment, a total of 145 exposure receptors, including 72 potential future receptors, were evaluated at 46 receptor locations within the 10-square km (km^2) assessment area. Each of the receptors was chosen for evaluation of one or more exposure scenarios based on the magnitude of the air parameter values estimated by the ISCST3 model and current and future potential land use.

At each of the receptors, one or more of the following exposure scenarios were analyzed: resident adult and child, fisher adult and child, and farmer adult and child. In addition, highly sensitive receptors such as a nearby elementary school, medical center, day care center, and retirement home were included in the assessment.

Table 6-3 of the Risk Assessment report lists the risks associated with the "RCRA permit" scenario. There are 35 receptors listed in Table 6-3 for which risk exposures were evaluated. Of those 35 receptors, all but seven of the receptors were evaluated for resident adult and child and fisher adult and child. Twenty of the 35 were not evaluated for farmer adult and child. Table E-3, located in Appendix E-2, lists the 35 receptor locations and the exposure scenarios for which each of the receptors was evaluated.

To determine whether there have been changes to site-specific conditions in the study area since the risk assessment that would impact the recommended and approved HBCA for total chlorine (again, see Section E.2.1, below), the current land use conditions at the 35 receptors used to recommend and approve the HBCA for total chlorine were re-evaluated.

First, since the only water body analyzed in the risk assessment was the North Fork Edisto River, it is assumed that no additional receptors should have been evaluated for fisher adult and child.

Second, the seven receptors which did not receive a risk assessment for resident adult and child have been visited by SI Group environmental staff and they have verified and documented through photographs that there are no residences in the vicinity of these seven receptors. Figures E-1 through E-7, located in Appendix E-3, provide the photographic evidence mentioned above.

Third, a telephone interview was conducted with the Orangeburg County Extension Office. During that interview, the Extension Office staff indicated that there has been no significant addition of farming activity in the 10-km^2 study area since 2005.

Therefore, it has been confirmed that there have been no changes to the site-specific conditions in the vicinity of the plant that would invalidate the findings and conclusions of the 2005 risk assessment with regard to impacts from total chlorine emissions.

E.2 Compliance with the Hazardous Waste Combustor Maximum Achievable Control Technology

In 2006, then-owner Albemarle, made both its initial and final notifications to SCDHEC of its notice of intent to comply with the HWC MACT (refer to letter from M. G. Clisby, Albemarle Corporation, to Carl Richardson, Engineering Services Division, Bureau of Air Quality Control, SCDHEC, dated March 31, 2006, and letter from M. G. Clisby, Albemarle Corporation, to Melissa Poage, Environmental Manager, Air Toxic Section, Bureau of Air Quality Control, SCDHEC, dated December 12, 2006).

In the final Intent to Comply, Albemarle concluded the following:

> "Past performance test data and projections of thermal concentration values based on existing waste characterization information, indicate that Albemarle's boiler will comply with the HWC MACT Phase II standards without upgrades to the combustor or air pollution control equipment. Additional review of the waste feed characterization data will be performed to verify that HWC MACT constituent levels used in the compliance evaluations in this report are representative. In addition, further consideration of the health-based compliance alternative for total chlorine should confirm that this alternative approach will provide a total chlorine feed rate limit comparable to Albemarle's current RCRA Part B total chlorine limit."

E.2.1 Health-Based Compliance Alternative for Total Chlorine

Following up on its commitment concerning the consideration of a HBCA for total chlorine, Albemarle submitted a detailed HWC MACT eligibility demonstration for a HBCA for total chlorine in 2007 (refer to letter from M. G. Clisby, Albemarle Corporation, to Elizabeth Basil, Manager, Air Toxics Section, Bureau of Air Quality Control, SCDHEC, dated October 8, 2007). Based on its review, SCDHEC approved the HBCA demonstration and set a maximum chlorine feed rate for the Albemarle boiler at 2.05 grams per second or 16.3 pounds per hour (refer to letter from Melissa Poage, Air Toxics Section, Bureau of Air Quality, SCDHEC to M. G. Clisby, Albemarle Corporation, dated April 29, 2008). As discussed in Section E.1.2 above, the results of the "RCRA permit" scenario from the 2005 risk assessment were used as the basis for the recommendation and approval of this HBCA. As also discussed in Section E.1.2, the site-specific conditions upon which the "RCRA permit" scenario of the risk assessment were based have not changed since 2005.

E.2.2 Notification of Compliance with the Hazardous Waste Combustion Maximum Achievable Control Technology and Initial Comprehensive Performance Test

In 2009, Albemarle submitted its Notification of Compliance (NOC) with the HWC MACT to SCDHEC (refer to letter from Tom Kerr, Regulatory Advisor, Albemarle Corporation, to Heinz Kaiser, Manager, Air Toxics Section, SCDHEC, dated September 11, 2009). Included with the NOC, were the results of the initial Comprehensive Performance Test (CPT) conducted by Albemarle in accordance with the approved HWC MACT CPT Plan. The NOC documented compliance with the emission limitations and continuous monitoring system requirements, and identified applicable operating performance standards in accordance with 40 CFR 63.1209.

Table E-4, located in Appendix E-2, summarizes the HWC MACT emission standards and the results of the initial CPT conducted by Albemarle.

For the NOC, the DRE and PCDD/PCDF emissions data from the 2003 trial burn/risk burn were submitted as "data-in-lieu" to demonstrate compliance with the HWC MACT DRE and PCDD/PCDF emission requirements.

The use of the 2003 trial burn/risk burn results for demonstration of compliance with the DRE requirement is in accordance with 40 CFR 63.1206(b)(7)(A) and 40 CFR 63.1206(b)(7)(B) which state that compliance with the HWC MACT DRE requirement need only be demonstrated once, "provided you do not modify the source after the DRE test in a manner that could affect the ability of the source to achieve the DRE standard," and if the DRE test data "meet QA objectives determined on a site-specific basis." Boiler No. 4 has not been modified, nor have boiler operations changed, in a manner that could affect the ability of the source to achieve the DRE standard since the 2003 trial burn/ risk burn met its QA objectives as is demonstrated in the final report of the trial burn (refer to *Trial Burn/Risk Burn Report For Boiler HE-3800-1*, February 2004). In 2003, at the time of the trial burn/risk burn, Boiler No. 4 was equipped with two Aeropulse baghouses for particulate matter (PM) control, however, only one baghouse at a time was utilized. In 2006, these two baghouses were replaced with one new, more efficient baghouse which is now used for PM control. Table E-5, located in Appendix E-2, summarizes the boiler operating conditions during the 2003 trial burn/risk burn and average boiler operations in 2016. As can be seen from Table E-5, the average boiler operations during 2016 were significantly similar (e.g., maximum waste feed rate, maximum steam production, and maximum combustion temperature) to the operating conditions during the 2003 trial burn/risk burn and should ensure continued compliance with the HWC MACT DRE standard and PCDD/PCDF emission requirements and the HBCA for total chlorine. In addition, the boiler continues to operate in accordance with the boiler operating parameters (e.g., maximum waste feed rate,

maximum steam production, and maximum combustion temperature) established by the 2009 CPT and summarized in Table E-4, located in Appendix E-2.

Table E-6, located in Appendix E-2, summarizes the operating performance standards established by Albemarle during the initial CPT to achieve the HWC MACT emission limitations.

A comparison of the waste codes from the 2003/2004 RCRA Permit Application (page 10 of 15 of the PDF) with those in the 2014/2015 RCRA Permit Application , indicates that there has been only one waste code added — F002. Since chlorobenzene is the most thermally stable F002 compound and chlorobenzene was one of the POHC's tested in the trial burn/risk burn, it is safe to assume that Boiler No. 4 will adequately treat the proposed waste streams at DRE levels in excess of that required by the HWC MACT.

E.2.3 First Recurrent Comprehensive Performance Test

In 2014, Albemarle conducted its first recurrent CPT and submitted the results to SCDHEC (refer to *Boiler No. 4 Comprehensive Performance Test Report, EPA I.D. No. SCD 043 348 072*, dated August 2014). Table E-7, located in Appendix E-2, summarizes the results of this test.

Again, in 2014, the DRE and PCDD/PCDF emissions data from the 2003 trial burn/risk burn were submitted as "data-in-lieu" to demonstrate compliance with the HWC MACT DRE and PCDD/PCDF emission requirements.

E.3 Proposed Performance Standards and Emission Limitations

State and Federal BIF Rule regulations state that "the standards of this part … no longer apply when an owner or operator of an existing hazardous waste boiler or industrial furnace unit demonstrates compliance with the MACT requirements of 40 CFR Part 63, Subpart EEE (NESHAPs from HWCs), by conducting a comprehensive performance test and submitting to the Department a NOC under 40 CFR Part 63.1207(j) and 63.1210(d) documenting compliance with the requirements of Part 63, Subpart EEE" (refer to SC Regulation 61-79.266.100(b)).

In addition, U.S. EPA states the following in its fact sheet, *Permit Transition: Moving from RCRA to the CAA*, Office of Solid Waste (5305W), July 2002:

- In the final rule promulgating MACT standards for hazardous air pollutants from incinerators, cement kilns and lightweight aggregate kilns that burn hazardous waste (see 64 CFR 52828, September 30, 1999), we chose to avoid imposing duplicative requirements under both RCRA and the CAA, where possible, by:

1. placing the standards only in the CAA implementing regulations at 40 CFR Part 63 Subpart EEE

2. specifying that the analogous standards in the RCRA regulations no longer apply once a facility demonstrates compliance with the HWC MACT standards in Subpart EEE

3. requiring the HWC MACT standards to be incorporated into operating permits issued under Title 5 of the CAA rather than into RCRA permits

The U.S. EPA further noted that permit transition referred "not only to switching from the RCRA permitting process to the Title V permitting process, but also to the more general idea of switching from compliance with RCRA performance standards…to compliance with the HWC MACT standards." To that end, U.S. EPA tied the transition out of RCRA to the point at which a facility demonstrated compliance with the HWC MACT standards by conducting an initial comprehensive performance test and submitting test results in a NOC.

E.3.1 Incorporation of Performance Standards and Emission Limitations into the Title V Air Quality Permit

Boiler No. 4 is currently operating under the HWC MACT, and the performance standards and emission limitations of the MACT will be incorporated into the SI Group's Part 70 Air Quality Permit (Title V permit).

SI Group's current Title V permit expired during Albemarle's ownership of the facility, and Albemarle filed a timely permit renewal application. SCDHEC is currently working on the Title V permit renewal. Consequently, performance standards and emission limitations based on the RCRA BIF rules should not be included in SI Group's renewed RCRA Permit.

The 2003 trial burn/risk burn demonstrates that Boiler No. 4 complies with the MACT DRE standard and the MACT PCDD/PCDF emission requirements and the 2005 risk assessment (and, by extension, the 2003 trial burn/risk burn) was used to establish the MACT HBCA for total chlorine.

Appendix E-1
February 2018 Technical Memorandum
by SI Group

MEMORANDUM

TO: Denise Housley, U.S. EPA, Region 4

Jeff Herbig, RCRA Permitting and Correction Action Section, South Carolina Department of Health and Environmental Control

FROM: SI Group

RE: Section E of the Part B Permit Renewal Application

Date: February 14, 2018

To address the specific comments on Section E of the permit application, SI Group offers the following information and responses.

Comment: Worst-case chlorobenzene concentrations in the waste burned now as compared to that in 2003 trial/risk burn

Response: Chlorobenzene was not a component of the waste stream in 2003, nor is it a component of the waste stream today and in the future. Chlorobenzene was chosen as one of the Principal Organic Hazardous Constituents (POHCs) for the 2003 trial/risk burn because of its high thermal stability. The three POHCs (toluene, chlorobenzene, and perchloroethylene) used in the 2003 trial/risk burn were selected to be representative of the types of wastes to be burned in the Boiler No. 4, and to demonstrate the capability of the boiler to adequately destroy and remove highly thermally stable organic hazardous constituents. Chlorobenzene is ranked by United States Environmental Protection Agency (U.S. EPA) as the 19th most thermally stable organic hazardous constituent and was the most thermally stable of the three POHCs tested (refer to *Guidance on Setting Permit Conditions and Reporting Trial Burn Results: Volume II of the Hazardous Waste Incineration Guidance Series*, EPA/625/6-89/019, January 1989, Appendix D, Table D-1).

Data for the test feed rates of chlorobenzene during the 2003 trial/risk burn are summarized in Table A-1 in Attachment A. As can be seen from this table, there was no chlorobenzene detected in the waste fed to the boiler during the tests. All of the chlorobenzene used in the test runs was from liquid spikes to the waste during the test.

Comment: Actual emission test results from 2014 or later that indicate the emissions of dioxin and furans are still represented by the 2003 trial/risk burn

Response: In December 2016, GEL Engineering LLC conducted emissions testing of Boiler No. 4 for dioxins/furans. The report of the results of that testing is provided in Attachment B.

The dioxins/furans concentration during that testing was found to average 0.0087 nanograms toxicity equivalents (TEQ) per dry standard cubic meter, corrected to 7% O_2 (ng TEQ/dscm @7% O_2).

The following is a summary of the dioxins/furans test results for Boiler No. 4 from 2003 to 2016:

Table 1
Summary of Dioxins/Furans Test Results for Boiler No. 4 from 2003 to 2016

	MACT Standard: 0.4 ng TEQ/dscm		
	Part B Permit Limit: 0.27 ng TEQ/dscm		
	Dioxins/Furans Concentration (ng TEQ/dscm @ 7% O_2)		
Test Date and Condition	**Run 1**	**Run 2**	**Run 3**
2003 Trial/Risk Burn			
Minimum Combustion Temperature (Tables 4-5 through 4-7)	0.15	0.20	0.14
Risk Burn (Tables 5-10 through 5-11)	<0.14	<0.31	<0.35
2009 Initial Comprehensive Performance Test (Page 2 of 7 of report)	0.016	0.027	NA
2014 First Initial Recurrent Comprehensive Performance Test			
Minimum Combustion Temperature (Table 4-4)	0.038	0.0044	0.0054
Maximum Production Rate (Table 4-8)	0.057	0.055	0.053
2016 Emissions Test (Summary of Test Results, page 7 of 8)	0.0079	0.0093	0.0090

As can be seen, the measured dioxins/furans concentrations in all tests since the 2003 trial/risk burn have been over an order of magnitude lower than those measured during the 2003 trial/risk burn. In every case the concentrations have been below the hazardous waste combustor (HWC) Maximum Achievable Control Technology (MACT) Standard (0.4 ng TEQ/dscm) and the current Part B permit limit which was based on the 2005 risk assessment (0.27 ng TEQ/dscm).

Comment: Efficiency of combustion/boiler units decreases with the age of the unit

Response: Boiler efficiency is a measure of how much steam is produced per unit of energy input to the boiler in the fuel. Degradation of boiler efficiency over time is due to such things as the loss of efficiency in the heat exchanger due to scaling and increases in radiation and convective losses within the boiler system.

Combustion efficiency, on the other hand, is a measure of how much of the fuel input to the boiler is combusted. In the case of a boiler used as a HWC, the hazardous waste destruction efficiency is closely tied to the boiler's combustion efficiency.

According to U.S. EPA, four conditions affect the degree of combustion that will occur in a boiler: fuel/air ratio, turbulence, temperature, and time. (*Combustion Efficiency Optimization Manual for Operators of Oil- and Gas-Fired Boilers*, EPA-340/1-83-023, September 1983, page 4) These four

factors are a function of boiler design and operation and do not tend to degrade over time due to the aging of the boiler.

Turbulence, in this case, is the turbulence in the combustion zone that allows every particle of the fuel to come into contact with oxygen. Temperature is the temperature of combustion. Time is the residence time of the fuel in the combustion chamber and is a function of boiler size, shape, and design.

Good combustion of the fuel input to the boiler requires an adequate supply of oxygen (air) in the combustion chamber. For this reason, excess air is provided to the combustion chamber. If an excess of fuel, rather than an excess of air, is fed to the combustion chamber, incomplete combustion of the fuel will result. The incomplete combustion of the fuel produces carbon monoxide (CO) and unburned hydrocarbons (HC). Therefore, the CO and HC concentrations in the flue gas from a boiler are an indication of the combustion efficiency of the boiler. In fact, in its response to comments on the final HWC MACT Standard (Federal Register/Vol. 70, No. 196/Wednesday, October 12, 2005, page 59461, section titled "*Carbon Monoxide and Hydrocarbons Are Adequate Surrogates to Control Dioxin/Furan when Other Controls Are Not Effective or Achievable*"), U.S. EPA stated that "Carbon Monoxide and hydrocarbons are widely accepted indicators of combustion conditions." Accordingly, U.S. EPA set a CO limitation of 100 parts per million (ppm) and a HC limitation of 10 ppm in the HWC MACT Standard as surrogates to ensure HWCs are operating at acceptable combustion/destruction efficiencies.

The CO concentrations in the flue gas from Boiler No. 4 during the 2003 trial/risk burn are as follows:

Table 2
CO Concentrations in Flue Gas From Boiler No. 4 During 2003 Trial/Risk Burn

Test Condition	CO Concentration (ppm @ 7% O_2)			
	Run 1	Run 2	Run 3	Average
Maximum Steam	22.2	11.7	12.2	15.4
Minimum Combustion Temperature	9.3	9.5	15.1	11.3
Risk Burn	9.8	9.6	15.9	11.7

Notes:
CO = carbon monoxide
ppm = parts per million

The CO and HC concentrations in the flue gas during the Initial Comprehensive Performance Test, conducted April 14-15, 2009, and the First Initial Recurrent Comprehensive Performance Test, conducted May 27-30, 2014, are shown in Table A-2 and A-3, which are in Attachment A. A comparison of the CO concentrations in the flue gas during the 2003 trial/risk burn with the CO concentrations in the flue gas during the tests conducted in 2009 and 2014 indicates there has been no degradation on the combustion efficiency of Boiler No. 4. In addition, the CO and

HC concentrations during the tests conducted in 2009 and 2014 are well below the limits set by the HWC MACT Standard (100 ppm @7%O_2 and 10 ppm @ 7% O_2, respectively) as an indication of combustion efficiency.

Comment: Changes to the waste streams since the 2003 trial/risk burn

Response: A comparison of the waste codes and Appendix VIII constituents from the 2003/2004 Part A permit application with those in the 2014/2015 Part A permit application indicates that there has been only one waste code added since 2003 – F002. Since chlorobenzene is the most thermally stable F002 compound and chlorobenzene was one of the POHCs tested in the 2003 trial/risk burn, it is safe to assume that compliance with the HWC MACT standards will be protective of the human health and environment (HH&E) in the future.

Comment: The risk assessment still holds true and the Hazardous Waste Combustor Maximum Achievable Control Technology Standards remain protective of the HH&E

Response: The comprehensive long-term, multi-pathway risk assessment (RA) conducted for U.S. EPA by TechLaw, Inc. in 2005 estimated potential human health — carcinogenic and noncarcinogenic, and ecological (HH&E) risks associated with emissions from both Boiler No. 4 and fugitives from the associated waste storage tanks. The boiler emissions were evaluated at both the Boiler and Industrial Furnaces rule levels and levels of the HWC MACT.

In the RA, a total of 145 exposure receptors, including 72 potential future receptors, were evaluated at 46 receptor locations within the 10-square kilometer assessment area. Each of the receptors was chosen for evaluation of one or more exposure scenarios based on the magnitude of the air parameter values estimated by the ISCST3 model and current and future potential land use. At each of the receptors, one or more of the following exposure scenarios were analyzed: resident adult and child, fisher adult and child, and farmer adult and child.

Table 6-3 of the RA report (*Final Preliminary Hazardous Waste Combustion Risk Assessment, Albemarle Corporation, Orangeburg, South Carolina*, TechLaw, Inc., March 18, 2005) lists the risks associated with the "RCRA permit" scenario. There are 35 receptors listed in Table 6-3 for which risk exposures were evaluated. Of those 35 receptors, all but seven of the receptors were evaluated for resident adult and child and fisher adult and child. Twenty of the 35 were not evaluated for farmer adult and child. Table A-4, which is in Attachment A, lists the 35 receptor locations and the exposure scenarios for which each of the receptors was evaluated in the RA.

To determine whether there have been changes to site-specific conditions in the study area since the RA was conducted, the current land use conditions at the aforementioned 35 receptors have been re-evaluated.

First, since the only water body analyzed in the RA was the North Fork Edisto River, it is assumed that no additional receptors should have been evaluated for fisher adult and child.

Second, the seven receptors which did not receive a RA for resident adult and child have been visited by SI Group environmental staff and they have verified and documented through photographs that there are no residences in the vicinity of these seven receptors. Figures C-1 through C-7, located in Attachment C, provide the photographic evidence mentioned above.

Third, a telephone interview was conducted with the South Carolina Department of Health and Environmental Control Agricultural Permitting Program. During that interview, the Agricultural Permitting staff indicated that there have been no additions of farming activity in the 10-square kilometer study area since 2005.

This re-evaluation indicates that there have been no changes to the site-specific conditions in the vicinity of the plant that would invalidate the findings and conclusions of the 2005 RA, and confirms that the HWC MACT standards remain protective of the HH&E since the levels of the HWC MACT standard were used in the RA.

In summary:

- Chlorobenzene was not a component of the SI waste stream in 2003 and is not now a component of the waste stream.

- Multiple emissions tests of the dioxins/furans concentration in the flue gas from Boiler No. 4 since 2003 have confirmed that the results of the 2003 trial/risk burn and the 2005 RA are still valid.

- Although Boiler No. 4 is aging, all indications are that the combustion efficiency, and thus the hazardous waste destruction efficiency, have not degraded since the 2003 trial/risk burn.

- A re-evaluation of current land use in the RA study area indicates that there have been no changes that would invalidate the results of the RA.

ATTACHMENT A

Table A-1 Summary of Chlorobenzene Concentrations in Waste Fed to Boiler No. 4 During 2003 Trial/Risk Burn				
Test/Run	**Chlorobenzene Concentration in Waste (milligram /Kilogram)**	**Waste Feed Rate (pound/hour)**	**Chlorobenzene Liquid Spike (pound/hour)**	**Chlorobenzene Feed Rate (gram/hour)**
Maximum Steam Production [1]				
Run 1	ND [2]	1,497	4.6	2,077
Run 2	ND	1,518	4.7	2,138
Run 3	ND	1,523	4.8	2,160
Minimum Combustion Temperature [3]				
Run 1	ND	584	5.1	2,320
Run 2	ND	584	4.9	2,216
Run 3	ND	582	4.9	2,241
Risk Burn [4]				
Run 1	<370	1,644	NA	<276
Run 2	<390	1,614	NA	<286
Run 3	<440	1,620	NA	<323

Notes:

1. From *Trial Burn/Risk Burn Report For Boiler HE-3800-1*, prepared by TRC Environmental Corporation, February 2004, Table 3-4. POHC Feed Summary, page 3-6.
2. "ND" = None detected.
3. From *Trial Burn/Risk Burn Report For Boiler HE-3800-1*, prepared by TRC Environmental Corporation, February 2004, Table 4-2. POHC Feed Summary, page 4-3.
4. From *Trial Burn/Risk Burn Report For Boiler HE-3800-1*, prepared by TRC Environmental Corporation, February 2004, Table 5-3.Volatile Organic Compounds in Waste Feed, Target List, page 5-4.

Table A-2 Results of the Initial Comprehensive Performance Test Conducted April 14-15, 2009				
Parameter	**HWC MACT Emission Standard [1,2]**	**Reference [1]**	**Test 1 Result [3]**	**Test 2 Result [4]**
PCDD/PCDF (ng TEQ/dscm @ 7% O_2)	0.40	63.1217(a)(1)(i)	0.016	0.027
Mercury (lb/MMBtu)	4.2E-5	63.1217(a)(2)(ii)	NA	1.89E-6
Cadmium plus Lead (SVM) (lb/MMBtu)	8.2E-5	63.1217(a)(3)(ii)	NA	2.83E-6
Chromium (LVM) (lb/MMBtu)	1.3E-4	63.1217(a)(4)(ii)	NA	2.63E-6
Total Chlorine (lb/hr)	16.3	63.1217(a)(6) and HBCA [5]	NA	3.02
PM (mg/dscm @ 7% O_2)	80	63.1217(a)(7)	NA	1.92
CO (ppmvd @ 7% O_2)	100	63.1217(a)(5)(i)	4.5	1.2
Hydrocarbons (ppmvd @ 7% O_2)	10	63.1217(a)(5)(ii)	2.5	0.4
DRE (% of designated POHC's)	99.99	63.1217(c)(1)	> 99.9977 [6]	> 99.9932 [6]

Notes:

1. 40 CFR 63 Subpart EEE, incorporated by reference into SC Regulation 61-62.63.
2. Based on burning liquid wastes with a heating value of 10,000 MMBtu/lb or greater.
3. Test conducted at minimum combustion temperature.
4. Test conducted at maximum waste feed rate and maximum steam production rate.
5. Based on a site-specific, health-based compliance alternative in accordance with 40 CFR 63.1215.
6. Based on the lowest DRE test result for the most thermally stable POHC. For complete results see Trial Burn/Risk Burn Report for Boiler HE-3800-1, February 2004

Table A-3 Results of the First Initial Recurrent Comprehensive Performance Test Conducted May 27-30, 2014				
Parameter	**HWC MACT Emission Standard [1,2]**	**Test 1 Result [3]**	**Test 2 Result [4]**	**Test 3 Result [5]**
PCDD/PCDF (ng TEQ/dscm @ 7% O_2)	0.40	0.016	NA	0.055
Mercury (lb/MMBtu)	4.2E-5	NA	< 4.6E-7	NA
Cadmium plus Lead (SVM) (lb/MMBtu)	8.2E-5	NA	< 1.5E-6	NA
Chromium (LVM) (lb/MMBtu)	1.3E-4	NA	6.4E-6	NA
Total Chlorine (lb/hr)	16.3 [6]	NA	15.2	NA
PM (mg/dscm @ 7% O_2)	80	NA	0.63	NA
CO (ppmvd @ 7% O_2)	100	11.0	21.5	19.0
Hydrocarbons (ppmvd @ 7% O_2)	10	0.83	0.78	0.29
DRE (% of designated POHC's)	99.99	> 99.9977 [7]	> 99.9932 [7]	

Notes:

1. 40 CFR 63 Subpart EEE, incorporated by reference into SC Regulation 61-62.63.
2. Based on burning liquid wastes with a heating value of 10,000 MMBtu/lb or greater.
3. Test conducted at minimum combustion temperature.
4. Test conducted at maximum waste feed rate and maximum steam production rate.
5. Test conducted at maximum waste feed rate and maximum steam production rate.
6. Based on HBCA for total chlorine approved by SCDHEC in 2008.
7. Based on the lowest DRE test result for the most thermally stable POHC. For complete results see Trial Burn/Risk Burn Report for Boiler HE-3800-1, February 2004.

Table A-4 RCRA Permit Receptors and Exposure Scenarios						
	Exposure Scenario					
Receptor	Farmer-Adult	Farmer-Child	Resident-Adult	Resident-Child	Fisher-Adult	Fisher-Child
E1	X	X	X	X	X	X
E2	X	X	X	X	X	X
E3	X	X	X	X	X	X
E4	X	X	X	X	X	X
E5	X	X				
E6	X	X				
NW1			X	X	X	X
NW2			X	X	X	X
NW3			X	X	X	X
NW4			X	X	X	X
NW5			X	X	X	X
NW6			X	X	X	X
SE1			X	X	X	X
SE2			X	X	X	X
SE3			X	X	X	X
W1			X	X	X	X
W2			X	X	X	X
W3			X	X	X	X
W4			X	X	X	X
W5			X	X	X	X
N	X	X				
NE1	X	X	X	X	X	X
NE2	X	X	X	X	X	X
NNW			X	X	X	X
NW	X	X	X	X	X	X
S1			X	X	X	X
S2			X	X	X	X
S3			X	X	X	X
S4			X	X	X	X
SW			X	X	X	X
SW1	X	X				
SW2	X	X				
SW3	X	X				
SW4	X	X				
W			X	X	X	X

ATTACHMENT B

GEL Engineering LLC

Environmental | Engineering | Surveying

RESULTS OF THE DECEMBER 2016 DIOXINS/FURANS EMISSIONS TESTING OF BOILER No.4

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Orangeburg, South Carolina

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RESULTS OF THE DECEMBER 2016 DIOXINS/FURANS EMISSIONS TESTING OF THE BOILER No.4 EXHAUST

Si Group
Orangeburg, South Carolina

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RESULTS OF THE DECEMBER 2016 DIOXINS/FURANS EMISSIONS TESTING OF THE BOILER No.4 EXHAUST

Si Group
Orangeburg, South Carolina

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Appendices

I Summary of Test Results
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III Field Data Sheets
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VI Facility and Process Data
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Signature Page

This document entitled, "Results of the December 2016 Dioxins/Furans Emissions Testing of the Boiler No. 4 Exhaust," has been prepared and reviewed by the undersigned at the request of and for the exclusive use of the Si Group facility located in Orangeburg, South Carolina. It has been prepared in accordance with accepted quality control practices and it has been reviewed by the undersigned.

Craig McKenzie, QSTI
Senior Project Manager

Kirk Alexander, QSTI
Senior Project Manager

Keith D. McCullock
Director

February 28, 2016

Date

Executive Summary

Emission testing of the Boiler No. 4 located at the Si Group facility in Orangeburg, South Carolina, was performed by GEL Engineering, LLC (GEL) personnel on December 7-8, 2016. The following table provides a comparison of measured emission rates versus the permitted emission limit:

EMISSIONS TESTING RESULTS
(Three Run Average)

Regulated Pollutant	Test Method	Test Dates	Test Result	Emission Limit	Units	Compliance Indicated?
Dioxins/Furans	SW-846 Method 0023A	12/(7-8)/2016	0.0087	0.4	ng/dscm TEQ[a]	Yes

[a]nanograms per dry standard cubic meter corrected to 7% oxygen on a dry standard basis.

RESULTS OF THE DECEMBER 2016 DIOXINS/FURANS EMISSIONS TESTING OF THE BOILER No. 4 EXHAUST

Si Group
Orangeburg, South Carolina

1.0 INTRODUCTION

Emission testing of Boiler No. 4 located at the Si Group facility in Orangeburg, South Carolina, was performed by GEL Engineering, LLC (GEL) personnel on December 7-8, 2016. Emissions testing of the exhaust flue gas of the boiler was conducted for Polychlorinated Dibenzo-p-dioxins/furans (PCDD/PCDF). These tests were necessary to meet the requirements of Albemarle's permit issued by the South Carolina Department of Health and Environmental Control (SCDHEC) and the hazardous waste combustor (HWC) maximum achievable control technology (MACT) regulation in 40 CFR 63.

2.0 TESTING EVENT PARTICIPANTS

The following table summarizes the participants in the testing event:

Name	Project Role	Affiliation
Kirk Alexander	Project Manager	GEL
Gregg Szymkowicz	Field Team Leader	GEL
Charles Rice	Sampling Technician	GEL
Sean Huber	Sampling Technician	GEL
Eric Sady	Sampling Technician	GEL
Michelle Reese	Facility Representative	Si Group
Chris McBride	Consultant	Focus Envir.
Bryan Nichols	Regulatory Observer	SCDHEC

3.0 TEST RESULTS

Three tests runs measuring PCDD/PCDF were performed on December 7-8, 2016. The test results obtained for this sampling program are detailed in Appendix I. A summary of the results is found in the Executive Summary. Test method formulas and nomenclature are included in Appendix II. Field data sheets are included in Appendix III. Laboratory data is included in Appendix IV. Process operational data is included in Appendix V, and equipment calibration data is included in Appendix VI.

4.0 PROCESS DESCRIPTION

Boiler No. 4 treats liquid hazardous wastes generated by the SI Group production operations. The facility produces industrial organic chemicals and pharmaceuticals. The waste streams treated in the boiler are organic solvents. The waste streams can include chlorinated organic compounds that form hydrogen chloride (HCl) when burned. SI Group petitioned and obtained approval for a health-based compliance alternative for total chorine emissions in accordance with 40 CFR 63.1215. The site-specific risk-based total chlorine feed rate limit is 16.3 lb/hr. SI Group manages and performs analyses of the liquid wastes burned in Boiler No. 4 to confirm compliance with the chlorine emissions standard. Boiler No. 4 is equipped with a baghouse for particulate emissions control. The use of a dry air pollution control (APC) system requires the boiler to comply with the numerical emissions standard for PCDD/PCDFs at 63.1217(a)(1)(i).

5.0 TEST METHODS

Test parameters and sampling methods for the test program are summarized in Table 1. Sampling methods and analytical procedures recommended by the United States Environmental Protection Agency (EPA) were used during this test program. Laboratory and calibration procedures described in EPA Quality Assurance Handbook for Air Pollution Control Systems, Vol. III, (EPA/600/R-94/038c), and the QA/QC procedures specified in EPA and SW-846 Reference Methods 1, 2, 3, 4, and 0023A were followed during execution of the test program. The sampling and analytical methodologies are described below.

5.1 Stack Sampling Locations

EPA Method 1 was followed to determine the number and location of the sampling points used for velocity measurements during the test program. As specified by Method 1, an appropriate number of sampling points were selected. Absence of cyclonic flow was verified using the angle of approach methodology in Method 1. The EPA Method 1 field data sheets are included in Appendix III.

5.2 Dry Molecular Weight

In accordance with the guidelines in EPA Method 3, the dry molecular weight was measured during each emission test using a Gas-Tech analyzer. Prior to the testing, the analyzer was calibrated with EPA protocol gases. O2 and CO2 measurements were from a Tedlar bag that was filled during the course of each run. Analyzer data and calibrations are included in Appendix III. Calibration gas certifications are included in Appendix VI.

5.3 Moisture Content

EPA Method 4 was used to determine the moisture content of the stack gas. Following the protocol given in Method 4, the volume of the condensed water vapor collected in the impingers and the silica gel were weighed before and after sample collection. The difference in the two weights of the silica gel, the difference in the two weights of condensed water vapor captured in the impingers, and the volume of air sampled with the impingers train were used to calculate the moisture content of the stack gas.

5.4 Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans Emissions Determinations

Three three-hour test runs were conducted at the Boiler No. 4 stack using SW-846 Method 0023A to determine the emission rates for PCDD and PCDF. The sampling train was equipped with a glass nozzle, a glass probe liner, a quartz fiber filter, a condenser and XAD-2 trap, an empty impinger, two impingers charged with HPLC water, an empty impinger, and an impinger charged with silica gel. The PCDD/PCDF emissions were collected isokinetically through a heated sampling probe onto the heated filter, and XAD trap. After completion of each sampling run, the sample train components including the nozzle, probe, filter housing, connecting lines, and condenser were rinsed and scrubbed with the appropriate rinse solutions until clean. The rinse solutions, the XAD traps, the filters collected from each run and a field blank were then submitted to the laboratory, digested, and analyzed to determine PCDD/PCDF emissions. The Method 0023A field data sheets are included in Appendix III.

6.0 TEST PLAN AND PROCEDURES

A test plan was submitted to SCDHEC by Si Group for this performance test. The performance test was executed without any deviations, additions or exclusions to the test methods detailed in the test plan and GEL's quality manual.

7.0 EQUIPMENT CALIBRATION

Equipment calibration data is included in Appendix VI.

7.1 Nozzles

Each nozzle is purchased from a stack testing equipment supplier and inspected and calibrated before putting it into field use. Thereafter, it is inspected prior to use and if damaged, the nozzle is not used. A set of three measurements is made prior to use and must be within 0.002 inches. Nozzles are checked prior and after each source test.

7.2 Pitot Tubes

All pitot tubes used by GEL are purchased along with the probe assembly from a stack testing equipment supplier. Prior to being used, the pitot tubes are calibrated as per Method 2. If a type "S" pitot tube is constructed properly it will have a Cp (pitot coefficient) of 0.84±0.02. Pitot tubes are checked before each source test and receive a complete calibration once per year.

7.3 Dry Gas Meter

Complete dry gas meter calibrations are performed annually. A meter orifice check calculation is performed in the data summary. The average difference from the annual calibration was less than five percent, therefore no post calibration of the metering system was necessary..

7.4 Thermocouples

Each new thermocouple purchased by GEL is checked and calibrated prior to use. After each source test, all temperature-sensing devices used receive a one-point calibration check as per Method 2.

7.5 Balance

GEL technicians utilize an Ohaus Model E12140 serial no. G2391121320091P balance. The serial number for the calibration weight set is 39325. A copy of the calibration log will be provided upon request.

7.6 Barometer

GEL utilizes the National Weather Service to determine the current barometric pressure. This is obtained either using the Internet.

APPENDIX I
SUMMARY OF TEST RESULTS

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[Raw Data]

Si Group
Orangeburg, South Carolina

			Run Number 1	2	3	Mean
Date	Date of Test		12/07/17	12/07/17	12/08/17	
Start	Start Time, D/F		9:08 AM	1:25 PM	7:45 AM	-
Stop	Stop Time, D/F		12:15 PM	4:30 PM	10:50 AM	-
θ	Total Sampling Time, D/F		180.0	180.0	180.0	180.0
Pbar	Barometric Pressure, in. Hg		29.90	29.92	29.89	29.90
Ds(d)	Stack Diameter (depth), inches		23.25	23.25	23.25	23.25
Ds(w)	Stack Diameter (width if rectangular), inches		0.00	0.00	0.00	0.00
Dn	Nozzle Diameter, inches		0.221	0.221	0.221	0.221
Δp	Average Velocity Head of Stack Gas, in. H2O		0.595	0.587	0.582	0.588
√Δp	Average Squareroot Velocity Head of Stack Gas, in. H2O		0.764	0.760	0.757	0.760
ΔH	Average Pressure Differential Across the Orifice Meter, in. H2O		0.932	0.956	0.962	0.950
√ΔH	Average Squareroot Pressure Differential Across the Orifice Meter, in. H2O		0.956	0.971	0.973	0.967
Tm	Dry Gas Meter Temperature, °F		72.2	72.5	70.2	71.6
Ts	Stack Temperature, °F		299.8	301.8	299.3	300.3
Pg	Stack Static Pressure, in. H2O		-0.34	-0.38	-0.35	-0.36
Vlc	TotalMass of Water Vapor Condensed in Impingers, g		114.5	116.8	121.7	117.7
Vwsg	Total Mass of Water Vapor Condensed in Silica Gel, g		17.3	17.8	20.3	18.5
%CO2	Percent CO2 by Volume, Dry Basis		8.00	8.10	8.20	8.10
%O2	Percent O2 by Volume, Dry Basis		9.10	9.20	9.40	9.23
%CO	Percent CO by Volume, Dry Basis		0.0	0.0	0.0	0.0
Vm	Volume of Gas Sample as measured by Dry Gas Meter, dcf		88.907	89.860	91.711	90.159
Y	Dry Gas Meter Calibration Factor		1.0362	1.0362	1.0362	1.0362
ΔHa	Orifice Coefficient Factor		1.8654	1.8654	1.8654	1.8654
Cp	Pitot Coefficient		0.84	0.84	0.84	0.84
Mn(PCDD)	**Dioxins, pg**	2378-TCDD Toxicity Equivalency Factor				
	2378-TCDD	1	< 8.2	< 10.3	< 7.6	< 8.7
	12378-PeCDD	0.5	< 3.0	< 3.4	< 2.9	< 3.1
	123478-HxCDD	0.1	< 3.4	< 3.7	< 2.7	< 3.3
	123678-HxCDD	0.1	< 3.4	< 3.5	< 2.6	< 3.2
	123789-HxCDD	0.1	< 3.3	< 3.5	< 2.6	< 3.1
	1234678-HpCDD	0.01	6.2	9.2	3.3	6.2
	OCDD	0.001	14.4	17.3	20.4	17.4
	Total TCDD		< 8.2	< 10.3	34.0	17.5
	Total PeCDD		< 3.0	< 3.4	11.0	5.8
	Total HxCDD		< 3.4	2.2	12.0	5.9
	Total HpCDD		8.7	19.3	11.8	13.3
	Other TCDD	0.01	0.0	0.0	34.0	11.3
	Other PeCDD	0.005	0.0	0.0	11.0	3.7
	Other HxCDD	0.0004	0.0	2.2	12.0	4.7
	Other HpCDD	0.00001	2.5	10.1	8.5	7.0

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[Raw Data]

Si Group
Orangeburg, South Carolina

Mn(PCDD)	**Furans, pg**									
	2378-TCDF	0.1		9.0		5.0		19.3		11.1
	12378-PeCDF	0.05		3.7	<	3.0	<	2.4		3.0
	23478-PeCDF	0.5		1.5		4.1		8.9		4.8
	123478-HxCDF	0.1		17.8		28.0		24.9		23.6
	123678-HxCDF	0.1	<	7.5		5.0		3.5		5.3
	234678-HxCDF	0.1	<	7.8	<	4.5	<	2.0	<	4.8
	123789-HxCDF	0.1	<	8.7	<	4.9	<	2.2	<	5.3
	1234678-HpCDF	0.01		35.0		25.8		48.0		36.3
	1234789-HpCDF	0.01		12.0	<	8.5	<	2.9	<	7.8
	OCDF	0.001		27.3		23.1		8.4		19.6
	Total TCDF			44.0		52.0		364.0		153.3
	Total PeCDF			13.5		16.0		157.0		62.2
	Total HxCDF			24.8		33.0		69.0		42.3
	Total HpCDF			52.0		25.8		48.0		41.9
	Other TCDF	0.001		35.0		47.0		344.7		142.2
	Other PeCDF	0.001		8.3		8.9		148.1		55.1
	Other HxCDF	0.0001		7.0		5.0		40.6		17.5
	Other HpCDF	0.00001		5.0		0.0		0.0		1.7
Tstd	Standard Temperature, °R			528		528		528		528
Pstd	Standard Pressure, in. Hg			29.92		29.92		29.92		29.92

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[Flowrate Calculations]

Si Group
Orangeburg, South Carolina

		Run Number			
		1	2	3	Mean
An	Cross Sectional Area of Nozzle, square feet	0.000266	0.000266	0.000266	0.000266
As	Cross Sectional Area of Stack, square feet	2.95	2.95	2.95	2.95
Tm	Absolute Dry Gas Meter Temperature, °R	532.2	532.5	530.2	531.6
Ts	Absolute Stack Temperature, °R	759.8	761.8	759.3	760.3
Vmstd	Volume of Gas Sample Measured by the Dry Gas Meter, corrected to Standard Conditions, dscf	91.547	92.543	94.765	92.952
Vwcstd	Volume of Water Vapor Condensed in the Impingers, Corrected to Standard Conditions	5.40	5.51	5.74	5.55
Vwsgstd	Volume of Water Vapor Condensed in the Silica Gel, Corrected to Standard Conditions	0.82	0.84	0.96	0.87
Bws	Water Vapor in the Gas Stream, proportion by volume	0.064	0.064	0.066	0.065
%N2	Percent N2 by Volume, Dry Basis	82.90	82.70	82.40	82.67
Md	Molecular Weight of Stack Gas, Dry Basis, lb/lb-mole	29.64	29.66	29.69	29.66
Ms	Molecular Weight of Stack Gas, Wet Basis, lb/lb-mole	28.90	28.91	28.92	28.91
Ps	Absolute Stack Gas Pressure, in. Hg	29.88	29.89	29.86	29.88
Vs	Average Stack Gas Velocity, ft/sec	51.46	51.24	50.97	51.22
Qa	Wet Volumetric Stack Gas Flow Rate at Actual Conditions, acf/min	9,110	9,070	9,020	9,070
Qa	Wet Volumetric Stack Gas Flow Rate at Actual Conditions, acf/hour	546,500	544,200	541,300	544,000
Qs	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions, dscf/hour	355,000	353,000	351,000	353,000
Yqa	DGM Calibration Check	1.0550	1.0598	1.0383	1.0510
Yqa	DGM Calibration Check, % difference from annual	1.8	2.3	0.2	1.4
% I	Isokinetics, %	95.3	97.0	99.8	97.4

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[Pollutant Concentrations and Emissions Summary]

Si Group
Orangeburg, South Carolina

		Run Number 1	Run Number 2	Run Number 3	Mean
Cs(PCDD)	**Dioxins, ng/M3**				
	2378-TCDD	< 3.16E-03	< 3.93E-03	< 2.83E-03	< 3.31E-03
	12378-PeCDD	< 1.16E-03	< 1.30E-03	< 1.08E-03	< 1.18E-03
	123478-HxCDD	< 1.31E-03	< 1.41E-03	< 1.01E-03	< 1.24E-03
	123678-HxCDD	< 1.31E-03	< 1.34E-03	< 9.69E-04	< 1.21E-03
	123789-HxCDD	< 1.27E-03	< 1.34E-03	< 9.69E-04	< 1.19E-03
	1234678-HpCDD	2.39E-03	3.51E-03	1.23E-03	2.38E-03
	OCDD	5.55E-03	6.60E-03	7.60E-03	6.58E-03
	Other TCDD	0.00E+00	0.00E+00	1.27E-02	4.23E-03
	Other PeCDD	0.00E+00	0.00E+00	4.10E-03	1.37E-03
	Other HxCDD	0.00E+00	8.40E-04	4.47E-03	1.77E-03
	Other HpCDD	9.64E-04	3.85E-03	3.17E-03	2.66E-03
Cs(PCDD)	**Dioxins, ng/M3 Corrected to 7% O2**				
	2378-TCDD	< 0.00372	< 0.00467	< 0.00342	< 0.00394
	12378-PeCDD	< 0.00137	< 0.00154	< 0.00131	< 0.00141
	123478-HxCDD	< 0.00154	< 0.00168	< 0.00122	< 0.00148
	123678-HxCDD	< 0.00154	< 0.00159	< 0.00117	< 0.00143
	123789-HxCDD	< 0.00150	< 0.00159	< 0.00117	< 0.00142
	1234678-HpCDD	0.00282	0.00417	0.00149	0.00283
	OCDD	0.00654	0.00784	0.00919	0.00786
	Other TCDD	0.00000	0.00000	0.01535	0.0051
	Other PeCDD	0.00000	0.00000	0.00496	0.0017
	Other HxCDD	0.00000	0.00100	0.00540	0.0021
	Other HpCDD	0.00114	0.00457	0.00383	0.0032
Cs(PCDF)	**Furans, ng/M3**				
	2378-TCDF	3.47E-03	< 1.91E-03	< 7.19E-03	4.19E-03
	12378-PeCDF	1.43E-03	< 1.14E-03	< 8.94E-04	< 1.15E-03
	23478-PeCDF	5.79E-04	1.56E-03	3.32E-03	1.82E-03
	123478-HxCDF	6.87E-03	1.07E-02	9.28E-03	8.95E-03
	123678-HxCDF	< 2.89E-03	1.91E-03	1.30E-03	2.03E-03
	234678-HxCDF	< 3.01E-03	< 1.72E-03	< 7.45E-04	< 1.83E-03
	123789-HxCDF	< 3.36E-03	< 1.87E-03	< 8.20E-04	< 2.02E-03
	1234678-HpCDF	1.35E-02	9.85E-03	1.79E-02	1.38E-02
	1234789-HpCDF	4.63E-03	< 3.24E-03	< 1.08E-03	< 2.98E-03
	OCDF	1.05E-02	8.81E-03	3.13E-03	7.48E-03
	Other TCDF	1.35E-02	1.79E-02	1.28E-01	5.31E-02
	Other PeCDF	3.20E-03	3.40E-03	5.52E-02	2.06E-02
	Other HxCDF	2.70E-03	1.91E-03	1.51E-02	6.57E-03
	Other HpCDF	1.93E-03	0.00E+00	0.00E+00	6.43E-04

Cs(PCDF)	**Furans, ng/M3 Corrected to 7% O2**								
	2378-TCDF		0.00409	<	0.00227	<	0.00869		0.00502
	12378-PeCDF		0.00168	<	0.00135	<	0.00108		0.00137
	23478-PeCDF		0.00068		0.00185		0.00401		0.00218
	123478-HxCDF		0.00809		0.01271		0.01122		0.01067
	123678-HxCDF	<	0.00340		0.00227		0.00157		0.00241
	234678-HxCDF	<	0.00355	<	0.00204	<	0.00090	<	0.00216
	123789-HxCDF	<	0.00396	<	0.00222	<	0.00099	<	0.00239
	1234678-HpCDF		0.01590		0.01170		0.02164		0.01641
	1234789-HpCDF		0.00545	<	0.00385	<	0.00131	<	0.00354
	OCDF		0.01237		0.01047		0.00378		0.00887
	Other TCDF		0.01590		0.02127		0.15471		0.0640
	Other PeCDF		0.00377		0.00404		0.06672		0.0248
	Other HxCDF		0.00318		0.00227		0.01825		0.0079
	Other HpCDF		0.00227		0.00000		0.00000		0.0008
	Total PCDD, PCDF		8.87E-02		9.00E-02		2.84E-01		1.54E-01
	Total PCDD, PCDF - Corrected to 7% O2		1.04E-01		1.07E-01		3.43E-01		1.85E-01

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[Mass Emission Rates]

Si Group
Orangeburg, South Carolina

		Run Number 1	2	3	Mean
Mp(PCDD)	**Dioxins, lb/hr**				
	2378-TCDD	< 7.01E-11	< 8.66E-11	< 6.21E-11	< 7.29E-11
	12378-PeCDD	< 2.56E-11	< 2.86E-11	< 2.37E-11	< 2.60E-11
	123478-HxCDD	< 2.91E-11	< 3.11E-11	< 2.20E-11	< 2.74E-11
	123678-HxCDD	< 2.91E-11	< 2.94E-11	< 2.12E-11	< 2.66E-11
	123789-HxCDD	< 2.82E-11	< 2.94E-11	< 2.12E-11	< 2.63E-11
	1234678-HpCDD	5.30E-11	7.74E-11	2.69E-11	5.24E-11
	OCDD	1.23E-10	1.45E-10	1.67E-10	1.45E-10
	Other TCDD	0.00E+00	0.00E+00	2.78E-10	9.27E-11
	Other PeCDD	0.00E+00	0.00E+00	8.98E-11	2.99E-11
	Other HxCDD	0.00E+00	1.85E-11	9.80E-11	3.88E-11
	Other HpCDD	2.14E-11	8.49E-11	6.94E-11	5.86E-11
Mp(PCDF)	**Furans, lb/hr**				
	2378-TCDF	7.69E-11	< 4.20E-11	< 1.58E-10	9.23E-11
	12378-PeCDF	3.16E-11	< 2.52E-11	< 1.96E-11	2.55E-11
	23478-PeCDF	1.28E-11	3.45E-11	7.27E-11	4.00E-11
	123478-HxCDF	1.52E-10	2.35E-10	2.03E-10	1.97E-10
	123678-HxCDF	< 6.41E-11	4.20E-11	2.86E-11	4.49E-11
	234678-HxCDF	< 6.67E-11	< 3.78E-11	< 1.63E-11	< 4.03E-11
	123789-HxCDF	< 7.44E-11	< 4.12E-11	< 1.80E-11	< 4.45E-11
	1234678-HpCDF	2.99E-10	2.17E-10	3.92E-10	3.03E-10
	1234789-HpCDF	1.03E-10	< 7.15E-11	< 2.37E-11	6.61E-11
	OCDF	2.33E-10	1.94E-10	6.86E-11	1.65E-10
	Other TCDF	2.99E-10	3.95E-10	2.81E-09	1.17E-09
	Other PeCDF	7.10E-11	7.48E-11	1.21E-09	4.52E-10
	Other HxCDF	5.98E-11	4.20E-11	3.32E-10	1.45E-10
	Other HpCDF	4.27E-11	0.00E+00	0.00E+00	1.42E-11
	Total PCDD, PCDF	1.97E-09	1.98E-09	6.23E-09	3.39E-09

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[2378-TCDD Toxic Equivalency Concentrations]

Si Group
Orangeburg, South Carolina

		Run Number 1	2	3	Mean
Mp(PCDD)	**Dioxins, ng/M3**				
	2378-TCDD	< 3.16E-03	< 3.93E-03	< 2.83E-03	< 3.31E-03
	12378-PeCDD	< 5.80E-04	< 6.50E-04	< 5.40E-04	< 5.90E-04
	123478-HxCDD	< 1.31E-04	< 1.41E-04	< 1.01E-04	< 1.24E-04
	123678-HxCDD	< 1.31E-04	< 1.34E-04	< 9.69E-05	< 1.21E-04
	123789-HxCDD	< 1.27E-04	< 1.34E-04	< 9.69E-05	< 1.19E-04
	1234678-HpCDD	2.39E-05	3.51E-05	1.23E-05	2.38E-05
	OCDD	5.55E-06	6.60E-06	7.60E-06	6.58E-06
	Other TCDD	0.00E+00	0.00E+00	1.27E-04	4.23E-05
	Other PeCDD	0.00E+00	0.00E+00	2.05E-05	6.83E-06
	Other HxCDD	0.00E+00	3.36E-07	1.79E-06	7.09E-07
	Other HpCDD	9.64E-09	3.85E-08	3.17E-08	2.66E-08
		4.16E-03	5.03E-03	3.83E-03	
Mp(PCDF)	**Furans, ng/M3**				
	2378-TCDF	3.47E-04	< 1.91E-04	< 7.19E-04	4.19E-04
	12378-PeCDF	7.15E-05	< 5.70E-05	< 4.47E-05	5.77E-05
	23478-PeCDF	2.90E-04	7.80E-04	1.66E-03	9.10E-04
	123478-HxCDF	6.87E-04	1.07E-03	9.28E-04	8.95E-04
	123678-HxCDF	< 2.89E-04	1.91E-04	1.30E-04	2.03E-04
	234678-HxCDF	< 3.01E-04	< 1.72E-04	< 7.45E-05	< 1.83E-04
	123789-HxCDF	< 3.36E-04	< 1.87E-04	< 8.20E-05	< 2.02E-04
	1234678-HpCDF	1.35E-04	9.85E-05	1.79E-04	1.38E-04
	1234789-HpCDF	4.63E-05	< 3.24E-05	< 1.08E-05	< 2.98E-05
	OCDF	1.05E-05	8.81E-06	3.13E-06	7.48E-06
	Other TCDF	1.35E-05	1.79E-05	1.28E-04	5.31E-05
	Other PeCDF	3.20E-06	3.40E-06	5.52E-05	2.06E-05
	Other HxCDF	2.70E-07	1.91E-07	1.51E-06	6.57E-07
	Other HpCDF	1.93E-08	0.00E+00	0.00E+00	6.43E-09
	Total PCDD, PCDF (Excludes "Others")	6.67E-03	7.82E-03	7.52E-03	7.34E-03
	Total PCDD, PCDF, Corrected to 7% O2	7.86E-03	9.29E-03	9.09E-03	8.74E-03

SUMMARY OF TEST RESULTS

Boiler No. 4
Exhaust

DIOXINS & FURANS

[2378-TCDD Toxic Equivalency Mass Emission Rates]

Si Group
Orangeburg, South Carolina

		Run Number			
		1	2	3	Mean
Mp(PCDD)	**Dioxins, lb/hr**				
	2378-TCDD	< 7.01E-11	< 8.66E-11	< 6.21E-11	< 7.29E-11
	12378-PeCDD	< 1.28E-11	< 1.43E-11	< 1.19E-11	< 1.30E-11
	123478-HxCDD	< 2.91E-12	< 3.11E-12	< 2.20E-12	< 2.74E-12
	123678-HxCDD	< 2.91E-12	< 2.94E-12	< 2.12E-12	< 2.66E-12
	123789-HxCDD	< 2.82E-12	< 2.94E-12	< 2.12E-12	< 2.63E-12
	1234678-HpCDD	5.30E-13	7.74E-13	2.69E-13	5.24E-13
	OCDD	1.23E-13	1.45E-13	1.67E-13	1.45E-13
	Other TCDD	0.00E+00	0.00E+00	2.78E-12	9.27E-13
	Other PeCDD	0.00E+00	0.00E+00	4.49E-13	1.50E-13
	Other HxCDD	0.00E+00	7.40E-15	3.92E-14	1.55E-14
	Other HpCDD	2.14E-16	8.49E-16	6.94E-16	5.86E-16
Mp(PCDF)	**Furans, lb/hr**				
	2378-TCDF	7.69E-12	< 4.20E-12	< 1.58E-11	9.23E-12
	12378-PeCDF	1.58E-12	< 1.26E-12	< 9.80E-13	1.27E-12
	23478-PeCDF	6.40E-12	1.73E-11	3.64E-11	2.00E-11
	123478-HxCDF	1.52E-11	2.35E-11	2.03E-11	1.97E-11
	123678-HxCDF	< 6.41E-12	4.20E-12	2.86E-12	4.49E-12
	234678-HxCDF	< 6.67E-12	< 3.78E-12	< 1.63E-12	< 4.03E-12
	123789-HxCDF	< 7.44E-12	< 4.12E-12	< 1.80E-12	< 4.45E-12
	1234678-HpCDF	2.99E-12	2.17E-12	3.92E-12	3.03E-12
	1234789-HpCDF	1.03E-12	< 7.15E-13	< 2.37E-13	6.61E-13
	OCDF	2.33E-13	1.94E-13	6.86E-14	1.65E-13
	Other TCDF	2.99E-13	3.95E-13	2.81E-12	1.17E-12
	Other PeCDF	7.10E-14	7.48E-14	1.21E-12	4.52E-13
	Other HxCDF	5.98E-15	4.20E-15	3.32E-14	1.45E-14
	Other HpCDF	4.27E-16	0.00E+00	0.00E+00	1.42E-16
	Total PCDD, PCDF (excludes "Others")	1.48E-10	1.72E-10	1.65E-10	1.62E-10

APPENDIX II
TEST METHOD FORMULAS AND NOMENCLATURE

GEL Engineering, LLC

A Member of The GEL Group, Inc.

TEST METHODS FORMULAS FOR EMISSIONS TESTING
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[updated September 9, 2016]

1. AREAS

1.1 Area of Stack, Square feet (Round Stack)

$$A_s = \left(\frac{D_{s(width)}^2 \pi}{4}\right) \times \left(\frac{ft^2}{144 in^2}\right)$$

1.2 Area of Stack, Square feet (Square Stack)

$$A_s = (D_{s(width)})(D_{s(depth)})\left(\frac{ft^2}{144\ in^2}\right)$$

1.3 Area of Nozzle, Square feet

$$A_n = \left(\frac{D_n^2 \pi}{4}\right)\left(\frac{ft^2}{144\ in^2}\right)$$

2. TEMPERATURE CONVERSIONS

2.1 Temperature, Degrees Celsius—> Degrees Fahrenheit

$$T^\circ F = (T^\circ C)(9/5) + 32$$

2.2 Dry Gas Meter Temperature, Degrees Fahrenheit—>Degrees Rankin

$$T_m{}^\circ R = T_m{}^\circ F + 460$$

2.3 Stack Temperature, Degrees Fahrenheit—> Degrees Rankin

$$T_s{}^\circ R = T_s{}^\circ F + 460$$

3. VOLUME OF AIR COLLECTED

3.1 Volume of Dry Gas Sample, Corrected to Standard Conditions (cubic feet)

$$V_{m(std)} = (V_m)(Y)\left(\frac{T_{std}}{T_m \circ R}\right)\frac{\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{P_{std}}$$

3.2 Volume of Dry Gas Sample, Corrected to Standard Conditions (liters)

$$V_{m(std)} = \frac{(V_m)(Y)(P_{bar})(T_{std})}{(T_m \circ R)(P_{std})}$$

4. MOISTURE DETERMINATION

4.1 Volume of Water Vapor Condensed in Impingers, Corrected to Standard Conditions

If measured with graduated cylinder:

$$V_{wc(std)} = (V_{lc})(0.04707)$$

If measured with balance:

$$V_{wsg(std)} = (V_{wsg})(0.04715)$$

4.2 Volume of Water Vapor Collected in Silica Gel, Corrected to Standard Conditions

$$V_{wsg(std)} = (V_{wsg})(0.04715)$$

4.3 Water Vapor in the Stack Gas, Proportion by Volume

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

4.4 Dry Mole Fraction of Flue Gas

$$M_{fd} = 1 - B_{ws}$$

5. MOLECULAR WEIGHT OF STACK GAS

5.1 Nitrogen Content of Stack Gas, Percent

$$\%N_{2dry} = 100 - \%CO_{2dry} - \%O_{2dry} - \%CO_{dry}$$

5.2 Dry Molecular Weight of the Stack Gas

$$M_d = 0.44(\%CO_{2dry}) + 0.32(\%O_{2dry}) + 0.28(\%N_{2dry} + \%CO_{dry})$$

5.3 Wet Molecular Weight of the Stack Gas

$$M_s = (M_d)(M_{fd}) + 18(B_{ws})$$

5.4 Sample Gas Density, pounds per cubic foot

$$P_{s(sgd)} = \frac{(M_d)(M_{fd}) + (18)(1 - M_{fd})}{385.3}$$

5.5 Total Weight of Gas Sampled, pound

$$W_{sg} = (V_{m(std)} + V_{wc(std)} + V_{wsg(std)})(P_{s(std)})$$

5.6 Excess Air, percent

$$\%EA = \left(\frac{\%O_{2dry} - (0.5)(\%CO_{dry})}{(0.264)(\%N_{2dry}) - (\%O_{2dry} - (0.5)(\%CO_{dry}))} \right) 100$$

6. FLOW DETERMINATIONS

6.1 Absolute Stack Gas Pressure

$$P_s = P_{bar} + \frac{P_g}{13.6}$$

6.2 Average Stack Gas Velocity, feet per second

$$V_s = (K_p)(C_p)\left(\sqrt{\Delta P}\right)\sqrt{\frac{T_s{}^\circ R}{(P_s)(M_s)}}$$

6.3 Wet Volumetric Stack Gas Flow Rate, Actual Conditions, cubic feet per minute

$$Q_a = (V_s)(A_s)\left(\frac{60\text{sec}}{\text{min}}\right)$$

6.4 Dry Volumetric Stack Gas Flow Rate, Corrected to Standard Conditions, cubic feet per hour

$$Q_s = (V_s)(A_s)\left(\frac{3600\ \text{sec}}{\text{hr}}\right)(M_{fd})\left(\frac{P_s}{T_s}\right)\left(\frac{T_{std}}{P_{std}}\right)$$

7. ISOKINETICS DETERMINATION

7.1 Raw Isokinetic Variation, Percent

$$\text{Raw } \%I = \left(\frac{(T_s{}^\circ R)\left((K4)(V_{lc})+\left(\frac{V_m}{T_m{}^\circ R}\right)\right)\left(P_{bar}+\left(\frac{\Delta H}{13.6}\right)\right)}{(60)(V_s)(P_s)(\theta)(A_n)}\right)100$$

$$K4 = 0.002676$$

7.2 Isokinetic Variation, Percent

$$\%I = \left(\frac{(T_s{}^\circ R)(V_{m(std)})(P_{std})}{(60)(V_s)(P_s)(\theta)(A_n)(M_{fd})(T_{std})}\right)100$$

7.3 Determining K-Factor

$$K = (846.72)(D_n{}^4)(\Delta H@)(C_p{}^2)(M_{fd}{}^2)\left(\frac{(M_d)(T_m{}^\circ R)(P_s)}{(M_s)(T_s{}^\circ R)(P_m)}\right)$$

7.4 Determining DH

$$\Delta H = [K]\Delta P$$

8. POLLUTANT DETERMINATIONS

8.1 Concentration of Pollutant, Grains per Dry Standard Meter

$$C_{sd} = \left(\frac{M_n}{V_{mstd}}\right)\left(\frac{g}{1{,}000{,}000\ \mu g}\right)\left(\frac{15.432\ grains}{g}\right)$$

8.2 Concentration of Pollutant, Milligrams per Dry Standard Cubic Meter

$$C_{sd} = \left(\frac{M_n}{V_{mstd}}\right)\left(\frac{g}{1{,}000\ \mu g}\right)\left(\frac{35.315\ ft^3}{m^3}\right)$$

8.3 Emission Rate for Pollutant, Grains per Dry Standard Cubic Foot —> Pounds per Hour

$$M_p = (C_{sd})(Q_s)\left(\frac{lb}{7000\ gr}\right)$$

8.4 Emission Rate for Pollutant, Pounds per Hour—> Pounds per Million BTU

$$M_{pBtu} = \left(\frac{M_p}{Qs}\right)(F)\left(\frac{20.9}{20.9 - \%O_2}\right)$$

8.5 Emission Rate of Pollutant based on Production Rate, Pounds per Hour—> Pounds per Ton

$$M_{pro} = \left(\frac{M_p}{P}\right)$$

8.6 Emission Rate of Pollutant, Actual Flow Rate, Parts per Million -> Pounds per Hour

$$M_p = \left(\frac{M_n}{1{,}000{,}000}\right)(Q_a)\left(\frac{m^3}{35.315\ dscf}\right)\left(\frac{mole}{0.02404\ m^3}\right)\left(\frac{P_s}{T_s°R}\right)\left(\frac{T_{std}}{P_{std}}\right)\left(\frac{MW\ g}{mole}\right)\left(\frac{lb}{453.6\ g}\right)$$

8.7 Emission Rate of Pollutant, Standard Flow Rate, Parts per Million -> Pounds per Hour

$$M_p = \left(\frac{M_n}{1{,}000{,}000}\right)(Q_s)\left(\frac{m^3}{35.315\ dscf}\right)\left(\frac{mole}{0.02404\ m^3}\right)\left(\frac{MW\ g}{mole}\right)\left(\frac{lb}{453.6\ g}\right)$$

9. POLLUTANT CORRECTIONS

9.1 Concentration Correction to 12% Carbon Dioxide

$$C_{s12} = (C_s)\left(\frac{12}{\%CO_{2dry}}\right)$$

9.2 Concentration Correction to 50% Excess Air Concentration

$$C_{s50} = (C_s)\left(\frac{100 + \%EA}{150}\right)$$

9.3 Concentration Correction to 50% Excess Air Concentration using Raw ORSAT Data

$$C_{s50} = \frac{C_s}{1 - \left(\frac{(1.5)(\%O_{2dry}) - (0.133)(\%N_{2dry}) - (0.75)(\%COdry)}{21}\right)}$$

9,4 Leak Rate Adjustment

$$Vm = \left[Vm - (L_1 - L_a)\right]\theta - \sum_{i=2}^{N}(L_1 - L_a)\theta_i - (L_p - L_a)\theta_p$$

9.5 Concentration of Pollutant, Corrected for Moisture, ppm

$$M_n = \left(\frac{M_n}{M_{fd}}\right)$$

9.6 Concentration of Volatile Organic Compounds, Corrected to Standard Conditions, ppm as Carbon

$$M_{n[VOC]} = \left(\frac{(M_{np})\left(\frac{3\ Carbon}{Propane}\right)}{M_{fd}} \right)$$

9.7 Concentration of Pollutant, Corrected for Oxygen, ppm

$$M_n = (M_n)\left(\frac{20.9 - \%O_{2Corr}}{20.9 - \%O_{2dry}}\right)$$

9.8 Concentration of Pollutant (CO, NOx), Corrected for Carbon Dioxide, ppm

$$M_n = (M_n)\left(1 - \frac{\%CO_{2dry}}{100}\right)$$

10. EFFICIENCY EQUATIONS

10.1 Capture Efficiency, percent

$$\%C = \left(\frac{M_{p(outlet)}}{M_{p(inlet)}}\right)100$$

10.2 Destruction Reduction Efficiency, percent

$$\%DRE = \left(\frac{M_{p(inlet)} - M_{p(outlet)}}{M_{p(inlet)}}\right)100$$

11. METHOD 8 EQUATIONS

11.1 Emission Rate of Pollutant (SO_2), pounds/cubic foot

$$C_{SO2} = (K_3)\left(\frac{N(V_t - V_{tb})\left(\frac{V_{solution}}{V_{aliquot}}\right)}{Vm_{std}}\right)$$

$$K3 = 7.061 \times 10^{-5} \text{ lb / meq}$$

11.2 Emission Rate of Pollutant (H_2SO_4), pounds/cubic foot

$$C_{H2SO4} = (K_2)\left(\frac{N(V_t - V_{tb})\left(\frac{V_{solution}}{V_{aliquot}}\right)}{V_{mstd}}\right)$$

$$K2 = 1.081 \times 10^{-4} \text{ lb / meq}$$

12. NOMINAL NOZZLE SIZE

12.1 Nozzle Determination, inches

$$D_n = \sqrt{\frac{(0.0358)(Q_m)(P_m)}{(T_m°R)(C_p)(M_{fd})}}\sqrt{\frac{(T_s°R)(M_s)}{(P_s)(\overline{\Delta P})}}$$

12.2 PM10 Nozzle Determination, inches

$$Dn = \sqrt{\frac{Qa}{Cp(\sqrt{DP})\left(\frac{85.49 * 3.1416 * 60}{576}\right)\left(\sqrt{\frac{Ts°R}{(Ps)(Ms)}}\right)}}$$

Qa is obtained from PM10 manual (acfm)

13. F-FACTOR EQUATIONS

Note: All Cs values must be in pounds per standard cubic foot (lb/scf)
See EPA 40 CFR 60, App. A, Method 9, Sec. 2.0.

Conversion Factors for Concentration

From	To	Multiply by
g/scm	ng/scm	1.00E+09
mg/scm	ng/scm	1.00E+06
lb/scf	ng/scm	1.60E+13
ppm SO2	ng/scm	2.66E+06
ppm NOx	ng/scm	1.91E+06
ppm SO2	lb/scf	1.66E-07
ppm NOx	lb/scf	1.19E-07

13.1 Oxygen-Based F Factor, Dry Basis

$$E = (C_d)(F_d)\left(\frac{20.9}{20.9 - \%O_{2dry}}\right)$$

13.1a Oxygen-Based F Factor, Dry Basis, correcting to 7% Oxygen

$$E = (C_d)(F_d)\left(\frac{20.9 - 7.0}{20.9 - \%O_{2dry}}\right)$$

13.2 Oxygen-Based F Factor, Wet Basis

$$E = (C_w)(F_d)\left(\frac{20.9}{20.9(1 - B_{ws}) - \%O_{2wet}}\right)$$

13.3 Oxygen-Based F Factor, Dry/Wet Basis

$$E = \frac{(C_w F_d)(20.9)}{(1 - B_{ws})(20.9 - \%O_{2dry})}$$

Note: When pollutant is measured on wet basis and %O2 is measured on a dry basis.

13.4 Oxygen-Based F Factor, Dry/Wet Basis

$$E = \frac{CdFd(20.9)(1 - Bws)}{(20.9 - \%O2wet)}$$

Note: When pollutant is measured on dry basis and %O2 is measured on a wet basis.

13.5 Carbon Dioxide-Based Factor, Dry Basis

$$E = (C_{dry})(F_c)\left(\frac{100}{\%CO_{2dry}}\right)$$

13.6 Carbon Dioxide-Based Factor, Wet Basis

$$E = (F_c)(C_{wet})\left(\frac{100}{\%CO_{2wet}}\right)$$

13.7 Carbon Dioxide-Based Factor, Dry/Wet Basis

$$E = \left[\frac{(C_w)(F_c)}{M_{fd}}\right]\left(\frac{100}{\%CO_{2dry}}\right)$$

Note: When pollutant is measured on wet basis and %O2 is measured on a dry basis.

13.8 Carbon Dioxide-Based Factor, Dry/Wet Basis

$$E = \left(\frac{(C_{dry})(M_{fd})(F_c)100}{\%CO_{2\,wet}}\right)$$

Note: When pollutant is measured on dry basis and %O2 is measured on a wet basis.

14. CYCLONIC FLOW

14.1 Average Stack Gas Velocity, feet per second (Cyclonic), used for Isokinetic Determination Only

$$V_{s[cyc]} = (K_p)(C_p)\left(\sqrt{\Delta P}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$

14.2 Average Stack Gas Velocity, feet per second (Laminar)

$$V_{s[lam]} = (K_p)(C_p)\left(\sqrt{\cos\phi(\Delta P)}\right)\sqrt{\frac{T_s}{(P_s)(M_s)}}$$

Note: When using Microsoft Excel, the Cosine function is in Radians. To convert Degrees to Radians multiply by π/180 (where π=3.1416).

14.3 Determination of Sampling Time

$$\text{Minutes / Point} = \cos\phi(\text{Base Time})$$

14.4 Average Differential Pressure

$$\Delta P_{Vavg} = \left[\frac{\sum \cos\phi \sqrt{\Delta P}}{n} \right]^2$$

14.5 Axial Volumetric Flow Rate

$$Q_s = K_p C_p A_s \sqrt{\frac{T_s}{P_s M_s}} \frac{\sum_i^n \left(\sqrt{\Delta P_i} \cos\phi_i \right)}{n}$$

15. METHOD 5 POST TEST CALIBRATION

15.1 Alternative Method 5 Post-Test Calibration

$$Y_{qa} = \left(\frac{\theta}{V_m} \right) \left(\sqrt{\Delta H_{avg}} \right) \sqrt{\frac{\left(\frac{P_{std}}{T_{std}} \right) (Q_m)^2 (T_m \circ R)(M_{d(AMB)})}{(\Delta H @) \left(P_{bar} + \frac{\Delta H_{avg}}{13.6} \right) (M_d)}}$$

15.2 CRITICAL ORIFICE

$$V_{mstd} = (K1)(V_m) \left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m \circ R} \right) \qquad V_{cr(std)} = (K_{co})(\theta) \left(\frac{P_{bar}}{\sqrt{T_{amb}}} \right) \qquad Y = \left(\frac{V_{cr(std)}}{V_{m(std)}} \right)$$

16. WET BULB/DRY BULB

16.1 Percent Moisture at Saturation As a Function of Temperature

$$W_2 = \frac{10^{\left(6.6911 - \left(\frac{3144}{T_W + 390.86} \right) \right)}}{P_b + \left(\frac{P_s}{13.6} \right)}$$

W_2=Value in %Moisture at Saturation as a Function of Temperature Table

* Note: Use Equation when Stack Temperature is greater than 211°F or less than 50°F.
Also use Equation if the absolute value of the Static Stack Pressure is greater than 1.

16.2 Percent Moisture in Stack Gas

$$\%H_2O = \left[W_2 - (0.000367)(T_d - T_w)\left(1 + \frac{T_w - 32}{1571}\right)\right](100)$$

16.3 Water Vapor in the Stack Gas, Proportion by Volume

$$Bws = \frac{\%H_2O}{100}$$

17. VOLUME PER POINT (ISOKINETIC TESTING)

17.1 Volume per Point

$$\frac{Vm}{Point} = \frac{60\ (V_s)(P_s)(\theta)(A_n)(M_{fd})(T_m°R)}{(Y)\left(P_{bar} + \frac{\Delta H}{13.6}\right)(T_s°R)}$$

18. INSTRUMENT TESTING

18.1 EFFLUENT GAS CONCENTRATION

$$C_{gas} = (C_{avg} - C_o)\left(\frac{C_{ma}}{C_m - C_o}\right)$$

[EPA 40 CFR 60, App. A, Method 6C, 8.0; Method 7E, 8.0]

18.2 Concentration of Carbon Monoxide, Corrected for Carbon Dioxide, ppm

$$M_n[CO] = (M_n[CO])\left(1 - \frac{\%CO_2}{100}\right)$$

[EPA 40 CFR 60, App. A, Method 10, 9.0]

18.3 SYSTEM CALIBRATION BIAS

$$\text{System Calibration Bias} = \left(\frac{\text{System Cal. Response - Analyzer Cal. Response}}{\text{Span}}\right)100$$

18.4 DRIFT CHECK

$$\%\text{Drift} = \left(\frac{\left| \text{Final System Cal. Response} - \text{Initial System Cal. Response} \right|}{\text{Span}} \right) 100$$

19. HEAT INPUT

19.1 Heat Input Rate

$$\text{HI} = \left(\frac{Q_s}{F} \right) \left(\frac{20.9 - \%O_2}{20.9} \right)$$

20. CONVERSION FACTORS

Conversion Factors for Concentration			
From	To	Multiply By	Reference
g/scm	ng/scm	1.00E+09	EPA 40 CFR 60, App. A, Method 19
mg/scm	ng/scm	1.00E+06	EPA 40 CFR 60, App. A, Method 19
lb/scf	ng/scm	1.60E+13	EPA 40 CFR 60, App. A, Method 19
ppm SO2	ng/scm	2.66E+06	EPA 40 CFR 60, App. A, Method 19
ppm NOx	ng/scm	1.91E+06	EPA 40 CFR 60, App. A, Method 19
ppm SO2	lb/scf	1.66E-07	EPA 40 CFR 60, App. A, Method 19
ppm NOx	lb/scf	1.19E-07	EPA 40 CFR 60, App. A, Method 19
scf	m^3	0.02832	EPA 40 CFR 60, App. A, Method 5
g/ft^3	gr/ft^3	15.43	EPA 40 CFR 60, App. A, Method 5
g/ft^3	lb/ft^3	2.205×10^{-3}	EPA 40 CFR 60, App. A, Method 5
g	mg	0.001	EPA 40 CFR 60, App. A, Method 5

21. CONSTANTS

Constants				
Abbreviation	Name	Value	Units	Reference
Kp	Pitot Constant	85.49	see below	EPA 40 CFR 60, App. A, Method 2
Mw	Molecular Weight of Water	18.0	lb/lb-mole	EPA 40 CFR 60, App. A, Method 5
P(std)	Standard Pressure	29.92	in. mercury	EPA 40 CFR 60, App. A, Method 2
T(std)	Standard Temperature	528	degrees Rankin	EPA 40 CFR 60, App. A, Method 2
R	Ideal gas constant	21.85	ft3/lb-mole	EPA 40 CFR 60, App. A, Method 5
%O2(amb)	Ambient Percent Oxygen	20.9	%O2 by volume	EPA 40 CFR 60, App. A, Method 3B
%CO2(amb)	Ambient Percent Carbon Dioxide	0.03	%O2 by volume	EPA 40 CFR 60, App. A, Method 3B
ρ	Density of Water	0.002201	lb/ml	EPA 40 CFR 60, App. A, Method 5
π	PI	3.1416		

Note: $$Kp = \frac{ft}{sec}\sqrt{\frac{(lb/lb-mole)(in.Hg)}{(^{o}R)(in.H_2O)}} = 85.49$$

22. NOMENCLATURE

Symbol	Description	Unit
A_n	Area of the Nozzle	Square feet (ft^2)
A_s	Area of the Stack	Square feet (ft^2)
B_{ws}	Water vapor in the stack gas	Proportion by volume
B_{wa}	Moisture content of ambient air	Proportion by volume
C_{dry}	Particulate concentration, dry basis	Mass/Volume
C_{H2SO4}	Emission rate of hydrogen sulfide	Milligrams per cubic foot
C_p	Pitot coefficient	Dimensionless
C_s	Particulate concentration	Mass/Volume
C_{s12}	Concentration correction to 12% Carbon Dioxide	Mass/Volume
C_{s50}	Concentration correction to 50% Excess Air	Mass/Volume
C_{sd}	Particulate concentration	Grains per dry standard cubic feet (gr/dscf)
C_{wet}	Particulate concentration	Mass/Volume, wet basis
D_n	Diameter of the Nozzle	Inches (in.)
dscf	Unit of flow measurement	Dry standard cubic feet
$D_{s(depth)}$	Depth of the stack	Inches (in.)
$D_{s(width)}$	Width of the stack	Inches (in.)
E	Emission rate	Mass per heat Btu input

Symbol	Description	Unit
F	F-Factor	Using F_C or F_d
F_C	F-Factor, wet basis	Using C_S and $\%CO_2$ on a wet or dry basis
F_d	F-Factor, dry basis	Using C_S and $\%O_2$ on a dry basis
F_w	F-Factor	Using C_{WS} and $\%O_2$ on a wet basis
ft	Unit of measurement	Feet
g	Unit of measurement	Grams
gr	Unit of measurement	Grains
HI	Heat input	MMBtu/hr
hr	Unit of time measurement	Hour
in	Unit of measurement	Inch
K	Constant	Constant used for DGM
K2	Constant used for H_2SO_4 titrations	7.061×10^{-5} lb/meq
K3	Constant used for SO_2 titrations	7.061×10^{-5} lb/meq
K4	Constant used for raw isokinetics	2.676×10^{-3} lb/meq
Kcf	Constant correction factor	Constant
Kco	Constant for critical orifice	Constant
Kp	Unit conversion constant for velocity	85.49
L_a	Average leak rate	Cubic feet
lb	Unit of weight measurement	Pounds
L_i	Initial leak rate	Cubic feet

Symbol	Description	Unit
L_p	Post leak rate	Cubic feet
M_d	Molecular weight of stack gas, dry basis	Pound per pound-mole (lb/lb-mole)
M_{fd}	Mole fraction dry basis of stack gas	Percent
min	Unit of time measurement	Minutes
mg	Unit of weight measurement	Milligrams
M_n	Mass pollutant found in sampling train	Micrograms (µg)
M_{nVOC}	Mass pollutant (VOC) determined with FID (as carbon)	parts per million (ppm)
M_{nP}	Mass pollutant (VOC) determined with FID (as propane)	parts per million (ppm)
M_p	Total pollutant mass emissions rate	Pounds per hour (lb/hr)
M_{pro}	Total pollutant mass emissions rate based on production rate	Pounds per ton (lb/ton)
$M_{p(Off)}$	Total pollutant mass emissions rate, while the scrubber is Off	Pounds per hour (lb/hr)
$M_{p(On)}$	Total pollutant mass emissions rate while the scrubber is On	Pounds per hour (lb/hr)
$M_{p(inlet)}$	Total pollutant mass emissions rate, inlet	Pounds per hour (lb/hr)
$M_{p(outlet)}$	Total pollutant mass emissions rate, outlet	Pounds per hour (lb/hr)
M_s	Molecular weight of stack gas, wet basis	Pound per pound-mole (lb/lb- mole)
MW	Molecular weight of pollutant	Grams per mole (g/mole)
n	Number of sampling points	Number

Symbol	Description	Unit
P_{bar}	Barometric pressure	Inches of mercury (in. of Hg)
P_g	Pressure of stack gas (static pressure)	Inches of water (in. of H_2O)
PMR	Pollutant Mass Rate	Mass per volume
ppm	Unit of Measurement	Parts per Million
P_s	Absolute stack gas pressure	Inches of mercury (in. of Hg)
$P_{s(sgd)}$	Sample Gas Density	Pounds per cubic foot
$P_{s(std)}$	Absolute stack gas pressure,	Inches of mercury (in. of Hg)
P_{std}	Standard pressure, 29.92 in. Hg	Inches of mercury (in. of Hg)
Q_a	Wet volumetric stack gas flow rate at actual conditions	Actual cubic feet/hour (acf/hr)
Q_m	Orifice Meter Calibration (Q_m=0.75 cfm) [at standard conditions]	Dry standard cubic feet per minute (dscf/min)
Q_s	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions	Dry standard cubic feet per hour (dscf/hr)
Qs(avg)	Dry Volumetric Stack Gas Flow Rate corrected to Standard Conditions Average flow before and after flow measurement	Dry standard cubic feet per hour (dscf/hr)
T_d	Absolute dry gas stack temperature Dry Bulb Temperature	Degrees Rankin (°R)
T_m°R	Absolute dry gas meter temperature	Degrees Rankin (°R)
T_s°R	Absolute stack temperature	Degrees Rankin (°R)
T_{std}	Standard temperature (528°R)	Degrees Rankin (°R)

Symbol	Description	Unit
T_w	Absolute wet gas stack temperature Wet Bulb Temperature	Degrees Rankin (°R)
T°C	Temperature in Celsius	Degrees Celsius (°C)
T°F	Temperature in Fahrenheit	Degrees Fahrenheit (°F)
T°R	Temperature in Rankin	Degrees Rankin (°R)
sec	Unit of time measurement	Seconds
$V_{aliquot}$	Volume of Aliquot	Milliliter (ml)
$V_{cr(std)}$	Volume of gas passed through the critical orifice, correct to standard conditions.	Dry standard cubic feet (dcf)
V_{lc}	Volume of water vapor condensed in the impingers	Milliliter (ml)
V_m	Volume of gas sample as measured by the dry gas meter	Dry cubic feet (dcf)
$V_{m(std)}$	Volume of gas sample as measured by the dry gas meter, corrected to standard conditions	Dry standard cubic feet (dscf)
$V_{m(std)(Total)}$	Volume of gas sample as measured by the dry gas meter, corrected to standard conditions	Dry standard cubic feet (dscf)
V_s	Average stack gas velocity	Feet per second (ft/sec)
$V_{solution}$	Volume of Solution (Sample)	Milliliter (ml)
V_{wsg}	Weight of water vapor condensed in silica gel	Grams (g)
$V_{w(std)}$	Volume of water vapor in the gas sample, corrected to standard conditions	Standard cubic feet (scf)
$V_{wc(std)}$	Volume of water vapor condensed in impingers, corrected to standard conditions	Standard cubic feet (scf)

Symbol	Description	Unit
V_t	Volume of Titrant used	Milliliters (ml)
V_{tb}	Volume of Titrant used on Blank	Milliliters (ml)
$V_{wsg(std)}$	Volume of water vapor condensed in silica gel, corrected to standard conditions	Standard cubic feet (scf)
W_{sg}	Total weight of Gas sampled	Pounds
W_2	Calculated constant, saturation $\%H_2O$ at Tw	Pounds
Y	Dry gas meter calibration factor	Dimensionless
Y_{aq}	Dry gas meter calibration check value	Dimensionless
$\Delta H@$	Calibrated theoretical pressure drop across orifice meter of dry gas meter at 0.75 CFM	Inches of water (in. of H_2O)
ΔH	Average pressure differential across the orifice	Inches of water (in. of H_2O)
ΔP	Average velocity head of stack gas	Inches of water (in. of H_2O)
$\sqrt{\Delta P}$	Average square root velocity head of stack gas	Inches of water (in. of H_2O)
%C	Percent Capture Efficiency	Percent (%)
$\%CO_{dry}$	Percent carbon monoxide by volume, dry basis	Percent (%)
$\%CO_{2dry}$	Percent carbon dioxide by volume, dry basis	Percent (%)
$\%CO_{2wet}$	Percent carbon dioxide by volume, wet basis	Percent (%)
%DRE	Percent Destruction Reduction Efficiency	Percent (%)
%EA	Percent Excess Air	Percent (%)

Symbol	Description	Unit
%I	Isokinetic Variation	Percent (%)
Raw %I	Raw Isokinetic Variation	Percent (%)
$\%N_2$	Percent nitrogen by volume, dry basis	Percent (%)
$\%O_{2dry}$	Percent oxygen by volume, dry basis	Percent (%)
$\%O_{2wet}$	Percent oxygen by volume, wet basis	Percent (%)
$\%O_{2Corr}$	Percent oxygen Correction Factor	Percent (%)
%Scrubber	Percent Scrubber Efficiency	Percent (%)
Θ	Total sampling time	Minutes (min)
Θi	Initial sampling time	Minutes (min)
Θp	Final sampling time	Minutes (min)
π	pi, π = 3.1416	Constant
ø	Angle between velocity vector and stack axis	Degrees

APPENDIX III
FIELD DATA SHEETS

EPA Method 1 Data Sheet

Plant	**SI Group**	**Date**	**12/7/2016**
City/State	**Orangeburg, SC**	**Project Code**	**ALBE-00216**
Sampling Location	**Boiler #4**	**Technican**	**SAH**

Ports		Diameters (in.)	
Number of Ports Available	**4**	**Distance from far wall to outside of port**	**30.25**
Number of Ports Used	**2**	**Nipple length and/or wall thickness**	**7.00**
Port Inside Diameter	**4.0**	**Depth of Stack or Duct**	**23.25**
		Stack or Duct width (if rectangular)	

	Distance (in.)	Diameters	Equivalent Diameter (if rectangular)
Nearest Upstream Disturbance (B)	**369**	**15.9**	$D_e = \frac{2\,(\text{Depth})\ (\text{Width})}{(\text{Depth} + \text{Width})} =$
Nearest Downstream Disturbance (A)	**120**	**5.2**	

ROUND STACK OR DUCT

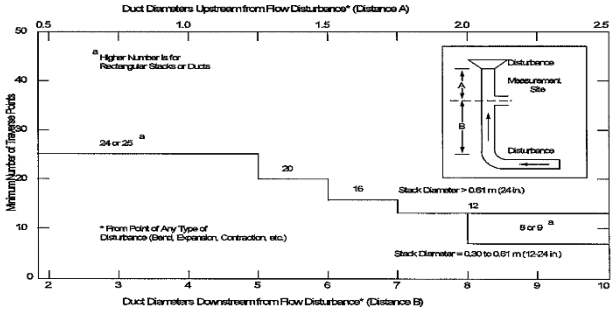
	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.5	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	6.7	4.3	4.4	3.9	3.5	3.2
3	75.0	29.4	19.4	14.6	11.5	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.8
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.8	80.6	65.8	35.5	26.9	22.0	18.8	16.5	14.5	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.4	85.4	75.0	63.4	37.5	29.5	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	78.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.3	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									96.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

SQUARE STACK OR DUCT

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.1
11										95.5	87.4
12											95.7

Decimal to Fraction Conversion Table

Decimal Inches	Fraction	Decimal Inches Range	Use These Fraction Inches
		0.0000-0.0625	0
0.125	1/8	0.0625-0.1874	1/8
0.250	1/4	0.1875-0.3125	1/4
0.375	3/8	0.3125-0.4375	3/8
0.500	1/2	0.4375-0.5625	1/2
0.625	5/8	0.5625-0.6875	5/8
0.750	3/4	0.6875-0.8125	3/4
0.875	7/8	0.8125-0.9375	7/8
		0.9375-1.0000	1



Point	Percent of Duct	Distance from Inside Wall	Distance from Outside of Port
1	4.4	1.02	**8.02**
2	14.6	3.39	**10.39**
3	29.4	6.84	**13.84**
4	70.4	16.37	**23.37**
5	85.4	19.86	**26.86**
6	95.8	22.27	**29.27**
7			
8			
9			
10			
11			
12			

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Cyclonic Flow Determinations

Client	SI Group	Date	12/7/2016
Plant Site	Orangeburg, SC	Run Number	1
Sampling location	Boiler #4	Project Number	ALBE-00216
Condition	normal	Observer	NA
Test Personnel	GMS-SAH	Agency	NA

Data

Barometric Pressure	29.9	Type of Pitot	S
Manometer Number	8	Pitot Number	P3-03
Duct Dimensions (inches)	23.25	Pitot Coeffient	0.84

Preliminary Traverse

Start Time	
Stop Time	

Point Number	Sample Point	DP @ 90° (0° reference)	Rotation Angle (a) for null DP
1	A1	neg.	5
2	A2	neg.	25
3	A3	neg.	20
4	A4	neg.	10
5	A5	neg.	15
6	A6	neg.	15
7	B1	neg.	5
8	B2	neg.	10
9	B3	neg.	10
10	B4	neg.	0
11	B5	neg.	5
12	B6	neg.	5
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
Mean			10.4

Note: The mean of the rotation angle must be less than 20 degrees

EPA Method 0023A Field Data

Client:	SI Group	**Method:**	23		
Source:	Boiler #4	**Start Time:**	9:08 AM	**RUN No.**	1
Date:	12/07/16	**End Time:**	12:15 PM	**JOB No.**	ALBE-00216

STACK DATA		EQUIPMENT		ESTIMATES		FILTERS	
% Moisture:	10 % est.	METER BOX:	8	Est. Tm:	76 °F	Filter #	Tare Weight
Barometric:	29.90 in Hg	Y:	1.0362	Est. Ts:	300 °F	G-2118	
Static Press:	-0.34 in H_2O	ΔH@:	1.8654 in H_2O	Est. dP:	0.62 in H_2O		
Stack Press:	29.87 in Hg	PROBE	P-303	Est. Dn:	0.261 inches		
%CO2:	8.00 %	Cp:	0.84				
%O2:	9.10 %	NOZZLE:	glass				
%N2/CO:	82.90 %	Dn:	0.221 in				
Md:	29.64 lb/lb-mole	Stack Area:	2.95 ft^2				
Ms:	28.48 lb/lb-mole	# of Points:	12 points				

LEAK CHECKS				
DGM initial	0.000	0.000	0.000	cf
DGM final	0.011	0.004	0.004	cf
Leak Rate	0.011	0.004	0.004	cfm
Vacuum	15	7	7	in. Hg

FINAL CATCH	
Liquid Vol. (g)	131.8
Particulate Mass (mg)	

Sample Point	Sample Time (min)	Dry Gas Meter Reading (ft^3)	Pitot ΔP ($in.H_2O$)	Gas Temperatures (°F) DGM Inlet	DGM Outlet	Stack	Cond.	STD DRY ΔH ($in H_2O$) Ideal	Actual	Pump Vac. (in Hg)	Heat Temps (°F) Probe	Filter	K FACTOR = 1.572 Imp. Exit	% ISO	Vs (fps)	sqrt (dP)	sqrt (dH)
A1	0.0	202.087	0.60	60.0	61.0	300	46	0.92	0.92	4	251	255	50	95.2	52.58	0.775	0.959
A2	15.0	209.2	0.75	65.0	61.0	302	45	1.15	1.20	5	254	260	43	95.5	58.86	0.866	1.095
A3	30.0	217.2	0.66	70.0	63.0	303	39	1.02	1.00	7	262	259	46	98.6	55.25	0.812	1.000
A4	45.0	225.0	0.68	74.0	66.0	305	39	1.05	1.10	6	259	260	47	100.4	56.16	0.825	1.049
A5	60.0	233.1	0.65	77.0	69.0	305	40	1.01	1.00	7	260	259	47	102.0	54.90	0.806	1.000
A6	75.0	241.2	0.30	77.0	71.0	285	40	0.48	0.48	5	262	258	47	100.3	36.81	0.548	0.693
B1	90.0	246.7	0.64	75.0	72.0	303	41	1.00	1.00	6	260	261	45	93.8	54.41	0.800	1.000
B2	105.0	254.1	0.65	78.0	72.0	306	41	1.01	1.00	6	256	261	46	92.9	54.94	0.806	1.000
B3	120.0	261.5	0.70	80.0	74.0	307	40	1.09	1.10	7	263	259	46	96.5	57.05	0.837	1.049
B4	135.0	269.5	0.71	81.0	75.0	307	40	1.11	1.10	7	263	258	45	99.3	57.46	0.843	1.049
B5	150.0	277.8	0.52	81.0	75.0	301	39	0.82	0.82	6	262	259	46	104.3	48.98	0.721	0.906
B6	165.0	285.3	0.28	80.0	75.0	273	41	0.46	0.46	4	259	259	46	105.9	35.27	0.529	0.678
END	180.0	290.994														0.764	0.956

RESULTS

Run Time	Vm	ΔP (H_2O)	Tm	Ts	Max Vac.	ΔH (H_2O)	%ISO	Vs
	2.518 m^3	15.113 mm	22.3 °C	148.8 °C		23.664 mm		15.684 m/s
180.00 min	88.907 ft^3	0.595 in	72.2 °F	299.8 °F	7	0.932 in	95.2	51.457 ft/s

Vm_{std}	Vw_{std}	$\%H_2O$	Qsd		Qsw		Concentration	Emission Rate
2.5920 dscm	0.1757 scm	(meas.)	167.57	dscmm	178.84	scmm	- mg/dscm	- kg/hr
91.537 dscf	6.204 scf	6.3	5,918	dscfm	6,316	scfm	- gr/dscf	- lb/hr

Szymkowicz - Rice - Huber — **Test Personnel**

Alexander — **Project Manager**

Barometric Pressure Corrected to Elevation of Meter	
Local Pbar (in. Hg) =	30.08
Elevation of meter above sea level (ft) =	185
Actual Pbar (in. Hg) =	29.90

Standard Temperature		
68	°Fahrenheit	527.67
Standard Pressure		
29.92	in Hg	

Pitot Tube Leak Check (Pretest)			Pitot Tube Leak Check (Post Test)		
Post Test LC Side	A	B	Post Test LC Side	A	B
Pressure Tap (in. H2O)	>= 3.0	>= 3.0	Pressure Tap (in. H2O)	>= 3.0	>= 3.0
Stable for 15 sec (Y/N)	Y	Y	Stable for 15 sec (Y/N)	Y	Y

EXTRA LEAK CHECKS				
DGM initial	0.000	_____	_____	cf
DGM final	0.007	_____	_____	cf
Leak Rate	0.007	_____	_____	cfm
Vacuum	8	_____	_____	in. Hg

Stack Diameter		
Ds(d)	23.25	Inches
Ds(w)	0	Inches
Round	2.95	ft^2
Rectangle	-	ft^2

Moisture	Pre	Post	Total (g)
DI:	293.3	407.8	114.5
SG:	361	378.3	17.3
Other:			0
Total Gain			131.8

0573

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Charleston, SC 29414

EPA Method 0023A Field Data

Client:	SI Group	**Method:**	23		
Source:	Boiler #4	**Start Time:**	1:25 PM	**RUN No.**	2
Date:	12/07/16	**End Time:**	4:30 PM	**JOB No.**	ALBE-00216

STACK DATA		EQUIPMENT		ESTIMATES		FILTERS	
% Moisture:	7 % est.	METER BOX:	8	Est. Tm:	76 °F	Filter #	Tare Weight
Barometric:	29.92 in Hg	Y:	1.0362	Est. Ts:	300 °F	G-2125	
Static Press:	-0.38 in H_2O	ΔH@:	1.8654 in H_2O	Est. dP:	0.62 in H_2O		
Stack Press:	29.89 in Hg	PROBE	P-303	Est. Dn:	0.257 inches		
%CO2:	8.10 %	Cp:	0.84				
%O2:	9.20 %	NOZZLE:	glass				
%N2/CO:	82.70 %	Dn:	0.221 in				
Md:	29.66 lb/lb-mole	Stack Area:	2.95 ft^2				
Ms:	28.85 lb/lb-mole	# of Points:	12 points				

LEAK CHECKS					FINAL CATCH
DGM initial	0.000	0.000	0.000	cf	Liquid Vol. (g)
DGM final	0.010	0.008	0.007	cf	134.6
Leak Rate	0.01	0.008	0.007	cfm	Particulate Mass (mg)
Vacuum	8	7	8	in. Hg	

Sample Point	Sample Time	Dry Gas Meter	Pitot ΔP	Gas Temperatures (°F) DGM Inlet	DGM Outlet	Stack	Cond.	STD DRY ΔH (in H_2O) Ideal	Actual	Pump Vac.	Heat Temps (°F) Probe	Filter	K FACTOR = 1.658 Imp. Exit	% ISO	Vs	sqrt (dP)	sqrt (dH)
	(min)	Reading (ft^3)	($in.H_2O$)							(in Hg)					(fps)		
A1	0.0	291.512	0.62	68.0	69.0	305	45	1.01	0.96	3	259	257	52	97.4	53.26	0.787	0.980
A2	15.0	299.2	0.65	73.0	68.0	307	43	1.06	1.00	4	259	262	47	98.8	54.61	0.806	1.000
A3	30.0	307.2	0.69	74.0	69.0	309	42	1.12	1.10	6	261	259	47	97.0	56.34	0.831	1.049
A4	45.0	315.3	0.66	76.0	69.0	306	41	1.08	1.10	6	257	256	45	95.2	54.99	0.812	1.049
A5	60.0	323.1	0.55	76.0	70.0	305	41	0.90	0.90	5	255	258	45	102.7	50.17	0.742	0.949
A6	75.0	330.8	0.39	77.0	71.0	285	42	0.66	0.66	3	257	259	50	98.3	41.69	0.624	0.812
B1	90.0	337.1	0.68	74.0	71.0	302	41	1.12	1.10	5	256	259	51	95.9	55.67	0.825	1.049
B2	105.0	345.1	0.72	76.0	71.0	303	42	1.19	1.20	7	255	256	53	95.5	57.32	0.849	1.095
B3	120.0	353.3	0.69	77.0	71.0	307	42	1.13	1.10	6	254	256	52	101.2	56.26	0.831	1.049
B4	135.0	361.8	0.64	77.0	71.0	307	42	1.05	1.10	6	255	257	53	95.2	54.19	0.800	1.049
B5	150.0	369.5	0.46	76.0	71.0	300	42	0.76	0.76	4	255	260	54	94.4	45.73	0.678	0.872
B6	165.0	376.0	0.29	75.0	71.0	286	43	0.49	0.49	4	253	257	54	97.4	35.97	0.539	0.700
END	180.0	381.372														0.760	0.971

RESULTS

Run Time	Vm	ΔP (H_2O)	Tm	Ts	Max Vac.	ΔH (H_2O)	%ISO	Vs
	2.545 m^3	14.901 mm	22.5 °C	149.9 °C		24.278 mm		15.624 m/s
180.00 min	89.860 ft^3	0.587 in	72.5 °F	301.8 °F	7	0.956 in	96.8	51.260 ft/s

Vm_{std}	Vw_{std}	$\%H_2O$	Qsd		Qsw		Concentration	Emission Rate
2.6199 dscm	0.1794 scm	(meas.)	166.39	dscmm	177.76	scmm	- mg/dscm	- kg/hr
92.520 dscf	6.336 scf	6.4	5,876	dscfm	6,278	scfm	- gr/dscf	- lb/hr

Szymkowicz - Rice - Huber — **Test Personnel**

Alexander — **Project Manager**

Barometric Pressure Corrected to Elevation of Meter	
Local Pbar (in. Hg) =	30.10
Elevation of meter above sea level (ft) =	185
Actual Pbar (in. Hg) =	29.92

Standard Temperature		
68	°Fahrenheit	527.67
Standard Pressure		
29.92	in Hg	

Pitot Tube Leak Check (Pretest)			Pitot Tube Leak Check (Post Test)		
Post Test LC Side	A	B	Post Test LC Side	A	B
Pressure Tap (in. H2O)	>= 3.0	>= 3.0	Pressure Tap (in. H2O)	>= 3.0	>= 3.0
Stable for 15 sec (Y/N)	Y	Y	Stable for 15 sec (Y/N)	Y	Y

EXTRA LEAK CHECKS				
DGM initial	0.000	_____	_____	cf
DGM final	0.007	_____	_____	cf
Leak Rate	0.007	_____	_____	cfm
Vacuum	8	_____	_____	in. Hg

Stack Diameter		
Ds(d)	23.25	Inches
Ds(w)	0	Inches
Round	2.95	ft^2
Rectangle	-	ft^2

Moisture			
	Pre	Post	Total (g)
DI:	292	408.8	116.8
SG:	362.8	380.6	17.8
Other:			0
Total Gain			134.6

0574

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2040 Savage Rd.
Charleston, SC 29414

EPA Method 0023A Field Data

Client:	SI Group	**Method:**	23		
Source:	Boiler #4	**Start Time:**	7:45 AM	**RUN No.**	3
Date:	12/08/16	**End Time:**	10:50 AM	**JOB No.**	ALBE-00216

STACK DATA		EQUIPMENT		ESTIMATES		FILTERS	
% Moisture:	7 % est.	METER BOX:	8	Est. Tm:	76 °F	Filter #	Tare Weight
Barometric:	29.89 in Hg	Y:	1.0362	Est. Ts:	300 °F	G-2132	
Static Press:	-0.35 in H_2O	ΔH@:	1.8654 in H_2O	Est. dP:	0.62 in H_2O		
Stack Press:	29.86 in Hg	PROBE	P-303	Est. Dn:	0.257 inches		
%CO2:	8.20 %	Cp:	0.84	LEAK CHECKS		FINAL CATCH	
%O2:	9.40 %	NOZZLE:	glass	DGM initial	0.000 0.000 0.000 cf	Liquid Vol. (g)	
%N2/CO:	82.40 %	Dn:	0.221 in	DGM final	0.006 0.005 0.005 cf	142	
Md:	29.69 lb/lb-mole	Stack Area:	2.95 ft^2	Leak Rate	0.006 0.005 0.005 cfm	Particulate Mass (mg)	
Ms:	28.87 lb/lb-mole	# of Points:	12 points	Vacuum	12 7 8 in. Hg		

Sample Point	Sample Time (min)	Dry Gas Meter Reading (ft^3)	Pitot ΔP ($in.H_2O$)	Gas Temperatures (°F) DGM Inlet	DGM Outlet	Stack	Cond.	STD DRY ΔH ($in H_2O$) Ideal	Actual	Pump Vac. (in Hg)	Heat Temps (°F) Probe	Filter	K FACTOR = 1.659 Imp. Exit	% ISO	Vs (fps)	sqrt (dP)	sqrt (dH)
A1	0.0	382.294	0.64	59.0	59.0	299	50	1.03	1.00	3	256	258	53	101.3	53.91	0.800	1.000
A2	15.0	390.3	0.66	65.0	61.0	304	42	1.06	1.10	3	254	255	51	99.3	54.92	0.812	1.049
A3	30.0	398.3	0.65	70.0	63.0	305	42	1.05	1.10	3	256	258	51	100.7	54.54	0.806	1.049
A4	45.0	406.4	0.64	73.0	63.0	306	42	1.04	1.00	4	257	257	52	97.4	54.15	0.800	1.000
A5	60.0	414.2	0.61	75.0	65.0	300	42	1.00	1.00	4	256	255	53	99.1	52.66	0.781	1.000
A6	75.0	422.0	0.35	76.0	68.0	290	43	0.59	0.60	3	257	254	53	97.8	39.63	0.592	0.775
B1	90.0	427.9	0.67	75.0	68.0	301	43	1.10	1.10	5	260	259	54	101.6	55.23	0.819	1.049
B2	105.0	436.3	0.70	75.0	69.0	302	43	1.15	1.20	6	261	259	54	97.0	56.49	0.837	1.095
B3	120.0	444.5	0.68	77.0	71.0	302	44	1.12	1.10	6	261	260	55	102.8	55.68	0.825	1.049
B4	135.0	453.1	0.64	78.0	71.0	300	45	1.06	1.10	6	260	255	56	99.6	53.94	0.800	1.049
B5	150.0	461.2	0.45	79.0	72.0	300	46	0.75	0.75	5	258	257	56	99.4	45.23	0.671	0.866
B6	165.0	468.0	0.29	79.0	73.0	283	47	0.49	0.49	4	255	258	58	108.0	35.90	0.539	0.700
END	180.0	474.005														0.757	0.973

RESULTS

Run Time	Vm	ΔP (H_2O)	Tm	Ts	Max Vac.	ΔH (H_2O)	%ISO	Vs
	2.597 m^3	14.774 mm	21.2 °C	148.5 °C		24.426 mm		15.532 m/s
180.00 min	91.711 ft^3	0.582 in	70.2 °F	299.3 °F	6	0.962 in	99.7	50.959 ft/s

Vm_{std}	Vw_{std}	$\%H_2O$	Qsd		Qsw		Concentration	Emission Rate
2.6832 dscm	0.1893 scm	(meas.)	165.45	dscmm	177.14	scmm	- mg/dscm	- kg/hr
94.756 dscf	6.684 scf	6.6	5,843	dscfm	6,256	scfm	- gr/dscf	- lb/hr

Szymkowicz - Rice - Huber — **Test Personnel**

Alexander — **Project Manager**

Barometric Pressure Corrected to Elevation of Meter	
Local Pbar (in. Hg) =	30.07
Elevation of meter above sea level (ft) =	185
Actual Pbar (in. Hg) =	29.89

Standard Temperature		
68	°Fahrenheit	527.67
Standard Pressure		
29.92	in Hg	

Pitot Tube Leak Check (Pretest)			Pitot Tube Leak Check (Post Test)		
Post Test LC Side	A	B	Post Test LC Side	A	B
Pressure Tap (in. H2O)	>= 3.0	>= 3.0	Pressure Tap (in. H2O)	>= 3.0	>= 3.0
Stable for 15 sec (Y/N)	Y	Y	Stable for 15 sec (Y/N)	Y	Y

EXTRA LEAK CHECKS				
DGM initial	_____	_____	_____	cf
DGM final	_____	_____	_____	cf
Leak Rate	_____	_____	_____	cfm
Vacuum	_____	_____	_____	in. Hg

Stack Diameter		
Ds(d)	23.25	Inches
Ds(w)	0	Inches
Round	2.95	ft^2
Rectangle	-	ft^2

Moisture	Pre	Post	Total (g)
DI:	295.6	417.3	121.7
SG:	361.6	381.9	20.3
Other:			0
Total Gain			142.0

0575

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EPA Method 3 - Dry Molecular Weight

Plant/Client	**Si Group**	Date	**12/7/2016**
Plant Site	**Orangeburg, SC**	Run Number	**1**
Sampling Location	**Boiler #4**	Project Number	**albe00216**
Tedlar Bag / Point by Point	**Bag**	Observer	**NA**
Analyzer Type / Model No.	**RKI Eagle 326**	Agency	**NA**
Moisture Removal Method	**NA**	GEL Test Personnel	**GMS**

	Sample Line Leak Check (Pretest)			Sample Line Leak Check (Post test)		
	Pressure Tap (in. H2O)	**> 3**	**> 3**	Pressure Tap (in. H2O)	**> 3**	**> 3**
	Leak Rate	**0**	**0**	Leak Rate	**0**	**0**

Point by Point Data

Start Time			
Stop Time			
Point Number	Sample Point	O_2 Reading (%)	CO_2 Reading (%)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
Mean			

Tedlar Bag Data

Sampling Time	Analysis Time	%CO_2 Reading (A)	%O_2 Reading (B)	%CO (If Taken) (C)	%N_2 (100-A-B-C)
09:08-12:15	12:20	8.1	9.0		82.9
	12:21	8.0	9.1		82.9
	12:22	8.0	9.1		82.9
Average		8.0	9.1		82.9
Bag No.	1		Pump No.	MB-8	

Analyzer Calibration

Time	O_2 Cal Value (%)	O_2 Response (%)	CO_2 Cal Value (%)	CO_2 Response (%)	
12:00	21.0	21.0	19.9	19.9	
	0.0	0.0	0.0	0.0	
	10.0	10.1	10.0	9.9	

Dry Molecular Weight Calculations:

$Md = (O_2 * 0.32) + (CO_2 * 0.44) + [(100-O_2-CO_2)*.28]$

Md =

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EPA Method 3 - Dry Molecular Weight

Plant/Client	**Si Group**	Date	**12/7/2016**
Plant Site	**Orangeburg, SC**	Run Number	**2**
Sampling Location	**Boiler #4**	Project Number	**albe00216**
Tedlar Bag / Point by Point	**Bag**	Observer	**NA**
Analyzer Type / Model No.	**RKI Eagle 326**	Agency	**NA**
Moisture Removal Method	**NA**	GEL Test Personnel	**GMS**

	Sample Line Leak Check (Pretest)			Sample Line Leak Check (Post test)		
	Pressure Tap (in. H2O)	**> 3**	**> 3**	Pressure Tap (in. H2O)	**> 3**	**> 3**
	Leak Rate	**0**	**0**	Leak Rate	**0**	**0**

Point by Point Data

Start Time			
Stop Time			
Point Number	Sample Point	O_2 Reading (%)	CO_2 Reading (%)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
Mean			

Tedlar Bag Data

Sampling Time	Analysis Time	%CO_2 Reading (A)	%O_2 Reading (B)	%CO (If Taken) (C)	%N_2 (100-A-B-C)
13:25-16:30	16:35	8.1	9.2		82.7
	16:36	8.2	9.3		82.9
	16:37	8.1	9.2		82.9
Average		8.1	9.2		82.8
Bag No.	2		Pump No.	MB-8	

Analyzer Calibration

Time	O_2 Cal Value (%)	O_2 Response (%)	CO_2 Cal Value (%)	CO_2 Response (%)	
16:20	21.0	21.0	19.9	19.9	
	0.0	0.0	0.0	0.0	
	10.0	10.1	10.0	10.0	

Dry Molecular Weight Calculations:

$Md = (O_2 * 0.32) + (CO_2 * 0.44) + [(100-O_2-CO_2)*.28]$

Md =

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EPA Method 3 - Dry Molecular Weight

Plant/Client	**Si Group**	Date	**12/8/2016**
Plant Site	**Orangeburg, SC**	Run Number	**3**
Sampling Location	**Boiler #4**	Project Number	**albe00216**
Tedlar Bag / Point by Point	**Bag**	Observer	**NA**
Analyzer Type / Model No.	**RKI Eagle 326**	Agency	**NA**
Moisture Removal Method	**NA**	GEL Test Personnel	**GMS**

	Sample Line Leak Check (Pretest)			Sample Line Leak Check (Post test)		
	Pressure Tap (in. H2O)	**> 3**	**> 3**	Pressure Tap (in. H2O)	**> 3**	**> 3**
	Leak Rate	**0**	**0**	Leak Rate	**0**	**0**

Point by Point Data

Start Time			
Stop Time			
Point Number	Sample Point	O_2 Reading (%)	CO_2 Reading (%)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
Mean			

Tedlar Bag Data

Sampling Time	Analysis Time	%CO_2 Reading (A)	%O_2 Reading (B)	%CO (If Taken) (C)	%N_2 (100-A-B-C)
07:45-10:50	10:55	8.2	9.4		82.4
	10:56	8.2	9.4		82.9
	10:57	8.0	9.5		82.9
Average		8.1	9.4		82.7
Bag No.	3		Pump No.	MB-8	

Analyzer Calibration

Time	O_2 Cal Value (%)	O_2 Response (%)	CO_2 Cal Value (%)	CO_2 Response (%)	
10:45	21.0	21.0	19.9	19.9	
	0.0	0.0	0.0	0.0	
	10.0	10.0	10.0	9.9	

Dry Molecular Weight Calculations:

$Md = (O_2 * 0.32) + (CO_2 * 0.44) + [(100-O_2-CO_2)*.28]$

Md =

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APPENDIX IV
LABORATORY ANALYTICAL DATA

REFER TO APPENDIX E OF THE
CONFIRMATORY PERFORMANCE TEST REPORT

APPENDIX V
FACILITY AND PROCESS DATA

REFER TO APPENDIX A OF THE
CONFIRMATORY PERFORMANCE TEST REPORT

APPENDIX VI
EQUIPMENT CALIBRATION DATA

METHOD 5 DRY GAS METER ANNUAL CALIBRATION USING CRITICAL ORIFICES

DATE:	10/12/2016	METER SERIAL #:	MB-8		
METER PART #:	17465148	CRITICAL ORIFICE SET SERIAL #:	1616	BAROMETRIC PRESSURE (in Hg):	INITIAL 30.23 / FINAL 30.23 / AVG (P_{bar}) 30.23

ΔH@ DIFF must be less than 0.200

Y DIFF must be less than 0.020

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH ($in\ H_2O$)	V_m (STD)	V_{cr} (STD)	Y	$\Delta H_@$	Y DIFF	DH@ DIFF
#12	1	0.3200	20	649.021	655.204	6.183	79	79	81	81	80	80.25	15.00	0.56	6.1148	6.2519	1.0224	1.7933	-0.001	0.00
	2	0.3200	20	655.204	661.389	6.185	80	81	82	80	81	81.00	15.00	0.56	6.1083	6.2461	1.0226	1.7941	-0.001	0.00
	3	0.3200	20	661.389	667.562	6.173	80	82	83	81	81	81.75	15.00	0.56	6.0880	6.2461	1.0260	1.7917	0.002	0.00
																AVG =	1.0236	1.7930	-0.013	-0.07
#16	1	0.4327	19	627.345	632.865	5.520	78	80	80	77	78	78.75	10.00	1.10	5.4815	5.6410	1.0291	1.9309	-0.001	0.00
	2	0.4327	19	632.865	638.387	5.522	78	80	81	78	79	79.50	10.00	1.10	5.4759	5.6410	1.0302	1.9282	0.000	0.00
	3	0.4327	19	638.387	643.905	5.518	79	81	79	79	81	80.00	10.00	1.10	5.4668	5.6358	1.0309	1.9300	0.001	0.00
																AVG =	1.0301	1.9297	-0.006	0.06
#18	1	0.5049	19	608.144	614.531	6.387	77	77	78	75	76	76.50	10.00	1.40	6.3737	6.5884	1.0337	1.8104	0.010	0.00
	2	0.5049	19	614.531	620.932	6.401	77	78	79	76	77	77.50	10.00	1.40	6.3758	6.5884	1.0334	1.8071	0.000	0.00
	3	0.5049	19	620.932	627.345	6.413	77	79	80	77	77	78.25	10.00	1.40	6.3788	6.5884	1.0329	1.8045	0.000	0.00
																AVG =	1.0333	1.8073	-0.003	-0.06
#23	1	0.6418	17	583.277	591.308	8.031	82	91	90	85	86	88.00	10.00	2.40	7.8650	8.3361	1.0599	1.9026	0.004	0.00
	2	0.6418	17	591.308	599.384	8.076	82	90	90	86	86	88.00	10.00	2.40	7.9091	8.3361	1.0540	1.9026	-0.002	0.00
	3	0.6418	17	599.384	607.469	8.085	82	90	90	86	87	88.25	10.00	2.40	7.9143	8.3361	1.0533	1.9017	-0.002	0.00
																AVG =	1.0557	1.9023	0.020	0.04
#30	1	0.8279	13	669.706	680.179	10.473	81	83	87	81	82	83.25	10.00	3.95	10.3851	10.7632	1.0364	1.9018	-0.002	0.01
	2	0.8279	13	680.179	690.689	10.510	81	87	90	82	83	85.50	10.00	3.95	10.3787	10.7632	1.0370	1.8940	-0.001	0.00
	3	0.8279	13	690.689	701.184	10.495	81	90	91	83	84	87.00	10.00	3.95	10.3355	10.7632	1.0414	1.8888	0.003	-0.01
																AVG =	1.0383	1.8949	0.002	0.03

AVERAGE DGM CALIBRATION FACTOR, Y = **1.0362**

AVERAGE $\Delta H_@$ = **1.8654**

0584

QA/QC CHECK

Completeness _____ Legibility _____ Accuracy _____ Specifications _____ Reasonableness _____

Entered by: _____ 12oct16 Checked by: _____ 10-12-16

Personnel (Signature/Date) Group QA/QC Leader (Signature/Date)

Meterbox Annual Temperature System Calibration

Date : 10/24/2016 Unit ID : MB-8 Technician : RRG

Thermocouple Input Check

T/C vs Mercury in Glass

Ambient Temperature	
Glass :	67
T/C Cal :	67

Position	Readout
Stack :	66
Probe :	66
Filter :	66
Dryer :	65
Aux :	65
DGM In :	65
DGM Out :	65

Acceptable Limit :
± 2 °F of Amb Temp

Meter Readout Check

Meter vs T/C Calibrator
in the Stack Position

T/C Cal

Setpoint	Readout	Error	% of Limit
100	99	-1	-1.00
500	495	-5	-1.00
1000	995	-5	-0.50
1500	1489	-11	-0.73
1970	1955	-15	-0.76

Acceptable Limit :
± 1.5 % of setpoint

Thermocouple ID : T-06
T/C Calibrator ID : 14000761

QA/QC CHECK

Completeness _____ **Legibility** _____ **Accuracy** _____ **Specifications** _____ **Reasonableness** _____

Entered by : [signature] 24 Oct 16
Personnel (Signature/Date)

Checked by: [signature] 10-24-16
Group QA/QC Leader (Signature/Date)

0585

Pitot Tube Calibration
S-Type

Pitot Number	P-303	Date	26 AUG 16
Technician	GRIFFIN, RL		

Calibration Data

Dimension	Figure	Description	Acceptable Limits	Within Acceptable Limits
Dt	1	Tubing Outside Diameter	0.189" to 0.375"	(YES) - NO
PA	1	Base to Opening Plane Distance	1.05 Dt < PA < 1.50Dt	(YES) - NO
PB	1	Base to Opening Plane Distance	1.05 Dt < PB < 1.50Dt	(YES) - NO
W	2	Pitot Tube Face Opening to Center Plane of Pitot	<0.031"	(YES) - NO
X	3	Pitot Tube Opening to Nozzle	>0.749"	(YES) - NO - N/A
Y	4	Pitot Tube Opening to Probe Sheath	>2.999"	(YES) - NO - N/A
Z	4	Pitot Tube Opening to Thermocouple	>0.749"	(YES) - NO
a1	5	Angle to Center	<10°	(YES) - NO
a2	5	Angle to Center	<10°	(YES) - NO
b1	6	Angle of Opening	<5°	(YES) - NO
b2	6	Angle of Opening	<5°	(YES) - NO
D (Z)	7 (8)	Offset of Pitot Openings	Z < 0.126 inches	(YES) - NO

Post Test Pitot Check

Is Pitot tube damaged? (if Yes, repair and recalibrate)	**Yes**	**NO**

Technician Signature	Job Number	Date

In accordance with (IAW) EPA 40 CFR 60, Appendix A, Method 2, 4. Calibration, 4.1 Type S Pitot Tube

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QA/QC CHECK

Completeness ___ Legibility ___ Accuracy ___ Specifications ___ Reasonableness ___

Checked by : RR DF 26 AUG 16
Personnel (Signature/Date)

Team Leader (Signature/Date) 9-2-16

Airgas
an Air Liquide company

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI59E15A3439	Reference Number:	122-124551444-1
Cylinder Number:	XC026506B	Cylinder Volume:	159.7 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22016	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Apr 25, 2016

Expiration Date: Apr 25, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	20.00 %	19.92 %	G1	+/- 0.7% NIST Traceable	04/25/2016
OXYGEN	21.00 %	21.00 %	G1	+/- 0.3% NIST Traceable	04/25/2016
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061551	CC354889	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 27, 2018
NTRM	12062003	CC367399	22.883 % OXYGEN/NITROGEN	+/- 0.2%	Apr 24, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA510 CO2 2L6YXWY0	Nondispersive Infrared (NDIR)	Mar 30, 2016
Horiba MPA510 O2 41499150042	Paramagnetic	Mar 30, 2016

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas

Airgas Specialty Gases
630 United Drive
Durham , NC 27713
919-544-3773 Fax: 919-544-3774
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: PRIMARY STANDARD

Part Number:	X03NI80P15A0002	Reference Number:	122-124483824-1
Cylinder Number:	CC366735	Cylinder Volume:	90 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	1200 PSIG
Analysis Date:	Mar 18, 2015	Valve Outlet:	590
Lot Number:	122-124483824-1		

Primary Standard Gas Mixtures are traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
CARBON DIOXIDE	10.00 %	9.931 %	+/- 1%
OXYGEN	10.00 %	9.973 %	+/- 1%
NITROGEN	Balance		

Approved for Release

ATTACHMENT C

Figure C-1 Receptor E5

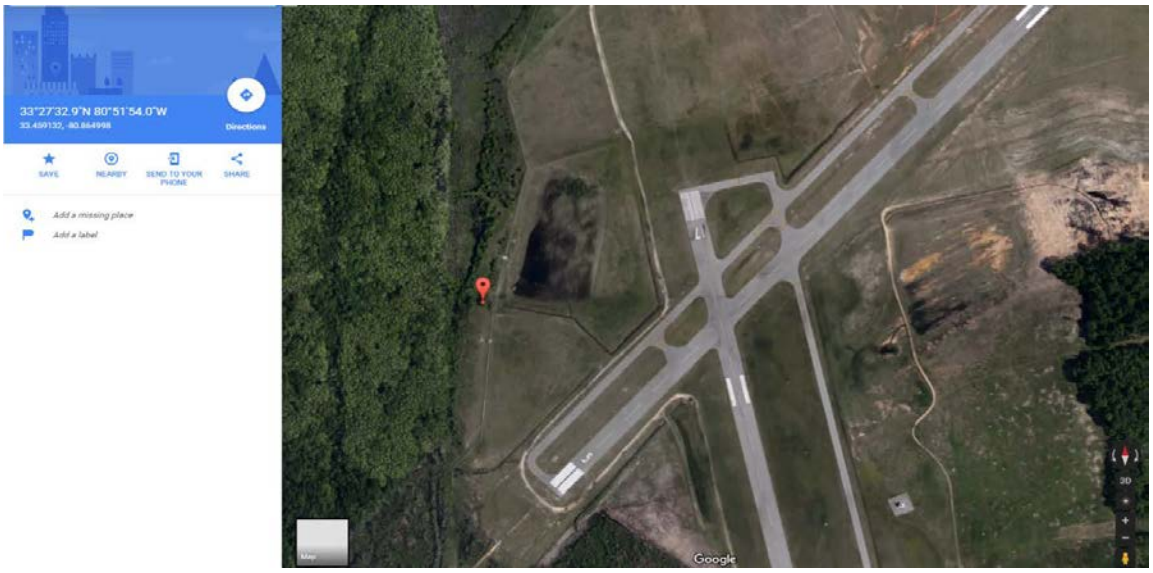


Figure C-2 Receptor E6

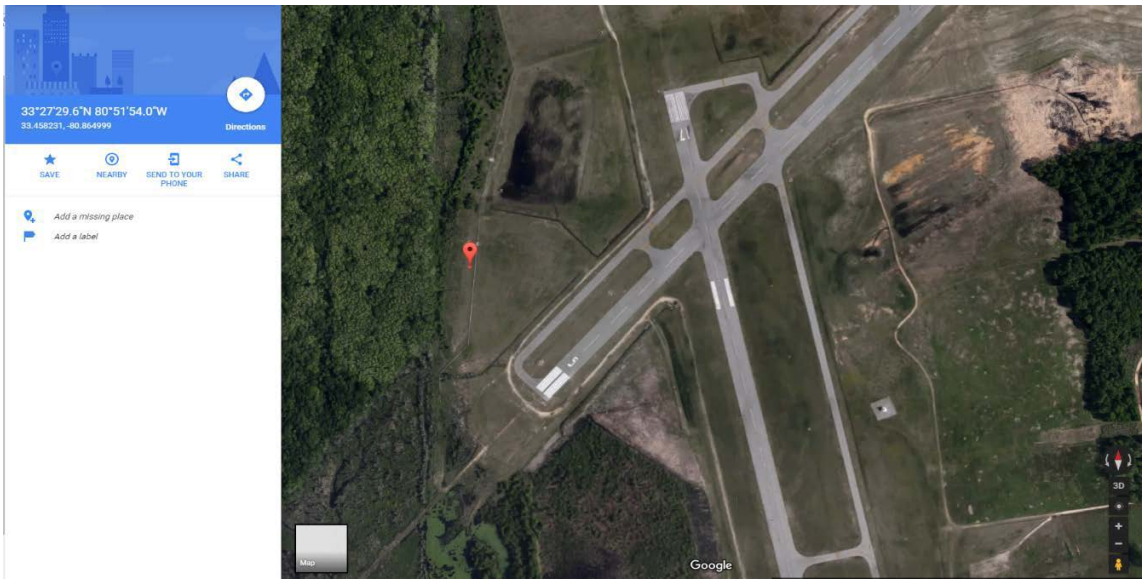


Figure C-3 Receptor SW1

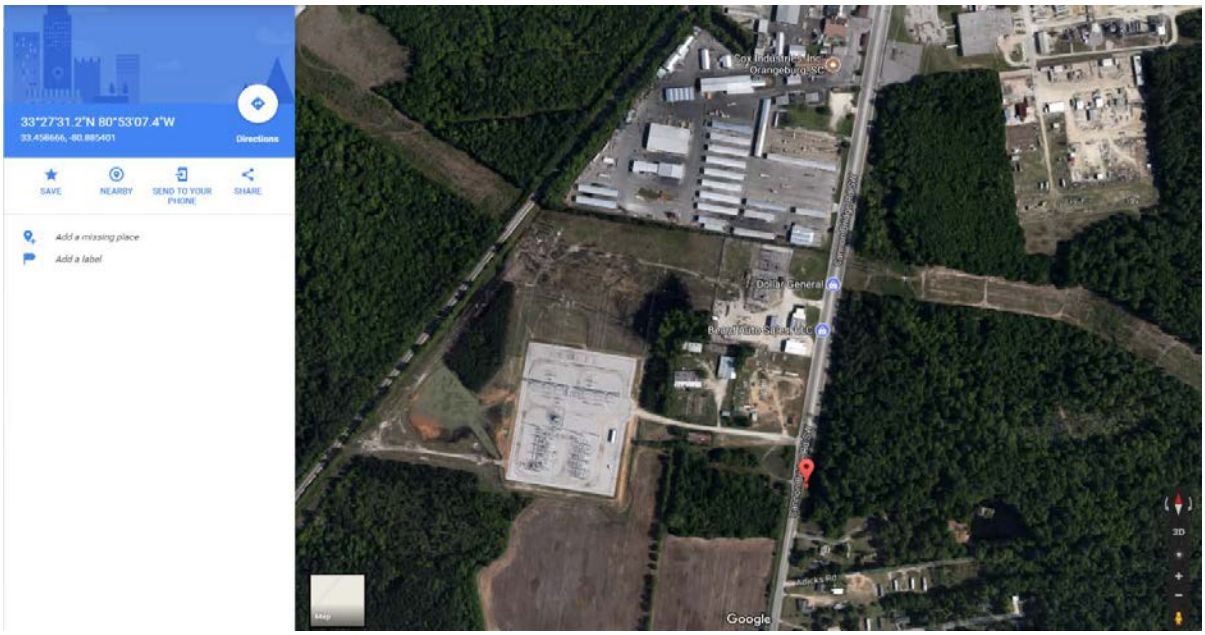


Figure C-4 Receptor SW2

Figure C-5 Receptor SW3

Figure C-6 Receptor SW4

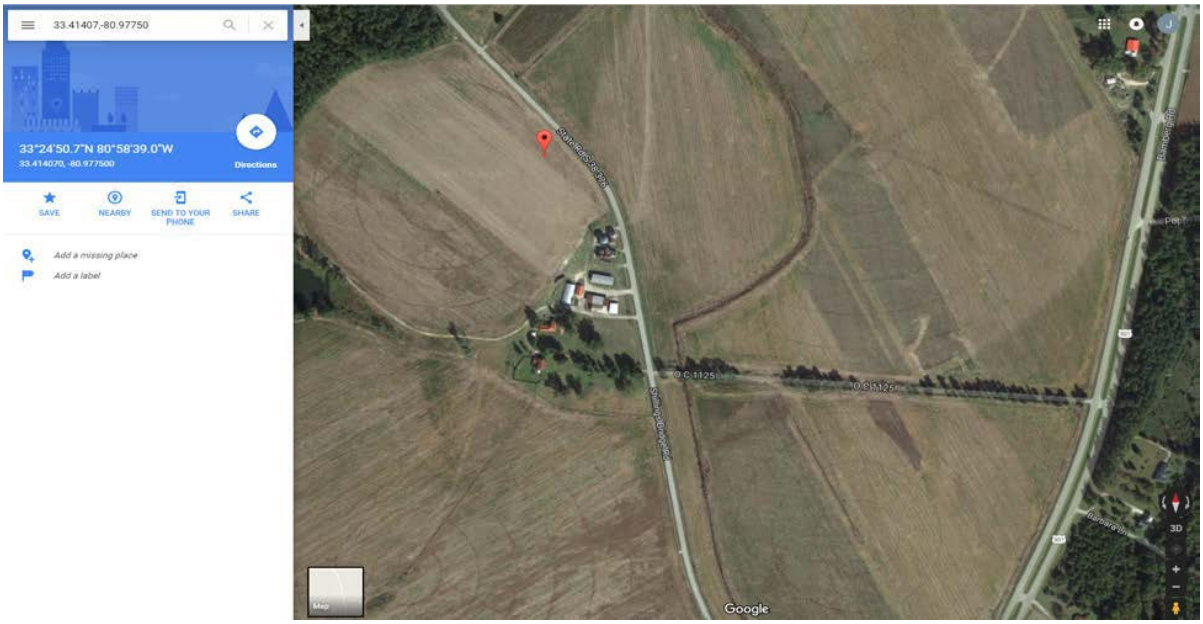
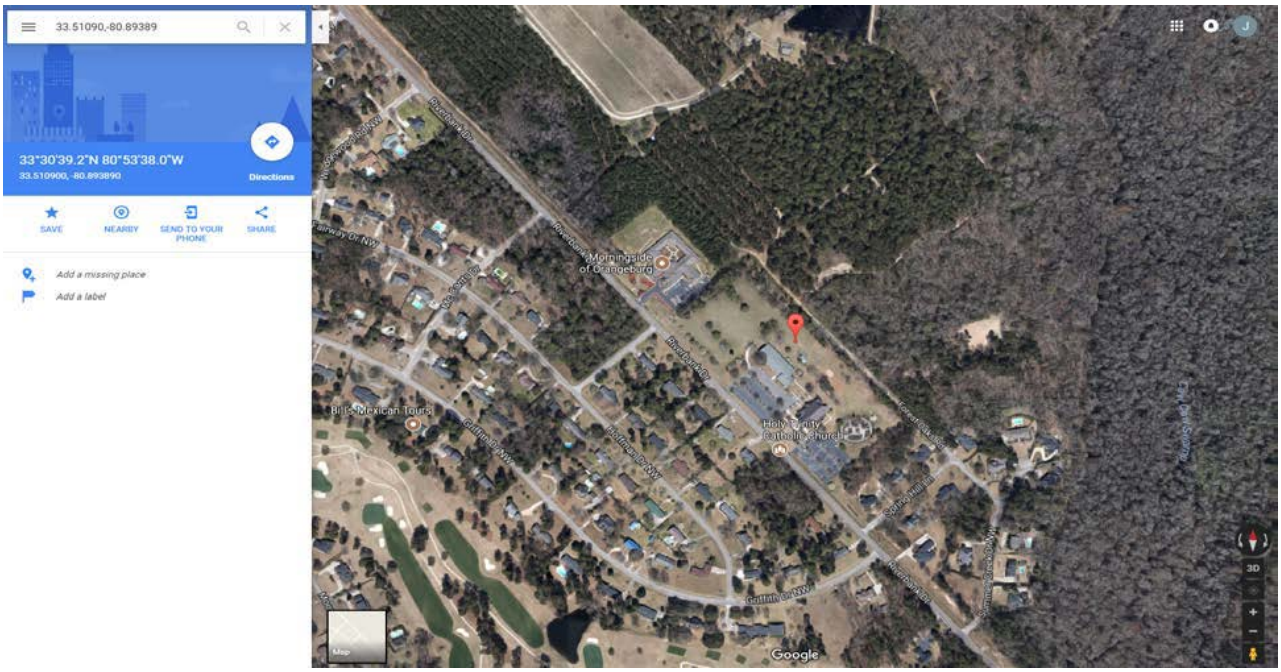


Figure C-7 Receptor N



Appendix E-2
Tables for Air Emissions

Table E-1
Comparison of the BIF Rule Requirements with Performance Standards in the Current RCRA Permit

Parameter	Current RCRA Performance Standards	Reference [1]	BIF Rule Requirement	Reference [2]	HWC MACT Standards	Reference
Hazardous waste treatment rate (Btu/hr)	32,200,000	Condition IV.D.2	As specified in the permit	61-79.266.102(e)	NA	NA
Minimum heating value of hazardous waste burned (Btu/lb)	5,000 [3]	Condition IV.D.3(a)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum viscosity of hazardous waste (centipoise)	150	Condition IV.D.3(b)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum total ash feed rate (g/hr)	10,053	Condition IV.D.3(c)	As specified in the permit	61-79.266.102(e)	9,534	40 CFR 63.1209
Maximum total chlorine/chloride feed rate (g/sec)	2.05	Condition IV.D.3(d)	As specified in the permit	61-79.266.102(e)	2.05	40 CFR 63.1215
Maximum feed rate for antimony (g/sec)	2.54E-3	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum feed rate for arsenic (g/sec)	1.13E-4	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum feed rate for barium (g/sec)	1.24E-3	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum feed rate for beryllium (g/sec)	3.80E-5	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum feed rate for cadmium (g/sec)	4.81E-5	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	6.94E-3 (Pb + Cd)	40 CFR 63.1207, 63.1209, and 63.1217
Maximum feed rate for total Chromium (g/sec)	3.11E-4	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	4.17E-3	40 CFR 63.1207, 63.1209, and 63.1217
Maximum feed rate for lead (g/sec)	1.27E-3	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	6.94E-3 (Pb + Cd)	40 CFR 63.1207, 63.1209, and 63.12179
Maximum feed rate for manganese (g/sec)	2.39E-2	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum feed rate for mercury (g/sec)	NA [4]	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	4.2E-05 lb/MMBtu	40 CFR 63.1207 and 40 CFR 63.1217
Maximum feed rate for silver (g/sec)	3.34E-5	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum feed rate for thallium (g/sec)	1.49E-4	Condition IV.D.3(e)	As specified in the permit	61-79.266.102(e)	NA	NA
Maximum total hazardous feed rate (lb/min on hourly rolling average basis)	26.8	Condition IV.D.4(a)	As specified in the permit	61-79.266.102(e)	22.6	40 CFR 63.1206, 63.1207, and 63.1209
Minimum combustion chamber temperature (° F on hourly rolling average basis)	1,294	Condition IV.D.4(b)	As specified in the permit	61-79.266.102(e)	1,294	40 CFR 63.1206, 63.1207, and 63.1209
Maximum steam production rate (lb/hr on hourly rolling average basis)	22,600	Condition IV.D.4(c)	As specified in the permit	61-79.266.102(e)	19,200	40 CFR 63.1206, 63.1207, and 63.1209

Table E-1 Comparison of the BIF Rule Requirements with Performance Standards in the Current RCRA Permit						
Parameter	**Current RCRA Performance Standards**	**Reference [1]**	**BIF Rule Requirement**	**Reference [2]**	**HWC MACT Standards**	**Reference**
Maximum inlet gas temperature to the fabric filter (°F on hourly rolling average basis)	431	Condition IV.D.4(d)	As specified in the permit	61-79.266.102(e)	399	40 CFR 63.1209

Notes:

1. = Hazardous Waste Permit SCD 043 384 072
2. = SC Regulation 61-79.266, Subpart H
3. = Minimum unless the heating value is increased above 5,000 Btu/lb by treatment other than blending prior to introduction of the waste into the boiler.
4. = No known sources of mercury in boiler feed streams.

Btu/hr = British thermal unit per hour
g/hr = gram per hour
g/sec = gram per second
BIF = Boilers and Industrial Furnaces

Table E-2 Comparison of the BIF Rule Requirements with Emission Limitations in the Current RCRA Permit						
Parameter	**Current RCRA Emission Limitations**	**Reference [1]**	**BIF Rule Requirement**	**Reference [2]**	**NESHAP Subpart EEE Standards**	**Reference**
DRE for POHCs (%)	99.99	Condition IV.C.1	99.99	61-79.266.104(a)	99.99	40 CFR 63.1217
PM (gr/dscf @ 7% O_2)	0.08	Condition IV.C.2	0.08	61-79.266.105(a)	0.036	40 CFR 63.1217
Antimony (g/sec)	2.54E-3 [3]	Condition IV.C.3	4.11E-1 [5]	61-79.266.106 (b)	NA	NA
Arsenic (g/sec)	1.13E-4 [3]	Condition IV.C.3	3.14E-3 [5]	61-79.266.106 (b)	NA	NA
Barium (g/sec)	1.24E-3 [3]	Condition IV.C.3	6.83E+1 [5]	61-79.266.106 (b)	NA	NA
Beryllium (g/sec)	3.80E-5 [3]	Condition IV.C.3	5.75E-3 [5]	61-79.266.106 (b)	NA	NA
Cadmium (g/sec)	4.81E-5 [3]	Condition IV.C.3	7.67E-3 [5]	61-79.266.106 (b)	8.2E-5 lb/MMBtu[6]	40 CFR 63.1217
Chromium +6 (g/sec)	3.11E-4 [3]	Condition IV.C.3	1.14E-3 [5]	61-79.266.106 (b)	1.3E-4 lb/MMBtu	40 CFR 63.1217
Lead (g/sec)	1.27E-3 [3]	Condition IV.C.3	1.22E-1 [5]	61-79.266.106 (b)	8.2E-5 lb/MMBtu[6]	40 CFR 63.1217
Manganese (g/sec)	2.39E-2 [3]	Condition IV.C.3	NA	NA	NA	NA
Mercury (g/sec)	NA [4]	Condition IV.C.3	1.11E-1 [5]	61-79.266.106 (b)	4.2E-5 lb/MMBtu	40 CFR 63.1217
Silver (g/sec)	3.34E-5 [3]	Condition IV.C.3	4.17 [5]	61-79.266.106 (b)	NA	NA
Thallium (g/sec)	1.49E-5 [3]	Condition IV.C.3	0.68 [5]	61-79.266.106 (b)	NA	NA
Hydrogen Chloride (g/sec)	3.44 [3]	Condition IV.C.4	9.59	61-79.266.107	5.1E-2 lb/MMBtu[7]	40 CFR 63.1217
Chlorine (g/sec)	5.02E-2 [3]	Condition IV.C.4	5.48E-1	61-79.266.107	5.1E-2 lb/MMBtu[7]	40 CFR 63.1217
PCDDs and PCDFs (ng TEQ/dscm)	0.27 [3]	Condition IV.C.5	Based on risk assessment	61-79.266.104(e)	0.40	40 CFR 63.1217

Table E-2 Comparison of the BIF Rule Requirements with Emission Limitations in the Current RCRA Permit						
Parameter	**Current RCRA Emission Limitations**	**Reference [1]**	**BIF Rule Requirement**	**Reference [2]**	**NESHAP Subpart EEE Standards**	**Reference**
CO (ppmv @ 7% O_2)	100	Condition IV.C.6	100	61-79.266.104(b)	100	40 CFR 63.1217

Notes:

1. = Hazardous Waste Permit SCD 043 384 072
2. = SC Regulation 61-79.266, Subpart H
3. = These emission limits are based on the long-term, multi-pathway risk assessment performed for this facility dated March 18, 2005 with a June 29, 2005 addendum.
4. = No known sources of mercury in boiler feed streams.
5. = Maximum allowable BIF emission rates are based on Adjusted Tier I rates for the 10 BIF metals which are based on dispersion modeling. (Refer to the approved Trial Burn Plan, pages 4-5.)
6. = Sum of lead and cadmium
7. = Combined emissions of hydrogen chloride and chlorine

BIF = Boilers and Industrial Furnaces
DRE = Destruction and Removal Efficiency
POHC = Principal Organic Hazardous Constituents
PM = Particulate Matter
PCDD = Polychlorinated Dibenzo-p-Dioxins
PCDF = Polychlorinated Dibenzo-p-Furans
g/sec = grams per second
CO = Carbon Monoxide
ppmv = Parts per million by volume
O_2 = Oxygen

Table E-3 Thirty-Five Receptor Locations and Exposure Scenarios for each of the Receptors						
	Exposure Scenario					
Receptor Name	**Farmer - Adult**	**Farmer - Child**	**Resident - Adult**	**Resident - Child**	**Fisher - Adult**	**Fisher - Child**
E1	X	X	X	X	X	X
E2	X	X	X	X	X	X
E3	X	X	X	X	X	X
E4	X	X	X	X	X	X
E5	X	X				
E6	X	X				
NW1			X	X	X	X
NW2			X	X	X	X
NW3			X	X	X	X
NW4			X	X	X	X
NW5			X	X	X	X
NW6			X	X	X	X
SE1			X	X	X	X
SE2			X	X	X	X
SE3			X	X	X	X
W1			X	X	X	X
W2			X	X	X	X
W3			X	X	X	X
W4			X	X	X	X
W5			X	X	X	X

Table E-3
Thirty-Five Receptor Locations and Exposure Scenarios for each of the Receptors

Receptor Name	Exposure Scenario					
	Farmer - Adult	Farmer - Child	Resident - Adult	Resident - Child	Fisher - Adult	Fisher - Child
N	X	X				
NE1	X	X	X	X	X	X
NE2	X	X	X	X	X	X
NNW			X	X	X	X
NW	X	X	X	X	X	X
S1			X	X	X	X
S2			X	X	X	X
S3			X	X	X	X
S4			X	X	X	X
SW			X	X	X	X
SW1	X	X				
SW2	X	X				
SW3	X	X				
SW4	X	X				
W			X	X	X	X

Table E-4
Comparison of the Hazardous Waste Combustor MACT Emission Limitations with the Results of the Initial Comprehensive Performance Test Conducted April 14-15, 2009

Parameter	HWC MACT Emission Standard [1,2]	Reference [1]	Test 1 Result [3]	Test 2 Result [4]
PCDD/PCDF (ng TEQ/dscm @ 7% O_2)	0.40	63.1217(a)(1)(i)	0.016	0.027
Mercury (lb/MMBtu)	4.2E-5	63.1217(a)(2)(ii)	NA	1.89E-6
Cadmium plus Lead (SVM) (lb/MMBtu)	8.2E-5	63.1217(a)(3)(ii)	NA	2.83E-6
Chromium (LVM) (lb/MMBtu)	1.3E-4	63.1217(a)(4)(ii)	NA	2.63E-6
Total Chlorine (lb/hr)	16.3	63.1217(a)(6) and HBCA [5]	NA	3.02
PM (mg/dscm @ 7% O_2)	80	63.1217(a)(7)	NA	1.92
CO (ppmvd @ 7% O_2)	100	63.1217(a)(5)(i)	4.5	1.2
Hydrocarbons (ppmvd @ 7% O_2)	10	63.1217(a)(5)(ii)	2.5	0.4
DRE (% of designated POHC's)	99.99	63.1217(c)(1)	> 99.9977 [6]	> 99.9932 [6]

Notes:

1. = 40 CFR 63 Subpart EEE, incorporated by reference into SC Regulation 61-62.63.
2. = Based on burning liquid wastes with a heating value of 10,000 MMBtu/lb or greater.
3. = Test conducted at minimum combustion temperature.
4. = Test conducted at maximum waste feed rate and maximum steam production rate.
5. = Based on a site-specific, health-based compliance alternative in accordance with 40 CFR 63.1215.
6. = Based on the lowest DRE test result for the most thermally stable POHC. For complete results see *Trial Burn/Risk Burn Report for Boiler HE-3800-1*, February 2004.

MACT = Maximum Achievable Control Technology
CFR = Code of Federal Regulations
MMBtu = Million British Thermal Units
DRE = Destruction and Removal Efficiency
PCDD = Polychlorinated Dibenzo-p-Dioxins
PCDF = Polychlorinated Dibenzo-p-Furans
O_2 = Oxygen
SVM = Semi-Volatile Metals
POHC = Principal Organic Hazardous Constituents
PM = Particulate Matter
LVM = Low Volatility Metals

Table E-5 Comparison of Operating Parameters — Boiler No. 4				
	2003 Trial Burn			
Operating Parameter	**Run 1**	**Run 2**	**Run 3**	**Average Operating Conditions for CY16**
Combustion Temperatures, °F	1911.5	2058.9	2177.9	1666
Waste Fuel Feed Rate, lbs./min.	26.8	26.7	26.0	9.7
Steam Flow, MM lbs./hr	23.7	24.0	22.8	10.7

Table E-6 Performance Standards Established During Initial Comprehensive Performance Test Conducted April 14-15, 2009			
Parameter	**Operating Parameter Limit [1]**	**Averaging Period [2]**	**Related HWC MACT Emission Standard [3]**
Maximum Waste Feed Rate (lb/min)	26.8	HRA	DRE/PCDD/PCDF
Maximum Steam Production Rate (lb/hr)	22,600	HRA	DRE/PCDD/PCDF
Minimum Combustion Temperature (° F)	1,294	HRA	DRE/PCDD/PCDF
Minimum Baghouse Temperature (° F)	400	HRA	DRE/PCDD/PCDF
Maximum Ash Feed Rate (lb/hr)	24.1	12-hr RA	PM
Maximum SVM [4] Feed Rate (lb/MMBtu)	8.72E-3	12-hr RA	SVM
Maximum LVM [5] Feed Rate (lb/MMBtu)	2.34E-2	12-hr RA	LVM
Maximum Mercury Feed Rate (lb/MMBtu)	4.2E-5	12-hr RA	Mercury
Maximum Chlorine/Chloride Feed Rate (lb/hr)	16.3	12-hr RA	SVM/LVM/HCl/Cl_2
Maximum Combustion Chamber Pressure (inches water column)	0.0	Instantaneous	Fugitives
Maximum Stack Gas CO (ppmvd @ 7% O_2)	100	HRA	CO
Minimum Liquid Waste Atomization Pressure (psig)	10	Instantaneous	DRE

Notes:

1. = Operating limits established by Albemarle based on the CPT to achieve compliance with the related emission standard.
2. = "HRA" is hourly rolling average and "12-hr RA" is 12-hr rolling average.
3. = Refer to the HWC MACT Emission Standards listed in Table 2.
4. = "SVM" is semi-volatile metals, which includes cadmium and lead.
5. = "LVM" is low volatility metals, which includes chromium.

MMBtu = Million British Thermal Units
DRE = Destruction and Removal Efficiency
PM = Particulate Matter
PCDD = Polychlorinated Dibenzo-p-Dioxins
PCDF = Polychlorinated Dibenzo-p-Furans
O_2 = Oxygen
psig = Pounds per square inch gauge
HWC = Hazardous Waste Combustor
MACT = Maximum Achievable Control Technology

Table E-7
Results of the First Initial Recurrent Comprehensive Performance Test Conducted
May 27-30, 2014

Parameter	HWC MACT Emission Standard [1,2]	Test 1 Result [3]	Test 2 Result [4]	Test 3 Result [5]
PCDD/PCDF (ng TEQ/dscm @ 7% O_2)	0.40	0.016	NA	0.055
Mercury (lb/MMBtu)	4.2E-5	NA	< 4.6E-7	NA
Cadmium plus Lead (SVM) (lb/MMBtu)	8.2E-5	NA	< 1.5E-6	NA
Chromium (LVM) (lb/MMBtu)	1.3E-4	NA	6.4E-6	NA
Total Chlorine (lb/hr)	16.3 [6]	NA	15.2	NA
PM (mg/dscm @ 7% O_2)	80	NA	0.63	NA
CO (ppmvd @ 7% O_2)	100	11.0	21.5	19.0
Hydrocarbons (ppmvd @ 7% O_2)	10	0.83	0.78	0.29
DRE (% of designated POHC's)	99.99	> 99.9977 [7]	> 99.9932 [7]	

Notes:

1. = 40 CFR 63 Subpart EEE, incorporated by reference into SC Regulation 61-62.63.
2. = Based on burning liquid wastes with a heating value of 10,000 MMBtu/lb or greater.
3. = Test conducted at minimum combustion temperature.
4. = Test conducted at maximum waste feed rate and maximum steam production rate.
5. = Test conducted at maximum waste feed rate and maximum steam production rate.
6. = Based on HBCA for total chlorine approved by SCDHEC in 2008.
7. = Based on the lowest DRE test result for the most thermally stable POHC. For complete results see *Trial Burn/Risk Burn Report for Boiler HE-3800-1*, February 2004.

MACT	=	Maximum Achievable Control Technology	SVM	=	Semi-Volatile Metals
CFR	=	Code of Federal Regulations	LVM	=	Low Volatility Metals
MMBtu	=	Million British Thermal Units	CO	=	Carbon Monoxide
POHC	=	Principal Organic Hazardous Constituents	ppmv	=	Parts per million by volume dry
PM	=	Particulate Matter	mg/dscm	=	Milligrams per dry standard cubic meter
PCDD	=	Polychlorinated Dibenzo-p-Dioxins	NA	=	Not available
PCDF	=	Polychlorinated Dibenzo-p-Furans	HWC	=	Hazardous Waste Combustor
O_2	=	Oxygen			

Appendix E-3
Photo Log

RCRA Permit Renewal Application
May 2020
Photo Log

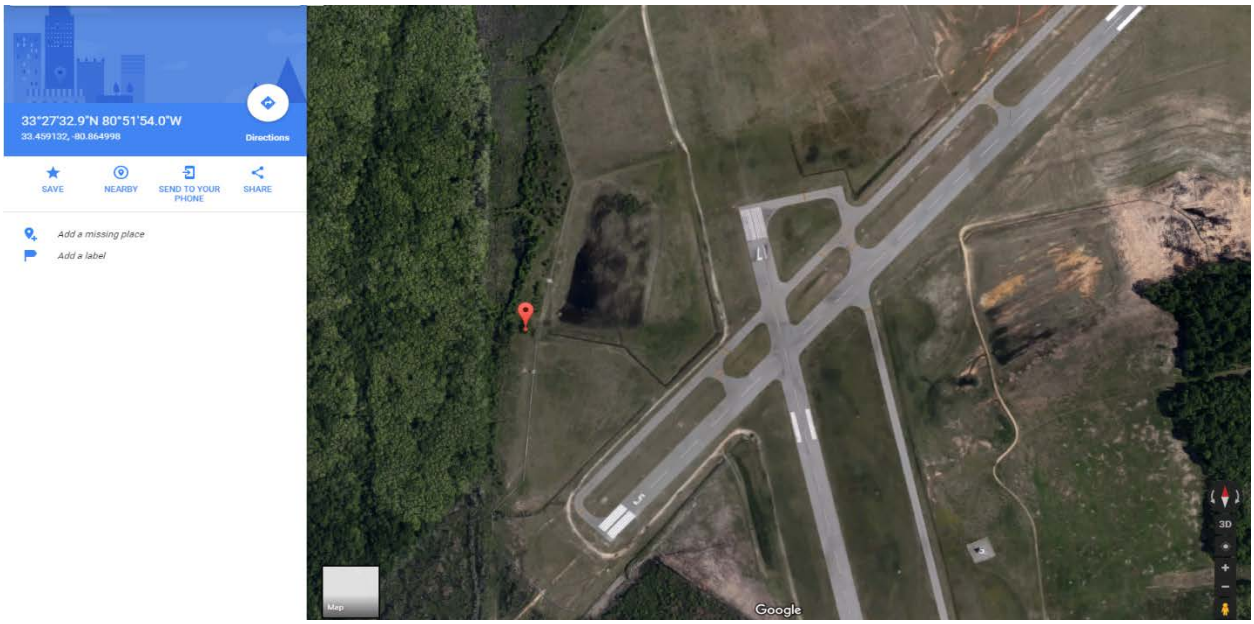


Figure E-1
Receptor E6 (from Table E-3)

RCRA Permit Renewal Application
May 2020
Photo Log

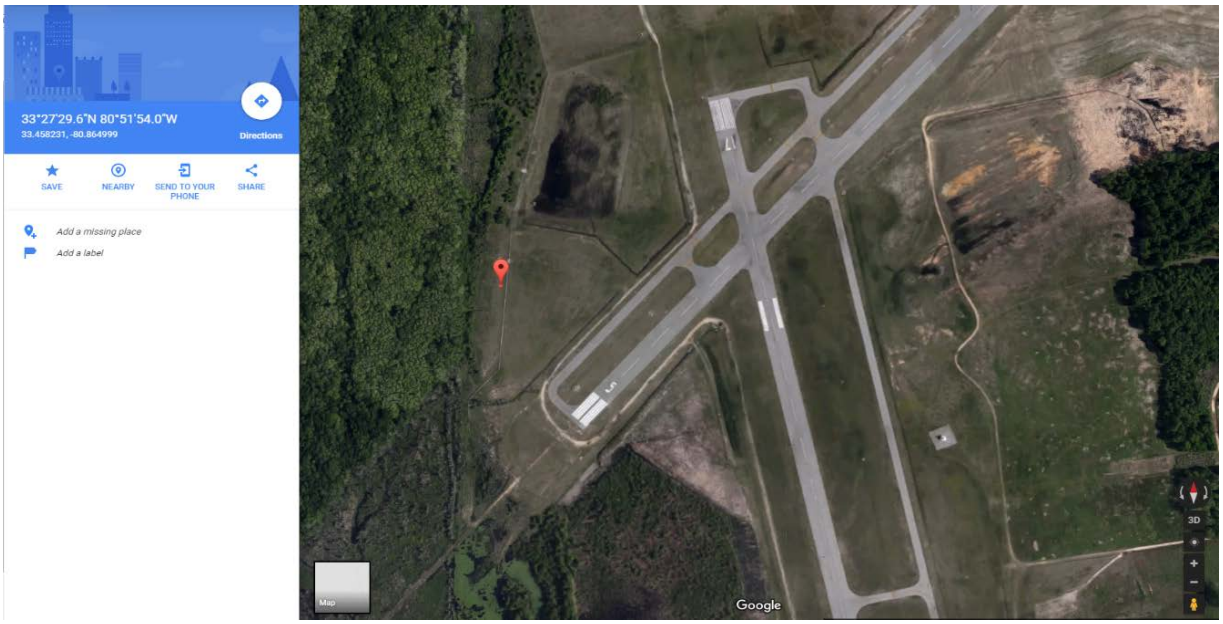


Figure E-2
Receptor E-5 (from Table E-3)

RCRA Permit Renewal Application
May 2020
Photo Log

Figure E-3
Receptor SW1 (from Table E-3)

RCRA Permit Renewal Application
May 2020
Photo Log

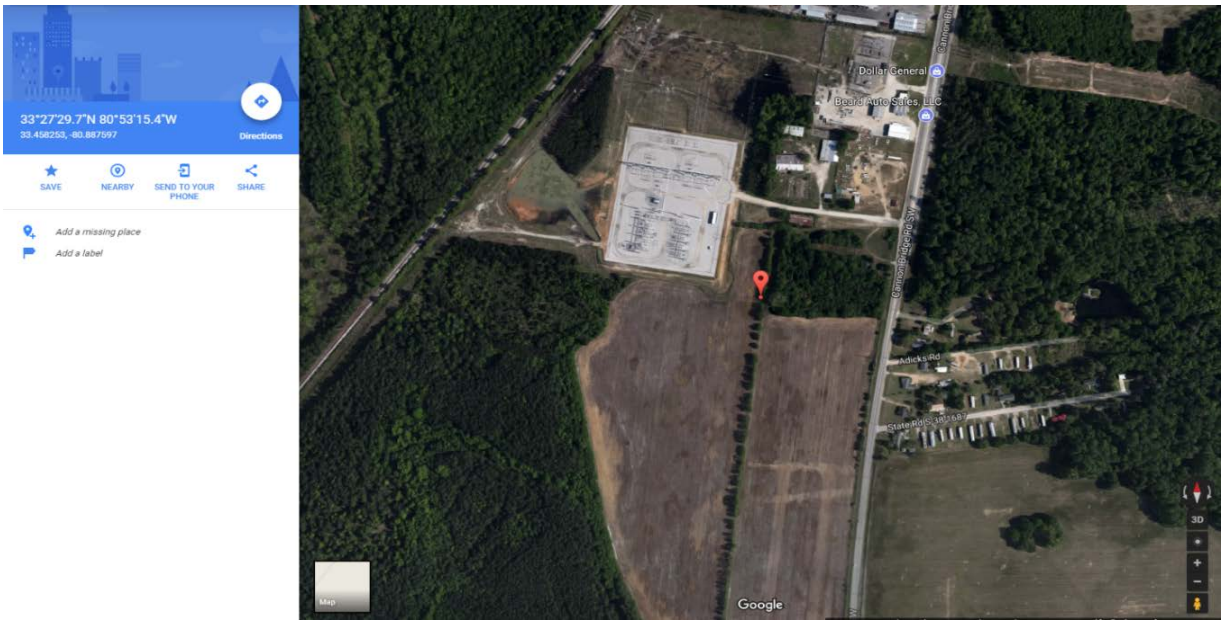
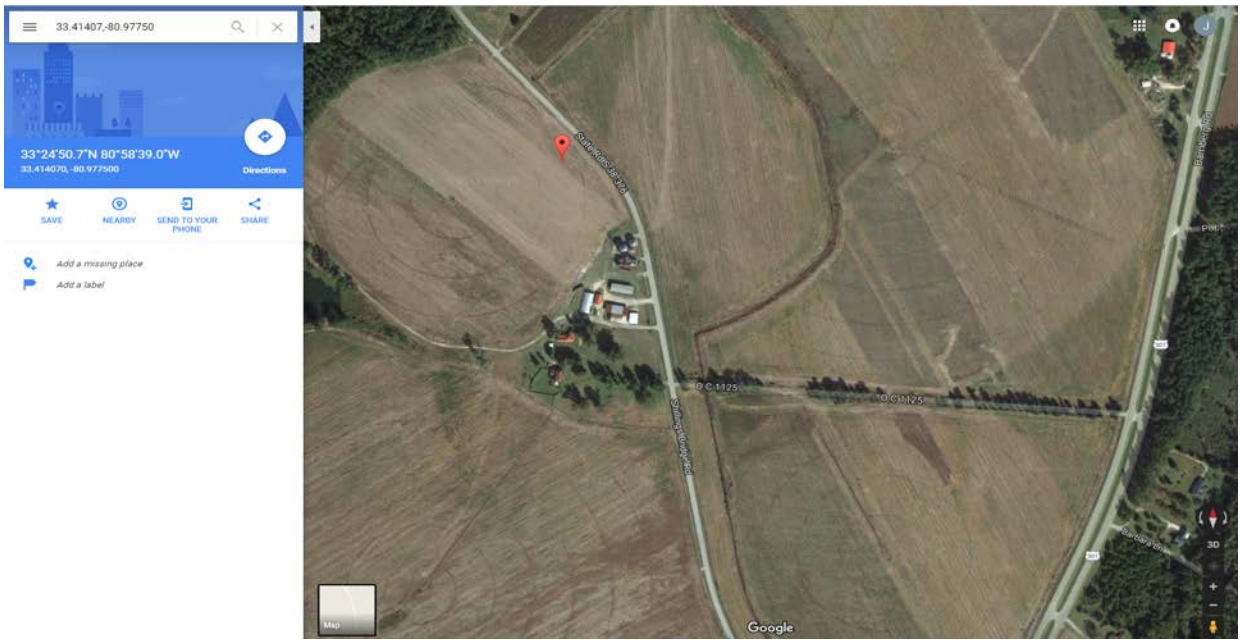


Figure E-4
Receptor SW2 (from Table E-3)

RCRA Permit Renewal Application
May 2020
Photo Log

Figure E-5
Receptor SW3 (from Table E-3)

RCRA Permit Renewal Application
May 2020
Photo Log



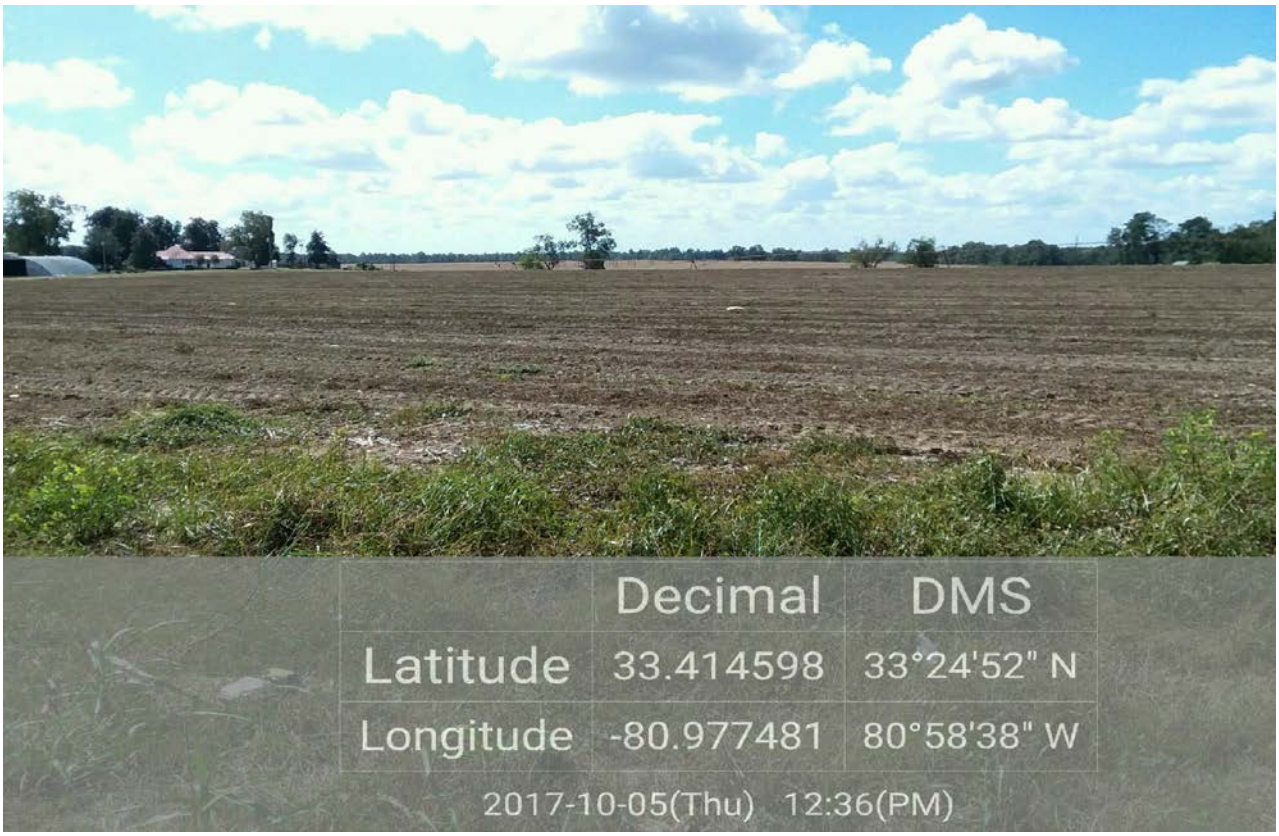


Figure E-6
Receptor SW4 (from Table E-3)

RCRA Permit Renewal Application
May 2020
Photo Log

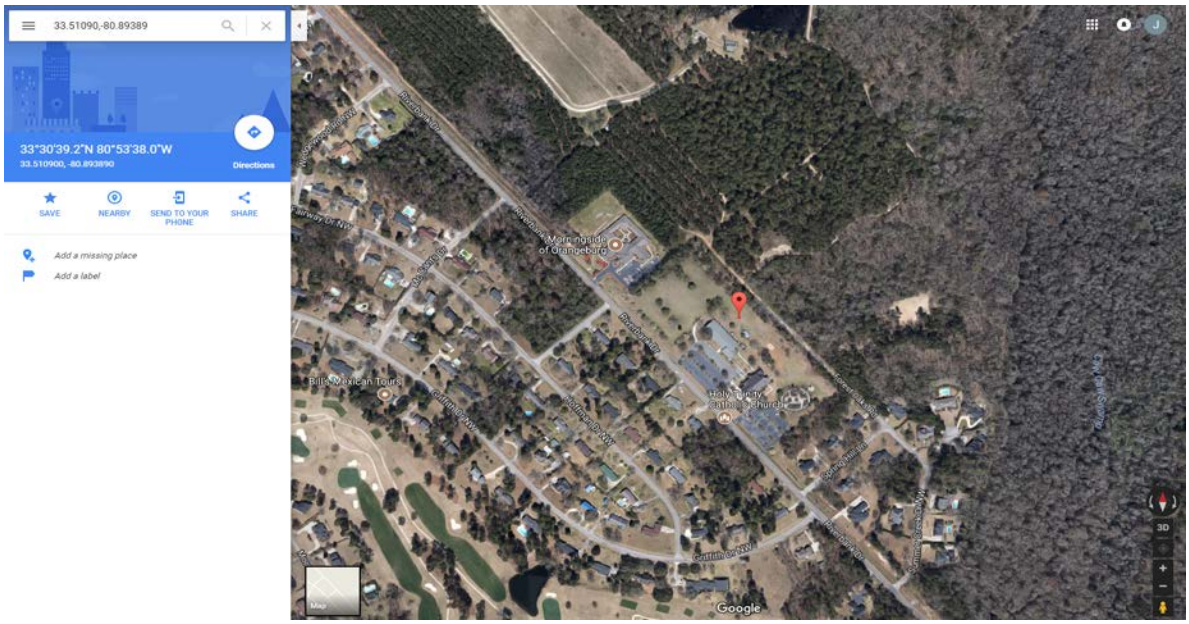


Figure E-7
Receptor N (from Table E-3)

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Appendix F-3 Boiler No. 4 General Inspection Plan
Appendix F-4 Hazardous Waste Storage Incompatibility Chart

SECTION F
PROCEDURES TO PREVENT HAZARDS
[40 CFR 264.14, 264.15, and 264.30-.37; 270.14(b)(4), (5), (6), (8), and (9); SC R.61-79.264.14, 79.264.15, and 79.264.30-.37; and R.61-79.270.14 (b)(4), (5), (6), (8), and (9)]

This section discusses the procedures, equipment, and structures maintained by SI Group to prevent hazardous waste incidents related to the accumulation, transportation, and treatment of hazardous waste associated with Boiler No. 4.

F.1 Security Procedures and Equipment

F.1.1 24-Hour Surveillance System

The guard office is staffed with one person per shift, 24 hours a day. Site personnel can easily contact, via radio or phone, the guard on duty in the event of an emergency around the clock. Recently, new LED lighting was installed in parking areas, building entrances, and other high traffic areas.

F.1.2 Barrier

A 7-foot high chain-link fence topped with three strands of barbed wire surrounds the facility to prevent access by unauthorized persons. The location of the fence is shown in Figure F-1 in Appendix F-1. The fence parallels the CSX Railroad tracks on the northern property boundary. Double gates that are opened manually control access into the plant via the railroad tracks. Gates remain locked except when needed for rail car access to the plant. Additionally, the gates are posted with "Private Property — No Trespassing" signs measuring 14 x 20 inches and 10 x 14 inches. A 455,000-square-foot area along 11th Street and A Street is also fenced for contractor equipment storage.

F.1.3 Means to Control Entry

As shown in Figure F-1, the plant is accessible through the main gate located on 9th Street south of the parking lot. Access can also be obtained via a gate located at the intersection of Cannon Bridge Road and 3rd Street, adjacent to the Administrative Services Building. The 3rd Street gate is not currently in use and remains locked. Gates that allow access to vehicular traffic are 30 feet wide and are monitored by the Security Department. There are additional gates located along the fence line to allow access to the plant as needed. Figure F-1 illustrates the gate locations at the facility. The gate construction is consistent with the security fence (i.e., 7-foot high, chain-link topped with three strands of barbed wire). The gates range from 3 feet to 20 feet wide and are

secured with steel padlocks. These gates remain locked except as needed to allow prior scheduled access to the plant.

SI Group employees are issued a photo identification badge. A computerized card reader system allows limited access by plant personnel to certain areas of the plant. This includes the Administrative Building, Administrative Services Building, Supply Chain Building, the Guard Office at the main gate, and the Maintenance Complex (see Figure F-2). The employee identification badge is encoded with employee's access information, readable by a card reader. Card readers are operated 24 hours a day, 7 days a week. An employee identification badge must be worn by employees and be clearly visible at all times while the employee is on plant premises. If an employee reports to work without a badge, the Security Department issues a temporary badge for one day. All one-day badges are returned to Security at the end of the day.

Permanent contractors are issued a photo identification badge, different from the SI Group's badge, which allows entry into the plant. Temporary contractors entering the plant must sign in and sign out at the guard gate via a temporary card reader. Contractor vehicles are parked outside the main gate; they must be documented on the log if vehicle access to the plant is permitted.

Security at plant entrances is as follows:

1. **Administration Building:** The front door is controlled by a card reader from 6:00 p.m. to 6:00 a.m. During normal work hours (6:00 a.m. to 6:00 p.m.), the front door is open and visitors must register at the Main Gate to have electronic visitor accountability. Access to the plant from the four back exits is controlled 24 hours a day by the card reader system.

2. **Administrative Services Building:** The front doors (two separate entry points) are controlled by the card reader system. Access to the plant from the two back exits is controlled by the card reader system from 6:00 p.m. to 6:00 a.m.

3. **Main Gate (9th Street):** Plant Security monitors this entrance. It is also equipped with a card reader and camera.

5. **Supply Chain Building:** Access from the parking lot on the north side of the building is controlled 24 hours a day by a card reader.

6. **Maintenance Complex:** Access to the building from outside the main gate is controlled by two card readers on the north side of the building. The back of the complex is open to the plant.

The Security Department maintains various logs to monitor traffic and personnel through the main gate. These logs are as follows:

- Key Log
- Exit/Entry Log for Company Vehicles
- Outside Personnel
- Contractor Sign-in/Sign-out
- Check Sheet for Outside Vehicles

All contractor vehicles exiting the plant are subject to inspection by the Security Department.

Parking for employees and plant visitors is provided in a parking area located adjacent to Cannon Bridge Road (see Figure F-2). One entrance controls access to the area and is equipped with a camera. The parking area is lighted at night. One security person per shift staffs the guard office.

F.1.4 Warning Signs

General private property/keep out signs are provided at gates and other points on the fence surrounding the plant. Specific warning signs, reading "Danger — Unauthorized Personnel Keep Out", are provided at all entrances to the facility and along the perimeter.

F.2 Inspection Schedule

This section of the Application details the inspection schedule and procedures, which will be followed at the HWMUs. The intent of these inspections is to ensure that all storage tanks and ancillary equipment maintain structural integrity and are properly maintained; that all operational, safety, and personal protective equipment (PPE) remains in good condition; and that all spills, leaks, or other releases of hazardous wastes are detected and remediated in a timely manner to prevent harm to human health or the environment.

F.2.1 General Inspection Requirements

Facility personnel will conduct daily, weekly, and monthly inspections of various aspects of the Storage Tank, Loading/Unloading Area, and boiler facility as appropriate to evaluate all potential problems and to ensure prompt preventative maintenance or remediation. Items that will be examined during these inspections are outlined in Table F-1, Inspection Schedule. In addition,

tank trucks will be inspected prior to transportation of material within the facility. All spill response and PPE will be inspected after each use to ensure that sufficient quantities are in stock, and that all items are in good working order. Copies of inspection schedules are maintained at the Maintenance Complex or Safety Department. Inspection procedures will be reviewed during annual facility training exercises in order to reacquaint personnel with the procedures and to determine whether additional inspection criteria are necessary. Details regarding training are presented in Section H and inspection procedures are described below. Inspection forms and procedures are included in Appendices F-2 to F-4.

F.2.1.1 Types of Problems

SI Group personnel will inspect waste storage tanks, ancillary equipment, and all additional equipment in hazardous waste service on a daily basis. During the inspection of the tanks, pumps, piping, filters, and other ancillary equipment, the following criteria will be reviewed or evaluated:

- the presence of waste in containment system
- the presence of visible cracks, delamination, spalling, or similar defects in concrete walls, curbs, floor paving, sewers, and sumps
- the condition of the joints between concrete structures
- the drain valves and sumps from contained areas are closed
- the covers to sump and sewers are in place and are not cracked or damaged
- the high level control and alarms are functioning
- the interior lining of the secondary containment system do not show signs of wear or loss of integrity
- signs of spills or leaks (e.g., pooled waste or stains)
- the storm water collection system is functioning
- the fire extinguishers and fire stations are present and accessible
- the emergency eyewash and showers are clean and accessible

Completed inspection forms are retained by the facility for a period of three years from the date of inspection in the foreman's office in the Environmental File Room.

SI Group conducts regular inspections of security equipment. Guard personnel inspect the security fence nightly. The security guard on duty continuously monitors surveillance systems. Inspection procedures for the HWMUs equipment (pumps, valves, compressors, etc.) are detailed in Section N-1 of this Application.

F.2.1.2 Frequency of Inspections

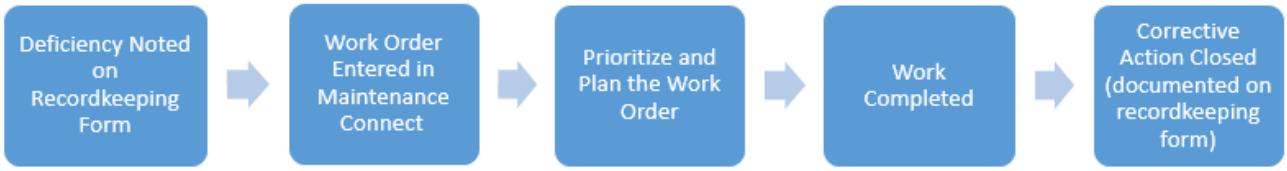
See Table F-1 for the facility inspection schedule.

Table F-1 **Inspection Schedule**
DAILY INSPECTION
Storage Tanks — Examined for signs of corrosion or leaks. Inspect corrosion protection system, overfill warning alarms and spill control equipment. Document the proposed corrective action taken if a leak was discovered. Document repairs made to storage tanks to correct leaks or corrosion.
Ancillary Equipment — Examine all pumps, filter, piping, and other ancillary equipment for signs of corrosion or leaks, both inside the secondary containment area and any other locations at the facility where equipment handles hazardous waste. Document the proposed corrective action taken if a leak was discovered. Document repairs made to ancillary equipment to correct leaks.
Containment Dikes — Examined for evidence of erosion and cracks.
Secondary Containment Interior Lining — Examined for signs of wear or loss of integrity and document any corrective actions that were taken.
Sump and Drain — Inspected to ensure that no clogs or backups have occurred, and that unit is operating properly.
Boiler House — At the beginning of each shift, the boiler house is inspected for signs of leakage. Boiler operators are responsible for inspecting and maintaining proper water levels, fuel levels, and pump operation.
Concrete Paving and Joints — Examine paving for cracks or defects. Examine joint material for condition.
WEEKLY INSPECTION
Respiratory Protection Equipment — Cylinder pressure is checked, if pressure is less than 1500 pounds per square inch (PSI), the cylinder is changed.
Plant Alarm — Tested each Wednesday at 11:30 a.m.
Hydrogen Cyanide Alarm — Tested each Friday at 11:30 a.m.
Plant Disaster/Evacuation Alarm — Tested each Monday at 11:30 a.m.
Automatic Waste Feed Cut-Off — Tested to ensure that unit operates properly.
Boiler Combustion Temperature — Thermocouple checked to ensure that temperature is within monitored range of 0 – 1,500 °C; typical values range 1,025 °C – 1,080 °C (+/- 5°C).
Baghouse — Thermocouple checked to ensure that inlet temperature is within monitored range of 32 °C — 482 °F; typical values range 350 °F - 380 °F (+/- 2 °F).
Baghouse — Differential Pressure Cell checked to ensure that water column is within monitored range of 0 — 20 inches; typical values range 1-10 inches (+/- 0.25% of range).
Stack Gas — Thermocouple checked to ensure that temperature is within monitored range of 0 °C — 250 °C; typical values range 200 °C — 220 °C (+/- 1 °C).

Table F-1 **Inspection Schedule**
MONTHLY INSPECTION
Eye Wash and Safety Shower — Tested to ensure that all units work properly and maintain adequate water pressures. All operating parts are checked for possible damage and repaired or replaced as necessary.
Spill Control Equipment — Inspected to ensure that adequate amounts and types of absorbent pillows, brooms, shovels, portable berms, and other spill control equipment (described more fully in SI Group's Contingency Plan [Section G of this Application]) are maintained.
Respiratory Protection Equipment — Self-contained breathing apparatus (SCBA) equipment is inspected to ensure proper number of working parts for full operation; straps, face pieces, and hoses inspected for signs of wear; system is checked for air tightness; and alarm system is checked to assure that alarm function between 475 PSI and 375 PSI; and diaphragm, regulator, main-line and by-pass valves function checked.
Community Siren — Tested monthly on the second Friday of each month at noon.
Fire Fighting Equipment — Fire extinguishers and stations are inspected to ensure that units are accessible and examined for structural damage and proper charging.
Boiler Opacity – Opacity visually checked to ensure that bag leak detection is within monitored range of 0 — 100 %; typical values range 25-35% (+/- 1%).
QUARTERLY INSPECTIONS
Boiler No. 4 Storage Tank containment and Trailer pad containment — Inspected quarterly by coating contractor for integrity with any repairs being made
Boiler Liquid Waste Feed Rate — Flow meter checked to ensure that feed rate is within monitored range of 0 — 800 lb/min; typical values range 10 — 25 lb/min (+/- 0.2% of reading).
Stack Carbon Monoxide Concentration — Gas analyzer checked to ensure that carbon monoxide concentrations are within monitored range of 0 — 200 ppmdv @ 7% O_2; typical values range 10 -20 ppmdv (+/- 3 ppmdv).
Stack Oxygen Concentration — Gas analyzer checked to ensure that oxygen concentrations are within monitored range of 0 — 25%; typical values range 5-8% (+/- 1% O_2).
OTHER ROUTINE INSPECTIONS
Boiler No. 4 Storage Tanks — Tank thickness (shell and bottom) — every 6 months; tank thickness — top of the tank — every 2 years. Internal inspection — every 3 years. Refer to Table F-3.
Boiler Natural Gas Feed Rate — Flow meter checked to ensure that feed rate is within monitored range of 0 — 488 scfm; typical values range 200 — 300 scfm (+/- 2% of reading).
Boiler Steam Production Rate — Flow meter checked to ensure that feed rate is within monitored range of 0 — 25,000 lb/hr; typical values range 10,000 — 20,000 lb/hr (+/- 2% of reading).
Boiler Air Pressure — Atomizer checked to ensure that air pressure is within monitored range of 0 — 100 psig; typical values range 15 — 25 psig (+/- 2%).
INSPECTION AFTER USE
Personal Protective Equipment — Each operating area is responsible for maintaining adequate supplies of the required PPE for that area as well as the integrity of the equipment.

F.2.1.3 Schedule of Remedial Action and Corrective Action

Inspection of the facility is performed in accordance with Table F-1. If, during the routine inspection, deteriorated or malfunctioning equipment or structures are detected, the area supervisor is notified and a work order is entered into the Maintenance Connect software system. The diagram below represents the flow of the corrective action process.



Prioritization is given to Environmental and Safety related work orders. Table F-2 indicates the work completion time frame for any Environmental related deficiencies.

Table F-2
Work Order Completion Time Frame

Area	Type	Priority
RCRA	Any Leaks of hazardous waste	Repair within 24 hours (unless inclement weather)
RCRA	Deficiency in containment — minor repairs	Repaired within 5 days via plant work crews
RCRA	Deficiency in containment	Repaired within 5 days with temporary repairs via plant work crews; permanent repairs within 30 days via contractor.
Safety/ Environmental	Immediate/Emergency	Within 24 hours
Safety/ Environmental	Improvement Priorities	Within 30 days
LDAR	Major Leak: greater than 10,000 ppm	The leak will be investigated. The first repair must occur within 5 days of leak being detected. Final repair should be completed within 15 days of leak being first detected.
LDAR	Minor Leak: greater than 50% of 10,000 ppm.	Repaired within 30 days

Notes:
RCRA = Resource Conservation and Recovery Act
LDAR = Leak Detection and Repair
ppm = parts per million

Facility personnel will remedy any deterioration or malfunction of equipment or structures which the inspection reveals on a schedule which ensures that the problem does not lead to an environmental or human health hazard. Where a hazard is imminent or has already occurred, remedial action will be taken immediately by facility personnel trained in implementation of the SI Group's Contingency Plan.

F.2.1.4 Inspection Logs

The SI Group's inspector will complete the appropriate form during each inspection. Blank inspection forms for Boiler No. 4, the Boiler No. 4 Storage Tanks, and associated piping systems are provided in Appendix F-2. Table F-3 presents the types and frequencies of inspections performed for the Boiler No. 4 Storage Tanks. Completed inspection forms will be maintained in the Safety file room. Inspection records will be retained for at least 3 years from the date of inspection. All inspection forms will include the date and time of inspection, the inspector's signature, items evaluated, any observations of incorrect or unacceptable items, and the date and nature of any repairs or other remedial action.

Table F-3
Hazardous Waste Tank Inspections Requirements

		Level 2 Controls				
		Boiler No. 4 Tanks				
Inspection Requirement	**Regulatory Citation**	**T-30M-61 (T8333)**	**T-30M-66 (T8336)**	**T-100M-5 (T8332)**	**T-10M-32 (T8345)**	**Compliance Method**
Visual inspection of: tanks — inspect overfill/spill control equipment, corrosions, releases of waste; and secondary containment system of releases/erosion.	40 CFR 264/265.195	Daily	Daily	Daily	Daily	Performed by Areas as part of daily inspection
Visual inspection of the roof, closure device, and closed-vent system (joints, seams, or other connections that are permanently or semi-permanently sealed).	40 CFR 264.1084(g)(3)(i), 40 CFR 264.1087(c)(7), 40 CFR 265.1088(c)(7), and 40 CFR 264/265.1033(i)(1)(ii)(A)	Annually	Annually	Annually	Annually	By Maintenance Group; results logged in Maintenance Connect
Thickness measurements — tank shell and bottom (via external ultrasonic)	RCRA Permit Condition III.F.6	Every 6 months	Every 6 months	Every 6 months	Every 6 months	By Maintenance Group; results logged in Maintenance Connect
Thickness measurements — top of tank (via external ultrasound)	RCRA Permit Condition III.F.6	Every 2 years	Every 2 years	Every 2 years	Every 2 years	By Maintenance Group; results logged in Maintenance Connect
Internal inspection (while tank is empty)	RCRA Permit Condition III.F.6	Every 3 years	Every 3 years	Every 3 years	Every 3 years	By Maintenance Group; results logged in Maintenance Connect

Notes:
CFR = Code of Federal Regulations
RCRA = Resource Conservation and Recovery Act

Piping transferring waste to Boiler No. 4 and < 90-day activities are is inspected daily, pursuant to SI Group's LDAR procedures (Subpart BB and Subpart CC, respectively). Additional details regarding SI Group's LDAR procedures are provided in Section N of this Application.

F.2.2 Tank System Inspection

The hazardous waste storage tanks in the tank farm are examined daily for signs of corrosion or leaks. The tank system is inspected including the corrosion protection system, the overfill warning alarms, and the spill control equipment. The proposed corrective action is documented if a leak was discovered. Repairs made to storage tanks to correct leaks or corrosion are documented.

F.2.3 Boiler No. 4 Inspections

Boiler No. 4 is inspected once each shift by the Boiler Operator. A boiler checklist is contained in Appendix F-2. The automatic feed shutoff is tested weekly. The testing protocol for the automatic waste feed cutoff system encompasses: 1) testing of each electronic signal associated with every cutoff parameter; and 2) actual closure of the waste feed cutoff valve for at least one parameter. The testing procedure is in Appendix F-2. A copy of the facility's general inspection plan for Boiler No. 4 is in Appendix F-3.

Release of waste streams from the containment, from tanks and ancillary equipment, and the unloading are checked daily. When a tank truck is unloading, the unloading connections and piping are checked hourly for leaks or malfunctions.

F.2.4 Containment Inspection

The containment for the tanks and ancillary equipment are checked on a daily basis. Checklists for these inspections are in Appendix F-2.

F.3 Preparedness and Prevention

Information in this section is provided to demonstrate that Boiler No. 4 and the associated hazardous waste storage and transfer facility is designed, constructed, and operated in order to minimize the possibility of a fire, explosion, or any unplanned release of hazardous waste to air, soil, or surface water which could threaten human health or the environment. Measures that will be taken in the event of any releases are fully described in Section G, Contingency Plan.

Boiler No. 4 and associated hazardous waste storage and transfer facility will be utilized to burn hazardous waste solvents, characteristic ignitable wastes, listed wastes, and non-hazardous wastes. Hazardous wastes are transported to an aboveground storage and accumulation area

adjacent to Boiler No. 4 via plant piping and tank trailers. This storage tank area will be utilized to hold hazardous wastes for periods that may exceed 90 days prior to energy recovery. All wastes transported to the storage and accumulation facility are generated from SI Group's operations.

As shown on Figure F-3, Boiler No. 4 is located within a steel-framed building with galvanized siding and corrugated polyvinyl chloride roofing. The boiler-building floor is constructed of a reinforced concrete slab; the floor is sloped to a center drainage trench. The trench drains to a sump located outside of the building that is pumped to the process sewer system. The sump pump is automatically activated to empty the sump as needed; however, the pump can be turned off to allow for sampling of the liquid collected by the sump prior to pumping, if needed. The storage tanks are enclosed in a diked area with concrete flooring and concrete masonry unit walls. The diked area is approximately 60 feet wide by 80 feet long and the wall height is 4.5 feet. The secondary containment area floor is sloped to a sump. The sump is used for storm water accumulation removal, or removal of potential releases.

Each tank is provided with overfill protection and fire protection equipment. Each tank is provided with a high level sensor that activates an audible high level alarm and automatically closes an actuated emergency shut-off valve in the tank fill line when the liquid level rises to within 16 inches of the tank top. Each tank is equipped with an inert gas blanketing system in order to mitigate potential fire conditions in the tank headspaces. Each tank is equipped with an emergency vent. Corrosion protection is provided at each tank by a 1/8 inch corrosion allowance and an exterior primer coating.

Hazardous waste is transferred from waste tank trucks to the storage tanks in the trailer unloading area. The unloading area is paved with 10-inch to 12-inch thick, 5,000 PSI reinforced concrete and constructed with 8-inch high concrete curbing. The floor area is sloped to a floor trench and drains to a sump. Accumulated storm water may be pumped from the sump for disposal.

Accumulated storm water is pumped to the process sewer system for treatment. If a leak or spill of hazardous wastes occurs, the release(s) are pumped back to a tank trailer or the other dedicated container for proper disposal. Hazardous waste is not sent to the process sewer. The paved area measures 65 feet by 90 feet. Complete design descriptions of the hazardous waste storage tanks and tank truck transfer area are included in Section D-2.

The boiler and hazardous waste transfer and storage facility is located within the SI Group's complex boundary, which is surrounded and secured by fencing as described in Section F.1, Security.

Tank trailer tires will be chocked to prevent trailer movement while parked. As illustrated in Figure F-1, the area north of the hazardous waste storage area provides ample room for truck maneuvering.

The hazardous waste storage and transfer areas are not covered with roofs. Precipitation is removed by the Boiler Operators through the floor sump and pump systems.

Secondary containment in the tank truck loading/unloading area is capable of containing approximately 44,421 gallons, which is greater than the capacity of the largest tank truck plus precipitation from a 25-year, 24-hour rainfall event. The interior walls and floor of the containment structure are coated with an epoxy resin that is compatible with the wastes that are to be placed in the tank system. Calculations of containment volume are provided in Appendix D-2. As shown on Figure F-3, a sump covered with a galvanized steel grate is located in the southwest corner of the tank truck loading/unloading area. The sloped floor of the transfer area drains to a trench along the south wall. Should any material other than rainwater accumulate within these secondary containment structures, they will be removed by the sump pump and returned to a tank truck or other dedicated container for proper disposal.

Emergency eyewash/safety showers are located in the southeast corner of the boiler building, at the northeast exterior wall of the boiler building, in the northern portion of the storage tank area, and along the south interior wall of the tank-trailer loading/unloading area.

F.3.1 Equipment

F.3.1.1 Internal Communication

There are 43 manual alarm stations distributed throughout the facility. The alarm signal locates potential emergencies in an audible voice code. An alarm pull station (pull station No. 22) capable of immediately summoning the_emergency response team (ERT) is located directly north of Boiler No. 4, across 10th Street. When the alarm, which is sounded through the public address (PA) system, is activated, a verbal direction through the plant speaker system is given. When the alarm pull station is activated, the security guard concurrently receives a signal indicating which station within the zone that requires a response, and directs the Incident Commander and other appropriate ERT personnel to the scene.

Alarm and non-alarm emergencies can be reported to the security guard using the plant telephone system (extension 313) or via radio as a secondary means of notification. The guard will notify the appropriate emergency action team members.

Radios are carried by the Incident Commander; Safety Officer, and the fire truck driver. Radios are also used to alert the onsite Emergency Medical Technician (EMT) and ambulance driver if their services are required.

The waste storage tanks are equipped with high level sensors and an automated audible alarm capable of immediately alerting all present facility personnel to an emergency overfill. The high level switches that operate the alarm are located within each tank. Should an emergency overfill or spill occur, the Boiler Operator will respond immediately and contact the Incident Commander if necessary. Due to the relatively small size of the storage area, personnel will be able to communicate by voice contact as well, should an emergency occur. In addition, hand-held radios will be maintained onsite for use by employees.

F.3.1.2 External Communications

A plant telephone is located at the boiler facility. In addition, telephones are located in the storage tank area, boiler building, and the adjacent boiler control room. The plant telephone system may be used to report emergencies on extension 313. Mobile radios are used as well to maintain communication with the Regional Medical Center (channel 1), the Orangeburg Emergency Medical Service (channel 2), or other onsite locations via the plant radio system (channel 3). Police, fire, and emergency response teams are contacted by telephone, as discussed in the Contingency Plan.

F.3.1.3 Emergency Equipment

SI Group maintains emergency response equipment throughout the facility. Available spill control equipment includes such items as granular absorbent, absorbent pads and booms, sumps, portable pumps, shovels, and empty Department of Transportation (DOT)-approved containers and recovery drums. Activated carbon and fire suppression foam are used to suppress flammable liquid vapors, and lime, which is used to neutralize corrosive materials, is stored in marked areas. In addition, barrels of absorbent are located within the facility. PPE such as tyvek and chemical-resistant outer clothing, fully encapsulated environmental suits, self-contained breathing apparatus units, and half- and full-face respirators are stocked in the equipment storage building. Spill response and PPE are fully delineated in the facility's Contingency Plan.

F.3.1.4 Water and Fire Control

Five portable, hand-held fire extinguishers, 30-pound, ANSUL dry chemical type, are mounted in the boiler, storage tank, and tank trailer area. Two extinguishers are located in the boiler building, two extinguishers are located in the storage tank area, and one extinguisher is located in the tank trailer area. The extinguishers are spaced across the boiler facility per National Fire Protection Association Requirements.

SI Group maintains a full-time ERT, ambulance, and EMT onsite. The firehouse is located on A Street and is equipped with a 1500 gpm pumper with 800 gallons of foam, and an ERT van with equipment, nozzles, and Haz-Mat equipment. The ERT has an authorized fire-fighting force of 90 personnel.

A fire protection system is located onsite. The water distribution system includes 1-inch to 12-inch raw water mains, a 500,000-gallon elevated water storage tank located in the southern portion of the facility, a 150,000-gallon elevated water storage tank filled with city water is located in the northern portion of the facility, and a series of fire hydrants and on-line turret nozzles. The Edisto River feeds the firewater distribution system. City water is available as a supplemental supply when required. In addition to the elevated water storage tanks, the water distribution system consists of a 2,500 gpm pump at 125 PSI serving the southern portion of the site, a 2,500 gpm pump at 125 PSI serving the northern portion of the site, and a 1,000 gpm backup pump. The fire pumps are activated automatically when the pressure in the distribution system drops below a preset level.

Two water turret nozzles serve the boiler facility. The turret nozzles are located directly north of the boiler facility, across 10th Street. Water pressure at the nozzles is 125 PSI. When the fire alarm system is activated and appropriate fire-fighting units are mobilized, Boiler Operators are responsible for reporting to the three firewater distribution pumps to monitor pump operations. The water pumps are not deactivated until directed by the Incident Commander. The Boiler Operators maintain operating logs for the pumps, water storage tanks, and fuel tanks.

All facility personnel are trained in emergency response procedures, as detailed in Section H, Training.

A list of emergency telephone numbers is given in the Contingency Plan and is posted at the Emergency Operation Center in the QC laboratory. A copy of the Contingency Plan is located in the Safety Library as part of the facility's Emergency Response Plan. Employees can also access the Contingency Plan from the Environmental, Health, and Safety Sharepoint site. In the event of a fire in the HWMUs area, the closest phone that is capable of dialing outside lines is in the Ambulance building (located south of the Boiler at the intersection of 10th Street and A Street);

however, the use of radios and a pull station in the HWMUs area is the primary means to contact onsite emergency personnel and those personnel with access to outside lines.

F.3.1.5 Testing and Maintenance of Equipment

All facility alarm systems, fire protection equipment, spill control and emergency equipment, and PPE are inspected to ensure proper condition and/or operation. Section F.1, details both the intervals at which these items are tested and the types of problems which may occur. Inspections and any maintenance activities are recorded and maintained in a log at the facility. A brief description of the boiler facility emergency equipment-testing program is outlined below.

- Plant Alarm Test: The plant alarm system is tested each Wednesday at 11:30 a.m. for three cycles.
- Plant Disaster/Evacuation Alarm: The plant disaster alarm is tested each Monday at 11:30 a.m.
- HCN Alarm: Tested each Friday at 11:30 a.m.
- Community Siren: Tested monthly on the 2nd Friday of the month at noon.
- Fire Protection System Elevated Storage Tanks and Pumps: Boiler operators are responsible for inspecting and maintaining proper water levels, fuel levels and pump operating modes.
- Waste Storage Tank High Level Alarm: Storage tank high level switches and the alarm indicator are tested daily.
- Miscellaneous Equipment: Valves, sumps, sump pumps, containment structures, and piping are inspected daily.

F.3.1.6 Access to Communication or Alarm Equipment

Personnel can immediately access the emergency alarm stations and telephones at the boiler and storage tank facility, should an emergency situation arise. In addition, the relatively small size of the facility ensures that voice contact can be maintained at all times. The plant telephones located in the boiler and storage tank area provide employees with a means of rapidly summoning emergency assistance, if necessary. Mobile radios capable of contacting other facility personnel, the Orangeburg County Emergency Medical Service, and/or the Regional Medical Hospital are available at the site.

F.3.2 Aisle Space Requirement

A minimum aisle width of at least 2 feet is maintained in the boiler building, waste storage and containment area, and waste tank trailer transfer area (see Figure F-3). This dimension is adequate for movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of the facility in an emergency.

The waste transfer area is designed to hold six 8-foot wide by 60-foot long tank trailers. Bays are 12 feet wide. These dimensions will ensure that ample space is maintained between trailers, allowing facility personnel to move through these areas with no difficulty and ensuring that trailers can be easily monitored, shut down, disconnected, and moved if necessary. The typical operating procedure is to unload one trailer at a time.

Sufficient aisle space is maintained in the boiler building to permit the unobstructed movement of personnel, fire protection equipment, or spill control equipment to any area of facility operation in an emergency.

F.3.3 Arrangements with Local Authorities

SI Group has made arrangements to familiarize police, fire departments, and emergency response teams with the layout of the facility, properties of hazardous wastes commonly handled at the facility and associated hazards, locations where personnel would normally be working, entrances to the facility and traffic routes within, and possible evacuation routes. The Orangeburg County Disaster Preparedness Center is responsible for contacting other offsite emergency response personnel, as well as informing selected media organizations of the emergency situation. SI Group and the County have developed an agreement and procedures for this notification. Refer to Section G of this Application for arrangements with local agencies for emergency response.

SI Group routinely works with local emergency response personnel to ensure familiarity with the facility and types of potential injuries. As an example, Mr. Billy Staley, Director of the Orangeburg County Emergency Services, is a member of the site's community advisory panel.

F.4 Prevention Procedures, Structures, and Equipment

F.4.1 Unloading Procedures

F.4.1.1 Storage Tank Transfer

Hazardous wastes are regularly collected from temporary (less than 90 days) storage tanks located throughout the plant property by 7,500-gallon stainless steel tank-trailers operated onsite by the SI Group. The collected waste is transferred from the tank trucks to the storage tanks at the facility.

Tank trucks delivering hazardous waste to the HWMUs are unloaded within a concrete containment area that is located immediately adjacent to and east of the storage tank containment structure (see Figure F-3). This containment area measures approximately 65 feet by 90 feet and is paved with 6 inches of reinforced concrete. Containment walls along three sides of the structure are constructed of 8-inch reinforced concrete. The fourth side of the structure is open to allow vehicular access. The floor of the area slopes up at 3/8 inches per foot to the vehicle entrance on the north side where a 4-inch roll curb prevents storm water from flowing into the area. This structure can contain 44,421 gallons, which is greater than 100% of the capacity of the largest tank trailer plus precipitation from a 25-year, 24-hour rainfall event.

The contained loading/unloading and direct transfer area slopes to a trench drain along the south side of the area. Any waste releases or accumulated liquids are contained within the area and collected in a sump that is located in the southwest corner of the loading area. An installed pump, for removal of storm water, pumps from this sump to a nearby process sewer that pumps to the wastewater treatment plant. This pump must be manually activated after any significant accumulation of storm water. The sump contents are visually inspected for signs of contamination such as an oily sheen or discoloration. If contamination is suspected or a spill of hazardous material has occurred, the sump contents will be pumped into a tanker or other appropriate container within 24 hours and treated as a hazardous waste. The secondary containment area, the sump, and all transfer equipment and piping are inspected daily for evidence of a release, presence of debris, and structural deterioration. Tank trucks are loaded or unloaded, one at a time, with a pump through two flexible hose connection ports located within the contained loading/unloading area. A platform with two self-leveling gangways and safety gates is used to allow safe access to tank trailer loading/unloading operations. The piping diagram for the tank-trailer loading/unloading facility and transfer operations is shown in Figure D.9-1. Waste is typically transferred to one of the collection and blending storage tanks.

As shown in Figure F-3, a metal stairway provides access between the two containment areas and a metal ladder located on the east wall of the structure provides a second means of escape in an emergency. Safety equipment located in the tank truck loading/unloading containment area consists of an emergency shower with eyewash and one ANSUL 30-pound dry chemical fire extinguisher. Additional equipment located in the adjacent storage tank containment area is easily accessible. A fire protection turret nozzle is located 50 feet north of the facility just across 10th Street. All safety equipment is inspected monthly, as discussed in Section F-2, Inspection Schedule and Procedures).

F.4.2 Runoff

All hazardous wastes are contained in storage tanks surrounded by a containment structures. The tank truck unloading area is also equipped with a containment structure. Since these enclosures can contain waste plus a 25-year rain, heavy rains are not expected to cause hazardous waste runoff. The boiler and baghouse are sloped and drained to two sump pumps that remove water to the wastewater treatment system where the water is treated to National Pollutant Discharge Elimination System (NPDES) standards before being discharged to the Edisto River in accordance with discharge permit requirements. In addition, any spills in the area are contained and cleaned up to prevent any waste leaving the area. Most of the piping and other ancillary equipment are visually inspected throughout the day. Therefore, the opportunity for hazardous waste to leave the facility through runoff is not anticipated.

The boiler area is at a higher elevation than the river; therefore, flooding is not expected in this area. The site can collect rain water in the impediment basin and can then overflow to storm water basins.

F.4.3 Water Supplies

The containment structures described in the previous section prevent hazardous waste from leaching into the soil and impacting groundwater and prevent runoff from impacting surface waters. These same containment structures prevent runoff from impacting surface waters.

F.4.4 Equipment and Power Failures

All equipment is designed to fail in the closed position if a power failure occurs. The waste feed shutoff promptly stops waste feed to the boiler. The boiler operation ceases when the fuel feed is shutoff and the flame is terminated. All pumps and ancillary equipment stops with a power failure limiting waste flows from storage tanks. Auxiliary power can be used to operate pumps to drain lines and sumps in the containments if required.

F.4.5 Personnel Protection Procedures

All personnel who work at the facility have been trained for emergencies that can occur in the plant. Specific emergency response training is given to those employees that would respond to an emergency that involved Boiler No. 4 or the balance to the hazardous waste facility. Specific training is discussed in Section H of this Application. The equipment that is available to protect personnel during emergency response situations is presented in the Contingency Plan.

F.4.6 Procedures to Minimize Releases to the Atmosphere

SI Group has procedures and equipment in place to minimize releases to the atmosphere from piping components and the hazardous waste storage tanks. The fugitive emission program is discussed in Section N of this Application. The four hazardous waste storage tanks are vented to a flare for destruction of organic vapors from the storage tanks during transfer operations and breathing losses. The flare is discussed in more detail in Section O of this Application.

If a fire occurred in the hazardous waste area, the SI Group would respond with its emergency team to extinguish the fire. Additionally, stationary monitors are designed to deluge the area with water which would minimize releases to the atmosphere. After the fire was controlled, wastes and fire water from the containment structures and damaged tanks would be transferred to tank trucks for offsite treatment and disposal, as needed.

F.5 Prevention of Reaction of Ignitable, Reactive, and Incompatible Waste

All flammable wastes are transported to the storage tanks at the boiler by truck trailer or via pipeline. The wastes delivered to the boiler storage tanks are compatible; however, some streams are segregated because of water solubility.

Each waste sent to the boiler is characterized to assure that the wastes are compatible. The characterization is documented on the Waste Receipt Slip. The Operating Foreman from the generating area is required to sign the Waste Receipt Slip to certify that the waste meets one of the characterizations approved for the boiler. This document accompanies all waste streams to the boiler and the Boiler Operator checks this document to ensure proper certification has been provided before unloading the waste. In addition to the Waste Receipt Slip, the facility utilizes the Hazardous Waste Storage Incompatibility Chart[1] in Appendix F-4 to ensure that the wastes are compatible.

All hazardous wastes stored at the facility are separated and protected from external sources of ignition or reaction including, but not limited to, smoking, open flames, cuffing and welding, hot surfaces or radiant heat, frictional heat, sparks (static, electric, or mechanical), and spontaneous ignition (i.e., from heat-producing chemical reactions). Hazardous wastes are stored at the boiler facility in aboveground tanks constructed to American Petroleum Institute 650 code requirements. Spark proof tools and equipment are available for use, should any actions (such as spill clean-up) be necessary around ignitable or reactive wastes. Use of welding equipment or other sources of open flames within the facility are restricted; appropriate notification procedures, approvals and permit

[1] Protocol for Conducting Environmental Compliance Audits for Hazardous Waste Generators under RCRA; U.S. EPA, June 2001.

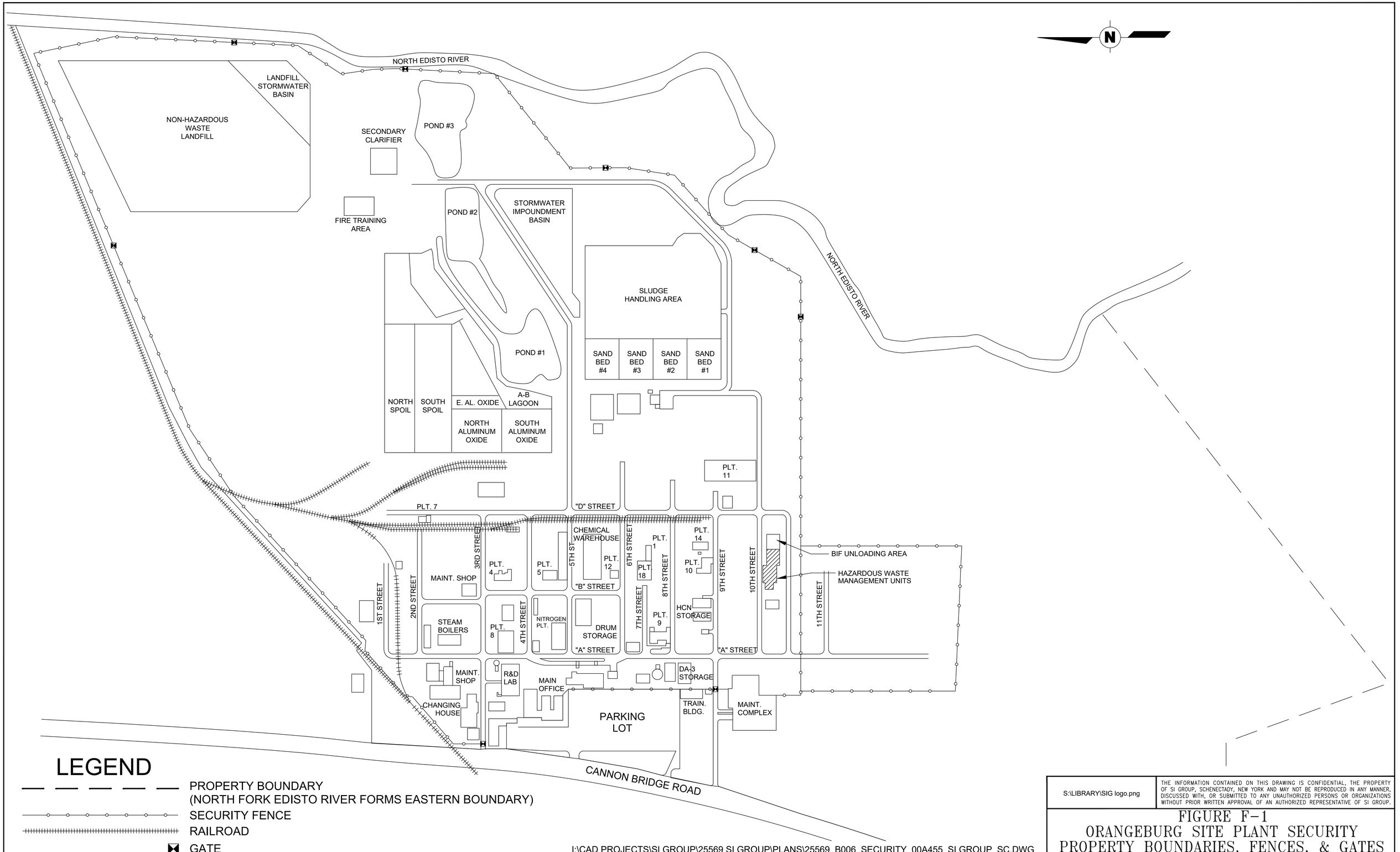
requirements must be complied with prior to initiation of any hot work. Although smoking is not permitted at the facility except at designated areas that are to the west of A Street (i.e., non-production areas), no smoking signs are posted throughout the plant.

Sunlight is a source of radiant heat that could affect wastes stored at the facility; however, as wastes will be stored within storage tanks and tank trailers, these materials will not be exposed to direct sunlight. There is no spark-generating equipment used within the active storage area, should corrective actions or implementation of the Contingency Plan occur. Finally, the waste segregation and storage measures described above will prevent spontaneous ignition of wastes.

All waste that is stored in temporary storage containers prior to transport to the boiler storage facility have an associated waste receipt slip that identifies the source and type of waste. The temporary storage containers, tank trailers, and storage tanks remain closed in order to minimize the potential for generation of uncontrolled vapors or gases in sufficient quantities to pose a risk of fire or explosions. Storage tanks are also equipped with nitrogen-blanketing systems to provide inert atmospheres to prevent the formation of flammable gaseous mixtures in their vapor spaces. Temporary containers are not opened unless waste transfer is necessary or corrective actions become necessary. Flexible hose connections and safety valves located at the storage tanks, tank trailers, and transfer platform minimize the potential for generation of uncontrolled releases during waste transfer operations. Hot work permits are required for any maintenance work associated with storage of flammable hazardous waste at the site.

Storage tanks may contain various combinations of waste types; however, all wastes stored will be compatible. Incompatible or difficult to blend wastes, i.e., methanol, alcohols, and amine, are transported to the boiler facility in tank trailers. These wastes will be loaded directly to one of the fuel burning tanks.

Appendix F-1
Figures



LEGEND

- PROPERTY BOUNDARY (NORTH FORK EDISTO RIVER FORMS EASTERN BOUNDARY)
- SECURITY FENCE
- RAILROAD
- GATE

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NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ISSUED FOR REFERENCE FOR POLLUTION CONTROL	12/14/04 RDS					

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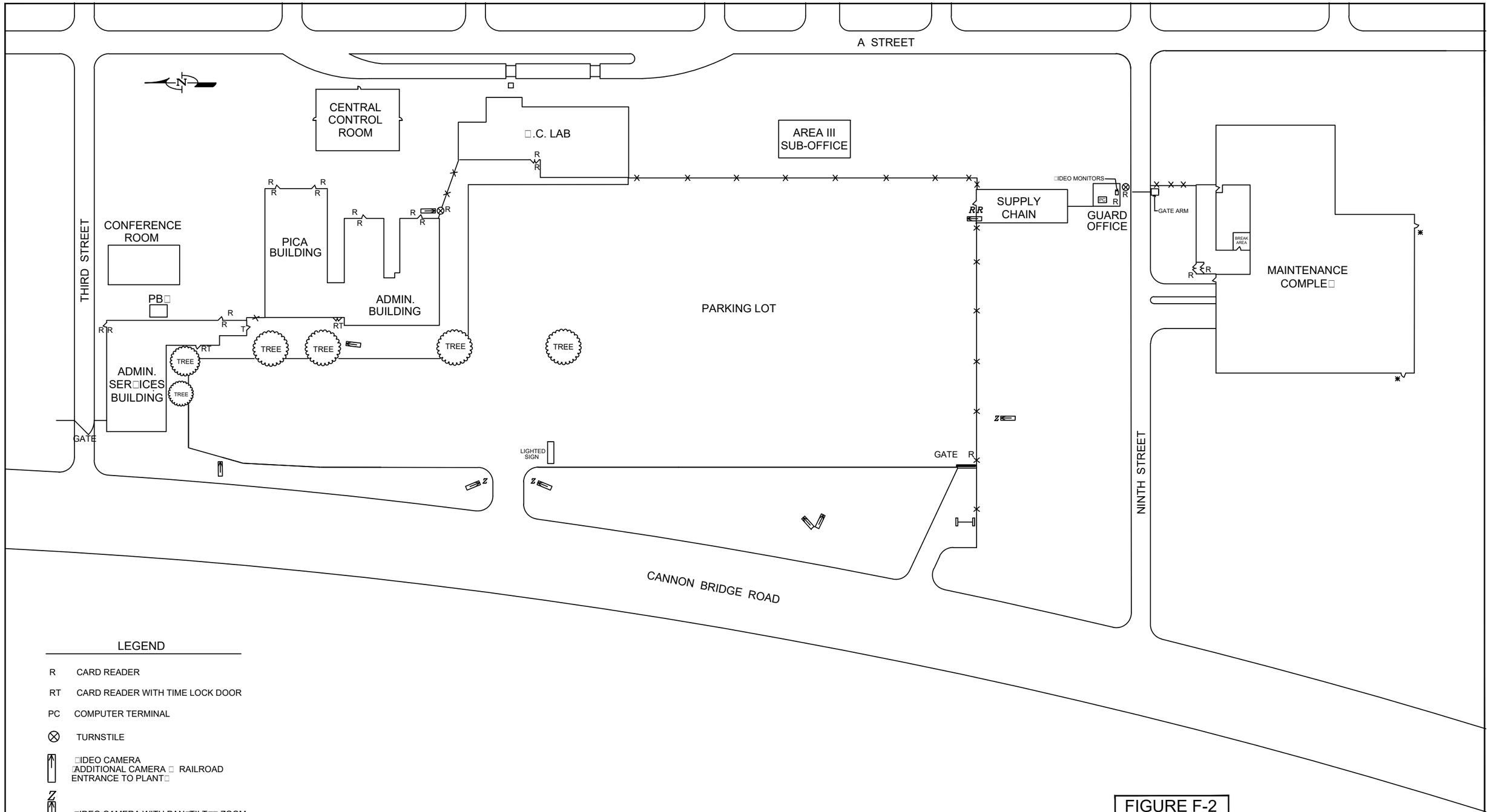
FIGURE F-1
ORANGEBURG SITE PLANT SECURITY PROPERTY BOUNDARIES, FENCES, & GATES

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A455	0
SCALE: 1"=200'	OPERATING AREA:	BUILDING NO:

0633



LEGEND

- R CARD READER
- RT CARD READER WITH TIME LOCK DOOR
- PC COMPUTER TERMINAL
- ⊗ TURNSTILE
- □IDEO CAMERA □ADDITIONAL CAMERA □ RAILROAD ENTRANCE TO PLANT□
- Z □IDEO CAMERA WITH PAN□TILT□□ ZOOM
- □— GATE ARM
- * WIRE TO ANNUNCIATOR IN GUARD OFFICE

FIGURE F-2

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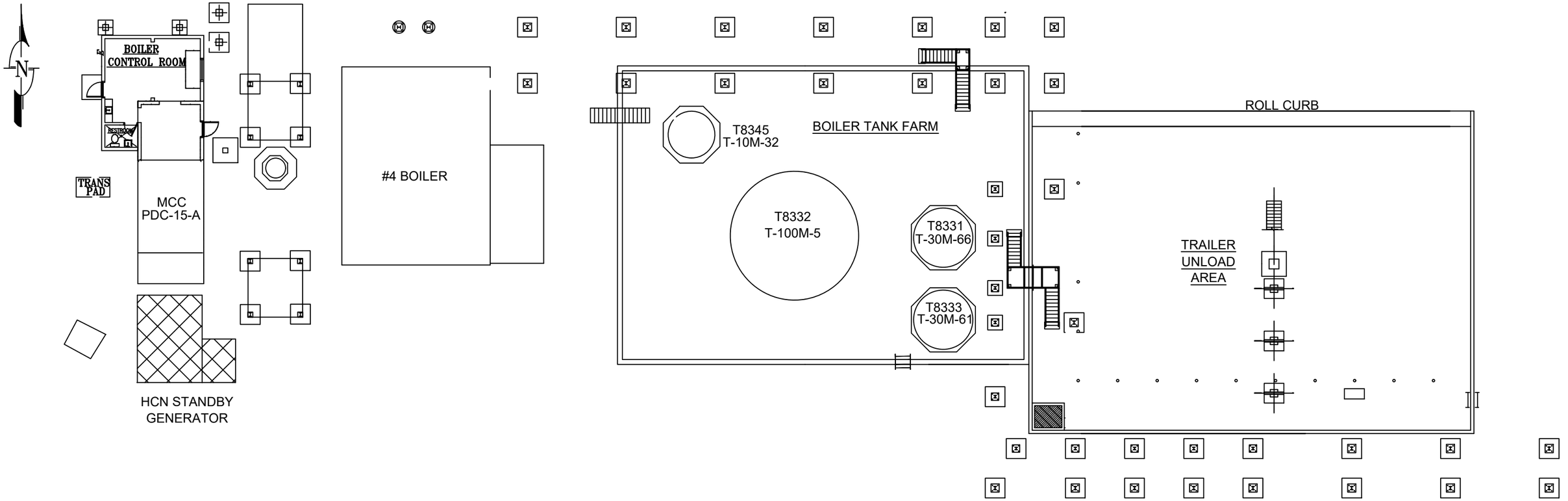
ORANGEBURG PLANT SECURITY PLAN OFFICE & LABORATORY

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	ORIGINAL	10/17/91 GFW					
1	REVISED PER LOCAL REVIEW	10/31/91 GFW					
2	ADDED ADDITIONAL CARD READERS	11/07/91 GFW					
3	ADDED CARD READERS @ MAINT. BREAK AREA & ADMIN. SERV. BLDG. PER PROJ. #0395	4/6/92 DLG	4/8/92 GFW	4/8/92 GFW			
4	REVISED CARD READERS AT MAINT. COMPLEX PER PROJ.# 0395	8/12/92 DLG	8/12/92 GFW				

0395	0BH00I001	4
PROJECT NUMBER	DRAWING NUMBER	REV.
SCALE: NONE	OPERATING AREA: –	BUILDING NO: –

TENTH STREET



I:\CAD PROJECTS\SI GROUP\25569 SI GROUP\PLANS\25569_B007_HAZ WASTE_SI GROUP_SC.DWG

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE RCRA FACILITY LOCATION	8/6/04 RDS	8/9/04 RDS	8/9/04 MGC	8/9/04 JWR		8/10/04 RAT

S:\LIBRARY\SIG logo.png

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FIGURE F-3
ALBEMARLE ORANGEBURG
HAZARDOUS WASTE MANAGEMENT UNITS

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A410	0
SCALE: NONE	OPERATING AREA:	BUILDING NO: –

Appendix F-2
Boiler No. 4 Inspection Checklists

CONTROLLED DOCUMENT Valid for use only if used within 24 hours of the time it was printed. **(PRINT DATE: 7/31/2018 5:28 PM)**

Must be performed DAILY for dikes, tanks and piping by area personnel.
This should be completed between 5AM and noon each day.

Look for evidence of leaks / corrosion / deterioration, or malfunctions, or operator error. Stop activities immediately if leaks present. All Hazardous Waste Spills must be immediately cleaned up and properly disposed of.

To Be Completed by Boiler Technician

DATE OF INSPECTION	Monday ___-___-___	Tuesday ___-___-___	Wednesday ___-___-___	Thursday ___-___-___	Friday ___-___-___	Saturday ___-___-___	Sunday ___-___-___
TIME OF INSPECTION							
INSPECTOR (PRINT NAME)							
INSPECTOR SIGNATURE							
HW Storage Tank T-100M-5 (T8332)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Pump (P8332) and Associated Piping (PC-200-90-10)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Storage Tank T-30M-66 (T8331)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Pump (P8331A) and Associated Piping (PC-00141)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Pump (P8331B) and Associated Piping (PR-20-15)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd

DEFICIENCIES: List deficiencies noted individually on the "Deficiency/Corrective Action Tracking Record" sheet. Do not duplicate entries for a deficiency which has already been recorded during any given week.
REPORT ALL DEFICIENCIES TO AREA SUPERVISION FOR CORRECTIVE ACTION.

CORRECTIVE ACTIONS/REPAIRS: Appropriate Corrective Actions for all noted deficiencies must be listed for each deficiency with individual verification of closure on "Deficiency/CA Tracking Record"

Look for evidence of leaks / corrosion / deterioration, or malfunctions, or operator error. Stop activities immediately if leaks present. All Hazardous Waste Spills must be immediately cleaned up and properly disposed of.

To Be Completed by Boiler Technician

DATE OF INSPECTION	Monday ___-___	Tuesday ___-___	Wednesday ___-___	Thursday ___-___	Friday ___-___	Saturday ___-___	Sunday ___-___
TIME OF INSPECTION							
INSPECTOR (PRINT NAME)							
INSPECTOR SIGNATURE							
HW Storage Tank T-30M-61 (T8333)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Pump (P8333) and Associated Piping (PR-300-60-23)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Storage Tank T-10M-32 (T8345)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
HW Pump (P8345) and Associated Piping (PC-180-70-1)	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd
Boiler #4 Containment Dike	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd	☐ All OK ☐ Action Req'd

DEFICIENCIES: List deficiencies noted individually on the "Deficiency/Corrective Action Tracking Record" sheet. Do not duplicate entries for a deficiency which has already been recorded during any given week.

REPORT ALL DEFICIENCIES TO AREA SUPERVISION FOR CORRECTIVE ACTION.

CORRECTIVE ACTIONS/REPAIRS: Appropriate Corrective Actions for all noted deficiencies must be listed for each deficiency with individual verification of closure on "Deficiency/CA Tracking Record:

Deficiency/Corrective Action Tracking Record

REPORT ALL DEFICIENCIES TO SUPERVISION FOR CORRECTIVE ACTION.

Deficiency Date-ID# (mm/dd#x) Example: 12/01#2 **(1) Production** _____	**Detailed Description of Deficiency to include location**	**(2) Production**	**(3) Production Work Order Written?** ☐ **Yes - Maintenance to Repair** ☐ **No - Operations to Correct**
	Detailed Description of Corrective Actions or Repairs	**(4) Corrected by: Plant Services or Production**	**(5) Production Closure Verification** **Date: ____ / ____ / ____** **Signature:** _____

REPORT ALL DEFICIENCIES TO SUPERVISION FOR CORRECTIVE ACTION.

Deficiency Date-ID# (mm/dd#x) Example: 12/01#2 **(1) Production** _____	**Detailed Description of Corrective Actions or Repairs**	**(2) Production**	**3) Production Work Order Written?** ☐ **Yes - Maintenance to Repair** ☐ **No - Operations to Correct**
	Detailed Description of Deficiency to include location	**(4) Corrected by: Plant Services or Production**	**(5) Production Closure Verification** **Date: ____ / ____ / ____** **Signature:** _____

REPORT ALL DEFICIENCIES TO SUPERVISION FOR CORRECTIVE ACTION.

Deficiency Date-ID# (mm/dd#x) Example: 12/01#2 **(1) Production** _____	**Detailed Description of Deficiency to include location**	**(2) Production**	**3) Production Work Order Written?** ☐ **Yes - Maintenance to Repair** ☐ **No - Operations to Correct**
	Detailed Description of Corrective Actions or Repairs	**(4) Corrected by: Plant Services or Production**	**(5) Production Closure Verification** **Date: ____ / ____ / ____** **Signature:** _____

REPORT ALL DEFICIENCIES TO AREA SUPERVISION FOR CORRECTIVE ACTION.

DIKE-TANK-PIPING RCRA INSPECTION REFERENCE LIST

THIS PAGE TO BE UTILIZED IN CONJUNCTION WITH THE RCRA INSPECTION CHECKLISTS

NOTE: *Inspection includes not only visual review but also unusual smells or sounds that might indicate malfunctions, deterioration/corrosion issues, operator errors, or any other problems.*

1) **Tank**
   Observe tank and associated systems (i.e. tank plus associated piping, pump, vent system, piping supports, tank supports, etc.) for signs of corrosion, leaks and stains for signs of leaks and/or container overflows.
   Are the Tanks Clearly Labeled as containing Hazardous Waste?

2) **Tank Foundations**
   Observe tank foundation (where applicable) for signs of cracks, discoloration, puddles containing spilled material, settling, gaps between tank and foundation or damage caused by vegetation or roots.

3) **Piping/Pumps**
   Check piping for discoloration, corrosion, bowing of pipes between supports, evidence of stored or material seepage from valves or seals. Check to ensure that pipe is properly supported and on all saddles and supports. Observe pumps for leaks on housing or seals or for vibration issues and seal oil levels where appropriate.

4) **Dike**
   Are joints properly sealed and in good condition?
   Is the interior lining in good condition, and does it prevent migration of spilled or leaked material into the concrete?
   - Major cracks in the Floor providing an immediate pathway to soil or Major cracks in the Walls providing an immediate breach of containment should immediately brought to the attention of supervision.
   - Minor cracks in the floor or walls providing a potential breach of containment or pathway to soil must be repaired within 5 days. (Hairline cracks, peeling and or minor corrosion requires immediate follow up.)
   - For all flaws, circle them and in circle write Date-ID# (mm/dd#x) Example: 12/01#2

   Is storm water standing in area?

5) **Sump**
   Are sump covers in place and in good condition?

6) **Housekeeping (Correct as Needed)**
   Is housekeeping in the area good, standing water or sand in area?

7) **Spills**
   Where evidence of a spill in excess of 1 pound exists to the containment system, on the ground, in the sumps or on the tank or piping system or any other location is noted corrective action must be taken. If the spill cannot be immediately cleaned up the area must be roped off with Red Barrier tape and Area Supervision notified.

NOTE: Technician should correct Minor Housekeeping or other Minor issues immediately. All Deficiencies noted should be resolved in 5 days. Work Orders to be entered by Production and given "C" Priority. Deficiencies not overcome within 5 days should be elevated to Supervision.

REVISION HISTORY

Date	Revision #	Comments/Changes
05/18/2012	N/A	Completely Updated Document to separate out various Hazardous Waste Inspection Areas. This document now only covers Daily Inspections for the Boiler #4 Tanks, Dike and associated Piping Systems.
08/24/2012	N/A	Update Verification sheets to clarify actions operations has.
01/21/2016	N/A	Remove "Area 1' references. Eliminated sign off by Unit Coordinator and foreman signature only on last page. Adapt wording to better resemble 264.15(a) text. Reduce to only one page of Tracking Record as almost never need more. Remove S. Jackson as reviewer, add Luna & Lambert.
03/16/2017	N/A	per LL, removed page for inspecting heel lines < *#4 BOILER STORAGE TANK PIPING SYSTEMS* **>;** replaced Lambert with Mirnazari; title change from foreman to team supervisor
03/22/2017	1.0	Moving Procedure to SharePoint as Revision 1.0. Changed job titles and formatting to be consistent with new roles. -NMM
9/13/2017	2.0	Removed the need for team supervisor signature

	Boiler # 4 – Automatic Waste Feed Cut Off (AWFCO) Test Procedure	Initial
	This document is to be filled out weekly Routine AWFCO & NDS testing to be performed each Friday. If boiler is planned to be off waste for several days to include Friday date, try to do the AWFCO (if practical) at end of the waste burn. The alarm cut off tests will be done by changing the alarm set points to a value where the current conditions are outside allowable ranges. This must be done immediately after the AWFCO occurs so that the hourly average will represent waste burning conditions. If testing can not be done, state the reason when signing below at end of this secion. The set points are changed by using the following procedure. Press escape key to go into the menu screen then: A. Select Operations Menu then press the "enter" key. B. Select Constant Editor then press the "enter" key. C. Press "enter" key again to come to constants screen. D. Change constant to value indicated in steps below. E. Press F 10 key. F. Press "Y" key in response to question, then press "enter". G. Press "Y" key in response to second question, then press "enter". H. Press escape key until you return to main menu, then select Real Time Display of Data and press "enter".	
1.	Shut down boiler using the AWFCO switch. Shutdown panel should indicate alarm condition –8. Verify that waste feed valve closes.	
2a.	Change set point for CO concentration to 1 ppm. Wait until computer gives alarm Condition –6 for the one minute average.	
2b.	Change CO set point back to 65 ppm. Change set point for waste feed rate to 1.0 pounds per minute.	
3a.	Wait until computer gives alarm condition –1 for the one minute average.	
3b.	Change set point for waste feed rate back to ____ pounds per minute (as designated on current burn slip). Change economizer exhaust temperature cut off temperature to 250 degrees.	
4a.	Wait until computer gives alarm condition –9 for the one minute average.	
4b.	Change economizer exhaust temperature cut off set point back to 398 degrees. Change boiler low temperature cut off temperature to 2500 degrees.	
5a.	Wait until computer gives alarm condition –4 for the one minute average.	
5b.	Change boiler low temperature cut off temperature back to 1393 degrees. Change set point on baghouse pressure drop alarm to 20".	
6a.	Wait until the computer gives alarm condition –3 for the one minute average.	
6b.	Change set point on baghouse pressure drop to back to 0.5". Change set point for steam rate to 1.0 (thousand) pounds per hours.	
7a.	Wait until the computer gives alarm condition –2 for the one minute average.	

7b.	Change set point for steam rate back to 20.3 (thousand) pounds per hour. Change set point for boiler pressure high limit -10 inches water column. Do not confuse with boiler pressure low limit setting (-14.5 but this is not a permit criteria)	

	Boiler # 4 – Automatic Waste Feed Cut Off (AWFCO) Test Procedure	**Initial**
8a.	Wait until computer gives alarm condition –10 for the one minute average.	
8b.	Change set point for pressure back to -1 "w.c. Change set point for Bag Particulate Detector to 0 %.	
9a.	Wait until computer gives alarm condition –7 for the one minute average.	
9b.	Change set point for BPD back to 60%. Change set point for Max. Ash Feed Rate to 0.1lbs/hr.	
10a.	Wait until computer gives alarm condition –11 for the one minute average.	
10b.	Change set point for Max Ash Feed Rate back to 21.6 lbs/hr. Change Max Chloride Feed Rate to 0.1 lbs/hr.	
11a.	Wait until computer gives alarm condition –12 for the one minute average.	
11b.	Change set point for Max Chloride Feed Rate back to 15.2 lbs/hr. Change Max Mercury Feed Rate to 0.0 lbs/MMM BTU	
12a.	Wait until computer gives alarm condition –13 for the one minute average.	
12b.	Change set point for Max Mercury Feed Rate back to 0.042 lbs/MMM BTU. Change Max SVM Feed Rate to 0.0 lbs/MM BTU	
13a.	Wait until computer gives alarm condition –14 for the one minute average.	
13a.	Change set point for MaxSVM Feed Rate back to .0024 lbs/MM BTU. Change Max LVM Feed Rate to 0.0 lbs/MM BTU	
14a.	Wait until computer gives alarm condition –15 for the one minute average.	
14b.	Change set point for Max LVM Feed Rate back to .0015 lbs/MM BTU. Alarm conditions should be cleared. Stop if not cleared.	
15.	Go into report generation and look at Shutdown parameters for the current day. Verify that the following shutdown conditions are listed in the report data: -15, -14, -13, -12,-11, –10,–9, –8, -7, –6, –4, –3, –2, and –1. If not repeat the appropriate test and verify the alarm condition registers on the report data.	

	Boiler # 4 – Automatic Waste Feed Cut Off (AWFCO) Test Procedure	**Initial**
16.	Go into constants editor screen and recheck all alarm set points to verify that are at normal conditions as indicated below. ✓ Note: waste fuel rate max is 23.1, but may be lower as lab analyses dictate. ☐ 20.3 ...Steam flow rate, M lb/hr ☐ ...Manual turn on CAL SV ☐ ? ...Waste fuel flow limit (23.1 max) ☐ 60.0 **...**BagParticulate Detect limit % ☐ **0.5** ...Baghouse press diff limit ☐ -14.50 ...Boiler pressure low limit ☐ 0.10 ...Pressure sensor deadband ☐ 0 ...Aborts CAL (w/o settle / 1=abort) ☐ 65 CO excess trip point ☐ 30 ...Register for Debug channel ☐ 398 ...Economizer out temp trip pt, high ☐ 0 ...Minutes after ON to Start CAL ☐ 2700 ...Boiler temp trip point, high ☐ 1 ...CAL options (1=Base, 2=Peak,) ☐ 25 ...Econ exhaust temp. limit db ☐ 1 ...AutoCAL during process OFF ☐ 50 ... Boiler temp. limit deadband ☐ 0 ...EPA CALstart offline qualified ☐ 0.5 ...Waste flow deadband ☐ 0 ...AutoCAL after process ON ☐ 0.50 ...Steam flow deadband ☐ 2500 ...Boiler temp high limit ☐ -1.00 Boiler pressure Hi limit (in w.c.) ☐ 1393 ...Boiler temp low limit ☐ 100 ...Puts value into input point ☐ 21.6...Max Ash Feed rate lb/hr ☐ 15.2 Max Chloride Feed Rate lb/hr ☐ 0.042....Max Mercury Feed rate lb/MMM BTU ☐ .0015.Max LVM Feed rate lb/MM BTU ☐ 0.0024 Max SVM Feed rate lb/MM BTU	
17.	The boiler can now be returned to waste feed when ready.	
18.	☐ **AWFCO was completed on _____/_____/_____** ☐ **AWFCO could not be performed because** ❍ **boiler not burning waste or** ❍ **other, explain _____** ☐ **informed other operators to do AWFCO shortly after start the next burn once collect enough hourly data to do the test**	
19.	Turn in this procedure for filing. It must be kept for at least three years.	

Signature: _____ Date: _____

NITROGEN DEMAND SYSTEMS (NDS) TESTING P	61	66	5	32	Initial
1. Close outlet valves on tank, so can't pump out. Check 61 & 66 on 1st Friday of each quarter, check 5 and 32 on 3rd week monthly.					
2. Close NZ valve into tank top, watch for pressure rise (leakthru).					
3. Open purge valve. Verify line pressure drops. Close valve.					
4. Repeat step 3 twice more to verify demand valves work (flows).					
5. Open NZ valve into tank top. Check tank pressure.	"wc	"wc	"wc	"wc	
6. Report problems immediately & issue notifications for repairs.					
7. On 1st Friday each month, check oxygen in flare vent line. (< 1%) If excess found, contact supervision immediately.		_____%			

FLARE CAR SEAL VERIFICATION	Initial
1. Car seals between the 3 burn tanks, T-100M-5 and the flare must be verified to be open at least monthly. Perform this on the First Friday of the month. If it is not the first Friday, strike through, initial, and date Step 2 below. First Friday? ☐_Yes ☐_No	
2. Verify the following. If car seals are not in place, add a car seal immediately and notify supervision. Car Sealed Open? ☐_Yes ☐_No T-10M-32 3" Vent Valve ☐_Yes ☐_No T-30M-61 3" Vent Valve ☐_Yes ☐_No T-30M-66 3" Vent Valve ☐_Yes ☐_No 3" Vent Valve to T-100M-5 from 32, 61, & 66. ☐_Yes ☐_No 4" Valve upstream of flowmeter FE-E8332-A at Flare	

Verifying car seal checks done Sign: _____ Date: _____

Here is documentation for setting initial limit: Bag Break 1st LIMIT (BASED ON MEMO).

Revision Record

DATE	Revision #	Comments/Changes
03/31/04	N/A	Moved document to Lotus Notes.
03/01/06	N/A	Incorporate new permit limits.
3/7/06	N/A	revised limits step 2b - set back to 250 as CEMS will not allow lower value, step 7b - allow for alternative feed rates but max set at 25.0 step 10 - CAL value default is 0, not 2 also, had 2 step #10's.
2/21/07	N/A	revised for new CEMS upgrade and new limits < Economizer exhaust temp, boiler pressure, particulate detector >
2/27/07	N/A	step 7b - changed from +8 to -10, to create trip, plus re-ordered info
3/6/07	N/A	Set bag break limit to 60% based on initial operating data.
5/7/07	N/A	Step 8c, add to change bag detector limit back to original after testing.
12/4/08	N/A	lowered dP for baghouse setting from 2.2 to 0.5" w.c. REGULATORY says the bag break detector is only required limit for baghouse, but am leaving a limit in just as backup test
9/8/09	N/A	Added new AWFCO parameters for the HWC MACT. These include 12 hour rolling averages for Ash, Chloride, Mercury, Semi-volitile metals, and Low volatile metals.
10-30-09	N/A	Corrected Economizer outlet temperature in step 4b to new limits.
12/16/10	N/A	Changed CO Cutoff from 95 to 65 ppm
7/30/12	N/A	Review.
10/29/2014	N/A	Revised to account for new AWFCO settings set by Hazardous Waste Combustor MACT and SC 61-62.5 Standard 3.0 demonstrated in the May 2014 Comprehensive performance test.
1/9/15	N/A	Added check that that all valves between the waste storage tanks and the flare are CSO to satisfy regulator requirements for monthly verification.
1/28/15	N/A	Clerical change. For simplicity, car seal verification will be done twice a month to match AWFCO testing.
3/26/2017	1.0	Moving Procedure to SharePoint as Revision 1.0. No Changes -NMM
7/28/17	2.0	Changed frequency of AWFCO per EHS direction, from twice monthly to weekly & added to explain if unable to do test (such as not burning waste). Also adjusted formatting on step 16 so could easily read/check off. AMG
8/15/17	3.0	Changed step 18 - do AWFCO after next start burn startup, once run enough to collect enough hourly average data to do testing

#4BLRLOG version = 07/18/2016

HE-3800-1 (No.4 Boiler) Operating Log								Date _____ / _____ / _____			Boiler # 4 Daily Log	
Time	Tank #	Trailers OK?	Tanks OK?	Feed #/min	Steam Out lb/hr	Economizer H2O Out ^{0}F	Baghouse dP "	Stack Temp ^{0}F	N-Door ^{0}F	S- Door ^{0}F	Flare Flow, Pilot	Initials
00:00											Record flare temperature, flowrate & total lbs at 8 am & 4 pm & midnight in cells below Max flowrate is: 50 lb/hr.VOC and 1200 lbs/day Flare min temperature is 900 F	
01:00												
02:00												
03:00												
04:00												
05:00										08:00 ▶	_____ deg F // _____ lb/hr	
06:00										08:00 ▶	lb total	
07:00											Chart recording right? ☐ Yes ☐No	
08:00											*Stop all transfers if pilot fails or flow over 50 or if chart not recording. *Report flare / chart problems in comments section below. **Immediately contact supervision for authorization to continue. *Contacted::	
09:00												
10:00												
11:00												
12:00												
13:00		▲								16:00 ▶	_____ deg F // _____ lb/hr	
14:00										16:00 ▶	lb tot	
15:00											Chart recording right? ☐ Yes ☐No	
16:00											**Note:** When charging caustic to solution drum, must wear chemical resistant suit, nitrile gloves, rubber boots, and bearded face shield.	
17:00												
18:00												
19:00												
20:00										24:00 ▶	_____ deg F // _____ lb/hr	
21:00										24:00 ▶	lb tot	
22:00											Chart recording right? ☐ Yes ☐No	
23:00											Record total hours of flare downtime or bypass at end of shift: _____ hours*	

Attach daily calibrate report ☐done & flow chart ☐N/A ☐done

▲Must inspect trailer area hourly if burn from trailer; else 1 p.m. daily. Ensure domes closed. Also inspect cuno filter and strainer at tank farm daily at 1 p.m. Note deficiencies & corrections in comments.

*Flare bypass is defined as any boiler waste containing tank venting to the atmosphere.

Weekly	**Do daily water level safety test** ☐**done** (red/green panel lights) Do AWFCO tests on 1st & 3rd Fridays ☐N/A ☐done Do weekly safety test on Fridays ☐ N/A ☐done			Friday drain flare vent & ignition lines. ☐not applicable ☐done Friday check — purge ☐ pilot ☐ & flow ☐instruments ☐not applicable ☐done @ ____:____ Visually check the level in D8365 daily to ensure there is no level accumulating: _____ inches		
Waste Feed Meter	Stop			☐ On **Weds**, sample 100M for pH Unit 80 Code 20 name "Boiler Org. T100M5" must be above 5.0 Comments and/or flare problems :::	Operator Signature	
	Start					
	Total			☐ Daily verify portable CO/O2 meter is on and functioning.		
	Gallons					
	Lot #					

LOTUS NOTES\Logbooks\Utilities\Boiler #4 Daily Log << S: \ENVIRON|)-REPORTS…\ >>

Operator Instructions

FLARE Instructions

Operation of Chart Recorder:

The recorder draws its own chart. Do not let the paper get wet. The chart records both flowrate of VOC and pilot temperature. Two scales are drawn, VOC in lb/hr and temperature in °**F**. Temperature is input 2. To change the chart press CHART button, pull the pen lifter, change the chart (be sure to get under the 4 guide tabs), push the pen lifter down, then press the CHART button again. Watch to be sure chart resumes recording correctly. To change the display, press LOWR DISP button. Each time you press, a different display will appear. Press until you see 2 lines, with bottom line reading 2IN. This will display the flowrate on top line and the temperature on bottom line. This is the normal view position. To read the total flow, press LOWR DISP until you see a capital T. This is the total lbs to date. If VOC or Temperature is out of limits, put comments detailing action/cause on the **LOGBOOK**. Do not receive / transfer wastes if equipment not functional, unless MOC authorizing continued operation. So if there is a new problem, call supervision immediately. THIS CHART IS A CRITICAL RECORD OF COMPLIANCE AND MUST BE OPERATIONAL**. When waste is transferred into any of the waste storage tanks, check the chart recorder every 15 minutes and record on the table below. If flow is shown to be greater than 50 lb/hr or temperature less than 250 ºF, stop the transfer immediately.** ~~Do not begin another transfer until midnight of the current day to avoid non-compliance with Title V regulations.~~

Weekly Equipment Testing:

Test purge alarm by reducing the purge rate to about 10%. Verify that horn blows and that the **Hawk** shows "**Low N2 flow**". Resume normal purge rate.

Test the pilot by turning off the power at the Flame Front Generator panel. This will cause the temperature recorder to drop to zero. Verify that horn blows and that **Hawk** shows "**Flare Alarm**". Turn power back on. Note on **logbook** that this was a "Weekly Check" and put your initials.

Check vent flowrate by opening rotameter to 10 scfm using downstream valve and when not receiving. Note nitrogen pressure. Verify that reading is in the range of 9 – 12. If not in this range, contact supervision. Turn off rotameter after take reading.

Indicate on daily operating log that tests were done (check off each test box and check done box)

Drain vent line and flame ignition lines weekly, using an appropriately HMIS labeled container. Empty immediately.

Alarms:

There are three alarms associated with the flare. If the nitrogen purge flow rate at the KO pot is low **(<1 scfm)** or if the temperature of the pilot sensor is low **(< 900 F)** or if flowrate is high **(>50 lb/min)**, the horn in the control room will sound. A minimum purge is necessary to assure that air is not sucked into the flare tip and cause an explosion. The temperature/flow alarm is to alert of a problem at the flare. All transfers should be stopped in the event of any alarm until problem is corrected. **The actual permit limit for the flare temperature is 250 F, but manufacturer says minimum must be least 600 F to indicate pilot working.**

Note any problems and corrections on the daily operating log sheet. **Do not write comments on the flare chart paper, just on the logbook**.

A Portable LEL/O2/CO Meter has been placed on the shelf by the CEMS System because CO and N2 bottles are piped into the room. Do Not remove this meter from the control room. Swap meters with the Foreman if bump testing or calibration is necessary (or barricade/green tag control room during this time). If this alarm goes off, evacuate the control room immediately and notify supervision

Hazardous Waste Instructions

Trailer Unloading:

The trailer unload area must be inspected hourly if burning from a trailer, otherwise once per day. Avoid allowing water to accumulate in the dike sump. If a bucket has to be used for unloading purposes, the bucket must have a HMIS label and emptied promptly after use. The area must be kept clean & free of dirt. Use absorbent materials to minimize spillage stains.

Before unloading a trailer, assure paperwork correct. Verify have storage space. Ground the trailer. Assure trailer vent / manway open to prevent damage to trailer. If possible, it is a good practice to look into the trailer before unloading and after to verify contents and when empty. Follow the unloading procedures on the Waste Receipt Slip.

Tank Farm:

The tank farm area must be inspected at least daily. Buckets must have a HMIS label and emptied promptly after use. The area must be kept clean, so use absorbent materials to minimize spillage stains. Whenever you fill a tank for sampling, inspect the nitrogen demand system and temperature controls for proper operation, assure tank has HMIS label & "HAZARDOUS WASTE" printed on the side, and observe tank and piping for leaks.

HE-3800-1

Keep the boiler/baghouse/control room areas neat, clean and free of spills. Issue notifications for all problems that cannot be repaired by the operator (this is all problems, thereby assuring that supervision is aware of any problem).

Before shutting down the boiler for internal work, switch to gas for 2 hours or more. All ash must be drummed and appropriately labeled. Drums must be taken to the 90 day storage area within 3 days of filling (whether cleanout or from baghouse). The Automatic Waste Feed Cut Off interlocks must be tested every 30 days (we do twice a month).

Appendix F-3
Boiler No. 4 General Inspection Plan

BOILER NO. 4 GENERAL INSPECTION PLAN
CONTROL NUMBER: OB62317
REVISION: 1

SCOPE:

This procedure outlines the general inspections for No. 4 Boiler as required under 40 CFR 264.15.

RESPONSIBILITY:

The administration of this procedure is the responsibility of the Manager - Environmental **Compliance**. Production and the Maintenance Department are responsible for implementation of this procedure.

DOCUMENT CONTROL:

This procedure must be reviewed and accepted by:

1) Environmental Engineer or Lead Environmental Engineer
2) **Sr. Production Manager - **North Plant**
3) **Production Coordinator
4) Emergency Response Specialist
5) Manager, **Maintenance**

The procedure must be approved by the Manager - Environmental **Compliance** who is the Master Copy Holder and is responsible for all revisions.

DEFINITIONS:

CFR:	Code of Federal Regulations
RCRA:	Resource Conversation and Recovery Act
SC DHEC:	South Carolina Department of Health and Environmental Control
TSDF:	Treatment, Storage, and Disposal Facility (i.e. a permitted hazardous waste treatment facility)

REGULATORY BACKGROUND:

Federal regulation 40 CFR 264.15 and SC DHEC Regulation R.61-79. 264.15 require that Treatment, Storage, and Disposal Facilities (TSDFs) inspect the facility to identify potential malfunctions, deterioration, errors, etc. which may lead to releases of hazardous waste. The facility must develop and follow a written inspection schedule.

INSPECTION REQUIREMENTS:

Inspections must:

- note date and time of the inspection,
- the name of the inspector,
- notations of the observations made, and
- date/nature of repairs or other remedial action taken.
-

Repairs must be made on a schedule that ensures problem does not lead to environmental or health hazards. Where a hazards is imminent, repairs must be taken immediately.

INSPECTION SCHEDULE:

Inspection Item	Inspection Criteria	Inspection Frequency	Resp. Area	Inspection Record Location
Emergency Equipment				
Respiratory Protection Equipment	Properly maintained/tested; adequate supplies	Monthly	EHS	Emergency Equipment Listing form maintained in the Emergency Services Specialist's Office
Plant Evacuation Alarm test	Proper functioning of alarm during test; ensure alarms are audible	Weekly	EHS	Evacuation Log Sheet maintained in Guard Office
Eye Wash and Safety Shower	Proper maintenance and water pressure of system	Monthly	EHS	Emergency Equipment Listing form maintained in the Emergency Services Specialist's Office
Spill Control Equipment	Adequate amounts/types are maintained	Monthly	EHS	Emergency Equipment Listing form maintained in the Emergency Services Specialist's Office
Respiratory Protection Equipment	Properly maintained and tested (SCBAs/hoses); alarm system tested	Monthly	EHS	Emergency Equipment Listing form maintained in the Emergency Services Specialist's Office
Community Siren test	Proper functioning of alarm during test; ensure alarms are audible	Monthly	EHS	SAFER computer system at Guard office
Fire Fighting Equipment	Extinguisher and stations are inspected to ensure accessibility, proper charging, and structural sound	Monthly	EHS	Emergency Equipment Listing form maintained in the Emergency Services Specialist's Office
Personal Protective Equipment	Properly maintained; adequate supplies	Inspected monthly, level A suits inspected and pressure checked prior to use, suits on	Each Area	Maintenance/Operations Breathing Air Cart Log forms maintained in the Emergency Services Specialist's Office

		truck are pressure checked annually		
Security Devices				
Site Fencing	Ensure no unauthorized personnel/traffic on site	Daily	Security	Security inspection forms maintained at Guard Office
Site Surveillance Cameras	Ensure no unauthorized personnel/traffic on site	Continuous monitoring	Security	Recordings on DVR and maintained in CCURE surveillance computer system in Guard Office
Boiler No. 4				
Direct Transfers	Evidence for potential spills; integrity of transfer line	During each transfer from trailer directly to Boiler	Production	Waste Burn Slip recordkeeping forms maintained in Env. File Room/RCRA Files
Automatic Waste Feed Cut Off	Testing of cutoff system in several modes; ensure system responds in timely manner during all testing scenarios	Monthly	Production	Automatic Waste Feed Cutoff recordkeeping forms maintained in Env. File Room/ RCRA Files
**Preventative Maintenance on Critical Instruments	temperature gauges, differential pressure, CO/O2 monitors, steam flow	Variable	Maintenance	Refer to Critical Instrument Listing for Boiler No. 4. All PMs are logged in Maintenance Connect. **
Boiler House	Boiler water levels, fuel levels, and effective pump operation; evidence of leaks/corrosion/overfills	Daily	Production	Boiler/Heater Daily Log Sheet and Boiler No. 4 Daily Log Sheet maintained in Production Coordinator's office
Boiler No. 4 Storage Tanks and Dike				
Storage Tanks	Signs of leaks/corrosion/overfills alarms; drain valves and sumps from contained areas are closed; integrity of tank	Daily	Production	Daily Hazardous Waste Inspection form maintained in the Env. File Room/ RCRA Files

Storage Tanks - Fixed roof and closed vent system 264.1033(l)(1); 264.1084(c)(4); 264.1087(g)(3)	Signs visible cracks, holes, or gaps in the roof sections or between the roof and tank wall; broken/cracked or otherwise damaged seals/gaskets; broken/missing hatches/access covers, caps, or other closure devices	Annually	Maint.	Maintenance Connect Software
Pumps/Filters/ Piping	Signs of leaks/corrosion; integrity of equipment	Daily	Production	Daily Hazardous Waste Inspection form maintained in the Env. File Room/ RCRA Files
Containment Dike	Evidence of leaks/cracks/erosion; presence of waste in containment; high level control and alarms are working	Daily	Production	Daily Hazardous Waste Inspection form maintained in the Env. File Room/ RCRA Files
Sumps and Drains	Ensure sumps operating properly (no clogs/backups); covers to sump/drains in place and not damaged	Daily	Production	Daily Hazardous Waste Inspection form maintained in the Env. File Room/ RCRA Files
Bypass Devices for closed vent system	Ensure bypass valves are car sealed in closed position	Monthly	Production	Monthly AWFCO form maintained in the Env. File Room/RCRA Files

INSPECTION RECORD RETENTION

Inspection records must be maintained for at least three years from the date of inspection.

REVISION HISTORY

DATE	CHANGE
12/18/2015	**Creation of new document.**
08/02/2016	**Added inspection requirements for air emission control devices per 264.1088. Updated approval listing. Removed reference to 'Area 2'.**
9/29/2016	**Added instrumentation inspections in Maintenance Connect.**
08/10/17	**Revised to capture correct number sequence in SharePoint. Changed titles throughout**

Appendix F-4
Hazardous Waste Storage Incompatibility Chart

Hazardous Waste Storage Incompatibility Chart

Substances in bold have detailed example lists on the next page.

If the material contains:	It may not be stored with any of the following:
Acid (pH below 2.0)	**Caustics** (pH above 12.5) **Reactive Metals** Alcohol Water Aldehydes Halogenated, Nitrated, or Unsaturated Hydrocarbons **Reactive Organic Compounds and Solvents** Spent Cyanide and Sulfide Solutions **Oxidizers**
Caustic (pH above 12.5)	**Acid** (pH below 2.0) **Reactive Metals** Alcohol Water Aldehydes Halogenated, Nitrated, or Unsaturated Hydrocarbons **Reactive Organic Compounds and Solvents**
Reactive Metals	**Caustics** **Acids** Alcohol Aldehydes Halogenated, Nitrated, or Unsaturated Hydrocarbons **Reactive Organic Compounds and Solvents** **Oxidizers**
Reactive Organic Compounds and Solvents	**Caustics** **Acids** **Reactive Metals**
Spent Cyanide and Sulfide Solutions	**Acids**
Oxidizers	Acetic or Other Organic Acids Concentrated Mineral Acids **Reactive Metals** **Reactive Organic Compounds and Solvents** **Ignitable [Flammable/Combustible] Wastes***

* "Ignitable" in this context refers to substances with a flashpoint below 140× ^{o}F, and includes:
Combustible substances, with a flashpoint below 140× ^{o}F
Flammable substances, with a flashpoint below 100× ^{o}F.

Some Deadly Combinations

Acids + Oil or Grease = Fire
Acids + Caustics = Heat/Spattering
Caustics + Epoxies = Extreme Heats
Chlorine Gas + Acetylene = Explosion
Flammable Liquids + Hydrogen Peroxide = Fire/Explosion
Aluminum Powder + Ammonium Nitrate = Explosion
Sodium Cyanide + Sulfuric Acid = Lethal Hydrogen Cyanide
Ammonia + Bleach = Noxious Fumes

In general: **Reactives** must be segregated from **Ignitables**
Acids must be segregated from **Caustics**
Corrosives should be segregated from **Flammables**
Oxidizers should be segregated from **EVERYTHING**
Many Corrosives are "Water Reactive"
Most **Organic Reactives** must be segregated from **Inorganic Reactives** (metals)

Ignitables (Flammables/Combustibles)	**Corrosives**	
	Acids	**Caustics**
Carburetor Cleaners Engine Cleaners Epoxy, Resins, Adhesives, and Rubber Cements Finishes Fuels Lacquers Paints Paint Thinners Paint Wastes Pesticides that contain Solvents (such as Methyl Alcohol, Ethyl Alcohol, Isopropyl Alcohol, Toluene, Xylene). Petroleum Solvents (Drycleaning Fluid) Solvents: Acetone Benzene Carbon Tetrachloride (Carbon Tet) Ethanol (Ethyl Alcohol) Ethyl Benzene Isopropanol (Isopropyl Alcohol) Kerosene (Fuel Oil #1) Methanol (Wood Alcohol) Methyl Ethyl Ketone (MEK) Petroleum Distillates Tetrahydrofuran (THF) Toluene (Methacide, Methylbenzene, Methylbenzol, Phenylmethane, Toluol, Antisal 1A) White Spirits (White Spirits, Mineral Spirits, Naptha) Xylene (Xylol) Stains Stripping Agents Varsol Waste Fuels Waste Ink Wax Removers Wood Cleaners	Battery Acids Degreasers and Engine Cleaners Etching Fluids Hydrobromic Acid Hydrochloric Acid (Muriatic Acid) Nitric Acid (<40%) (Aquafortis) Phosphoric Acid Rust Removers Sulfuric Acid (Oil of Vitriol) **Reactive Metals** Lithium (Batteries) Aluminum Beryllium Calcium Magnesium Sodium Zinc Powder	Acetylene Sludge Alkaline Battery Acids Alkaline Cleaners Alkaline Degreasers Alkaline Etching Fluids Lime and Water Lime Wastewater Potassium Hydroxide (Caustic Potash) Rust Removers Sodium Hydroxide (Caustic Soda, Soda Lye) **Reactive Organic Compounds and Solutions** Alcohols Aldehydes Chromic Acids (from chrome plating, copper stripping and aluminum anodizing) Cyanides (from electroplating operations) Hypochlorides (from water treatment plants, swimming pools, sanitizing operations) Organic Peroxides (including Hydrogen Peroxide) Perchlorates Permanganates Sulfides
	Oxidizers	
	Chlorine Gas Nitric Acid (>40%), aka Red Fuming Nitric Nitrates (Sodium Nitrate, Ammonium Nitrate) Perchlorates Perchloric Acid Perioxides Calcium Hypochlorite (>60%)	

SI Group®

RCRA Contingency Plan

Updated: October 2020

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QUICK REFERENCE GUIDE (40 CFR 262.262(b))

Types/Names of Hazardous Waste Onsite

Type/Name	Hazard	Typical Container Type	Estimated Max. Amount Present (gals)	Location at Site
CONTAINERS (TOTES/DRUMS)				
Lab Sample Wastes	Ignitable, reactive, and toxic	55 gallon steel drum	110 gallons (2 drums)	AS and PT Labs; < 90 day storage shed (D Street)
Process sample waste, process contaminated rags	Ignitable and toxic	55 gallon steel drum	1,100 gallons (~20 drums)	Throughout facility within each process; < 90 day storage shed (D Street)
Paint waste	Ignitable and toxic	55 gallon steel drum	450 gallons (3 drums)	North Maintenance Complex; Contractor Area; < 90 day storage shed (D Street)
Phenol sample jars	Toxic	55 gallon steel drum	110 gallons (2 drums)	Traffic – South Blending Area (B St. and 6th St) ; < 90 day storage shed (D Street)
Spent filters	Corrosive	55 gallon poly drum	55 gallons (1 drum)	Alkyl Blending- Plant 7; < 90 day storage shed (D Street)
Spent filters	Ignitable	55 gallon steel drum	220 gallons (4 drums)	330 Production Plant 10/14; < 90 day storage shed (D Street)
TANKS				
T-15M-42 IBB Solvent Waste Tank	Ignitable	15,000 gallon tank	15,000 gallons	2,6 DTBP Production A Street
T1034 330 Heel Tank	Ignitable	10,000 gallon tank (T1034)	10,000 gallons	330 Production Plant 10/14
T-100M-5 Hazardous Waste Storage Tank	Ignitable	100,000 gallon tank (T-100M-5)	100,000 gallons	Boiler No. 4 Area 10th St
T-30M-61 Hazardous Waste Storage Tank	Ignitable	30,000 gallon tank (T-30M-66)	30,000 gallons	Boiler No. 4 Area 10th St
T-30M-66 Hazardous Waste Storage Tank	Ignitable	30,000 gallon tank (T-30M-61)	30,000 gallons	Boiler No. 4 Area 10th St
T-10M-32 Hazardous Waste Storage Tank	Ignitable	10,000 gallon tank (T-10M-32)	10,000 gallons	Boiler No. 4 Area 10th St
TRAILERS				
Process waste	Ignitable	4500 gallon trailer	135,000 gallons (3 trailers for month on average basis)	Boiler Trailer Pad 10th St

HW Exposure with Unique Treatment:

Phenol containing waste streams:

- Health Effects: Exposure to phenol to toxic and can cause burns
- Waste Generation: Phenol waste is generated from samples, spill cleanup, and phenol scrubber cleanout. This waste is stored in drums.
- Exposure Routes: The most common route of exposure is through skin contact. Phenol is a solid at room temperature, so inhalation risks are minimal.
- Treatment: Immediate removal of phenol is required using water and then propylene glycol (PEG), which is available on site in emergency kits, and then testing with castor oil to ensure all the phenol has been removed.

On Site Notification Systems:

Hand Held Radios	400 MHz radios issued to majority of personnel at site.
Plant Telephone System	The plant telephone system may be used to report emergencies on Extension 5313.
Site PA system	A public address system is used for normal and emergency messages.
Plant Alarm/Plant Disaster	Numerous alarm stations are distributed throughout the plant. The alarms, which are sounded through the PA system, emit an audible signal followed by a voice that identifies the location of the specific alarm that was activated. When an alarm station is activated, the security guard also receives a signal indicating the specific station
Hydrogen Cyanide Alarm	Located on the third floor level of the DR-3 (Ibuprofen) plant. This siren is to be used only in the event of a major release and is manually activated at A Street DR-3 packaging warehouse in the DR-3 plant yard area. An electronic siren sound generator has been connected to the plant public address system and is interlocked with the HCN siren.
Community Siren	The Orangeburg site has 3 community sirens strategically placed near the plant. Two of the sirens are located within the boundaries of the plant in the north east and south west quadrants while the third siren is located on Rivelon Rd. In the rare case of an emergency in which the nearby community would need to be notified, the community siren is manually activated by the WISER Operator. Annually, the plant provides a calendar that contains a map of the community and emergency information.
Mobile Radios	800 MHz mobile radio can be used to maintain communications with the plant from off-site or on-site locations, Orangeburg EMS, or The Regional Medical Center and other hospitals.

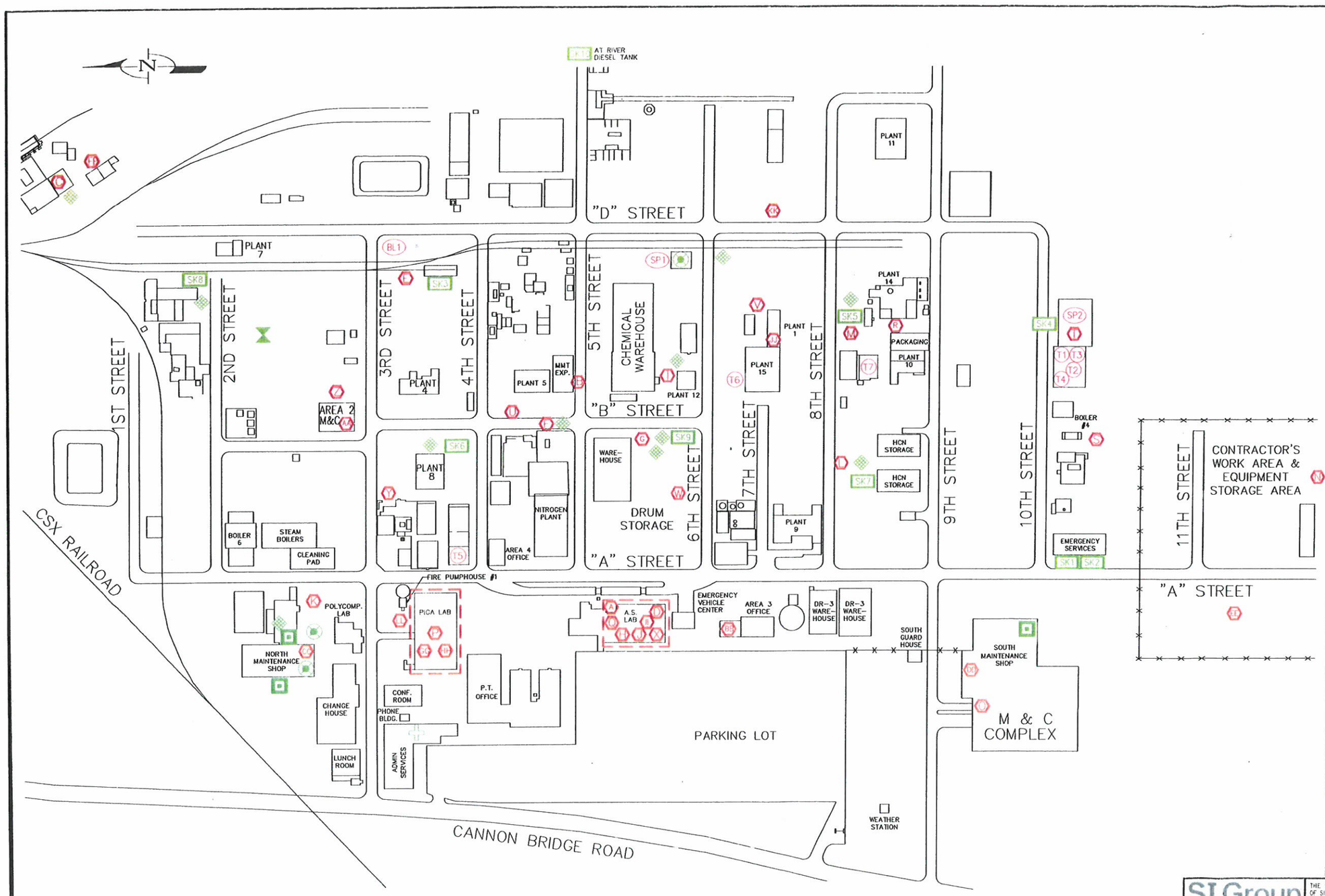
On Site Emergency Coordinators

Name	Address	Telephone Number (home)	Telephone Number (Work)
Facility Coordinator			
Russell Smoak	302 Sabb Road, Cope, SC 29038	531-2117	539-5390
Primary Coordinators			
Terrance Hunter	128 Hobcaw Lane, Orangeburg, SC 29118	937-5006	See note below
Mark Holstein	119 Mount Lebanon Road, Cameron, SC 29030	823-2862	See note below
Ericka Morgan	1023 Wedgewood Road, Orangeburg, SC 29118	937-6872	See note below
Keith Furtick	307 Cleveland Court, Branchville, SC 29432	274-8014	See note below
Jared Robinson	5474 North Road, Orangeburg, SC 29118	707-8125	See note below
Jason Chavis	310 Lake Francis Drive, Columbia, SC 29170	378-6684	See note below
Chris Glover	142 Oakmont Drive, Orangeburg, SC 29118	533-1013	See note below

Note: ECs can alternate per shift. Office phone numbers: 539-5238 and 539-5350. Radio channels: North Side and South Side.

Figure A –

Map of facility showing HW generated, accumulated and treated



CURRENT LEGEND

SAA

A AS LAB	W PLANT 9 ETHANOX 4716
B MMT MCP FILTERS	X AS LAB XRF
C PLANT 7 -- ACID FILTERS	Y PLANT 8 COLUMNS
D AS LAB SAMPLE JARS	Z AREA 2 MAINT SHOP
E MERCURY	AA AREA 2 MAINT SHOP
F PLANT 5 – B ST	BB AREA 3 MAINT SHOP
G PHENOL – D ST	CC NORTH MAINT SHOP
H AS LAB	DD SOUTH MAINT SHOP
I PLANT 12 – AN-702	EE THOMPSON CAPITAL SHOP
J AS LAB	FF PLANT 7
K NORTH MAINT SHOP	GG AT LAB
L PLANT 9 – 8TH ST	HH AT LAB
M PLANT 14–AN330 – 8TH ST	II AS LAB
N CB&I PAINT SHED	JJ PLANT 1 LCAP
O SOUTH MAINT SHOP	KK PLANT 9 ETHANOX 4716
P PICA LAB	LL PT LAB – MEOH WASTE
Q AS LAB	
R PLANT 14 AN-330 HEPTANE FILTERS	
S BOILER ASH	
T BOILER TRAILER PAD	
U PLANT 5	
V PLANT 14 AN-330 FILTERS	

SPILL KITS

SK1	FIRE TRUCK
SK2	FIRE STATION
SK3	90 DAY PAD
SK4	BOILER #4–PAD
SK5	AREA I–330
SK6	AREA II
SK7	AREA III–8TH STREET
SK8	NORTH TRAFFIC AREA
SK9	TRAFFIC DRUMMING SHED
SK10	AREA I–NEAR RIVER DIESEL

BOILER 4 TANKS

T1	T8331	(T–30M–66)
T2	T8332	(T–100M–5)
T3	T8333	(T–30M–61)
T4	T8345	(T–10M–32)

<90 DAYS STORAGE AREAS AND TANKS

SP1		DRUM SHED
SP2		BOILER 4 TRAILER PAD
T5	T8155	(T–15M–42)
T7	T1034	(T–10M–14)
BL–1		LAB SAMPLE DRUM

SYMBOLS

- SITE ACCUMULATION AREA
- (T1) HAZARDOUS WASTE TANKS
- SK1 SPILL KIT LOCATION
- (SP1) <90 DAYS STORAGE
- MEDICAL (NURSE)
- USED OIL
- UNIVERSAL WASTE STORAGE
- ASBESTOS STORAGE
- GMA

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PLANT MAP HAZARDOUS WASTE SATELLITE LOCATIONS

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE FOR APPROVAL	4/12/95 ROS	4/12/95 JBK		4/12/95 HAB		4/12/95 RPS
26	TSR-14096, AS-BUILT PER LISA LUNA	4/13/16 H BASS	LL 4/14/16	LL 4/14/16	4/13/16 H BASS	4/13/16 H BASS	4/14/16 HWM
27	TSR-16151 AS BUILT PLANT MAP	10/26/16 JSJ	11/16/16 LL	11/16/16 LL	11/15/16 HAB	11/15/16 HAB	11/17/16 HWM
28	HAZARDOUS WASTE MAP TSR-17014, AS-BUILT PLANT MAP ADDED LOCATIONS II & JJ	3/13/17 H BASS	3/13/17 LL	3/13/17 LL	3/13/17 H BASS	3/13/17 H BASS	3/22/17 HWM
29	TSR-17069, MOC ETHANOX 4716-2017-8-2 NEW SAAs FOR PLANT 9 ETHANOX 4716 PROCESS	8/31/17 H BASS	8/31/17 LL	8/31/17 LL	8/31/17 H BASS	8/31/17 H BASS	9/8/17 HWM
30	TSR-18003, ADDED LL & T7 REMOVED T6	01/09/18 HAB	1/10/18 LL	1/10/18 LL	1/9/18 HAB	1/9/18 HAB	1/12/18 HWM

PROJECT NUMBER	0BH00A348		30
	DRAWING NUMBER		REV.
SCALE: NONE	OPERATING AREA –	BUILDING NO.	0667

Figure B –

Surrounding Areas Map

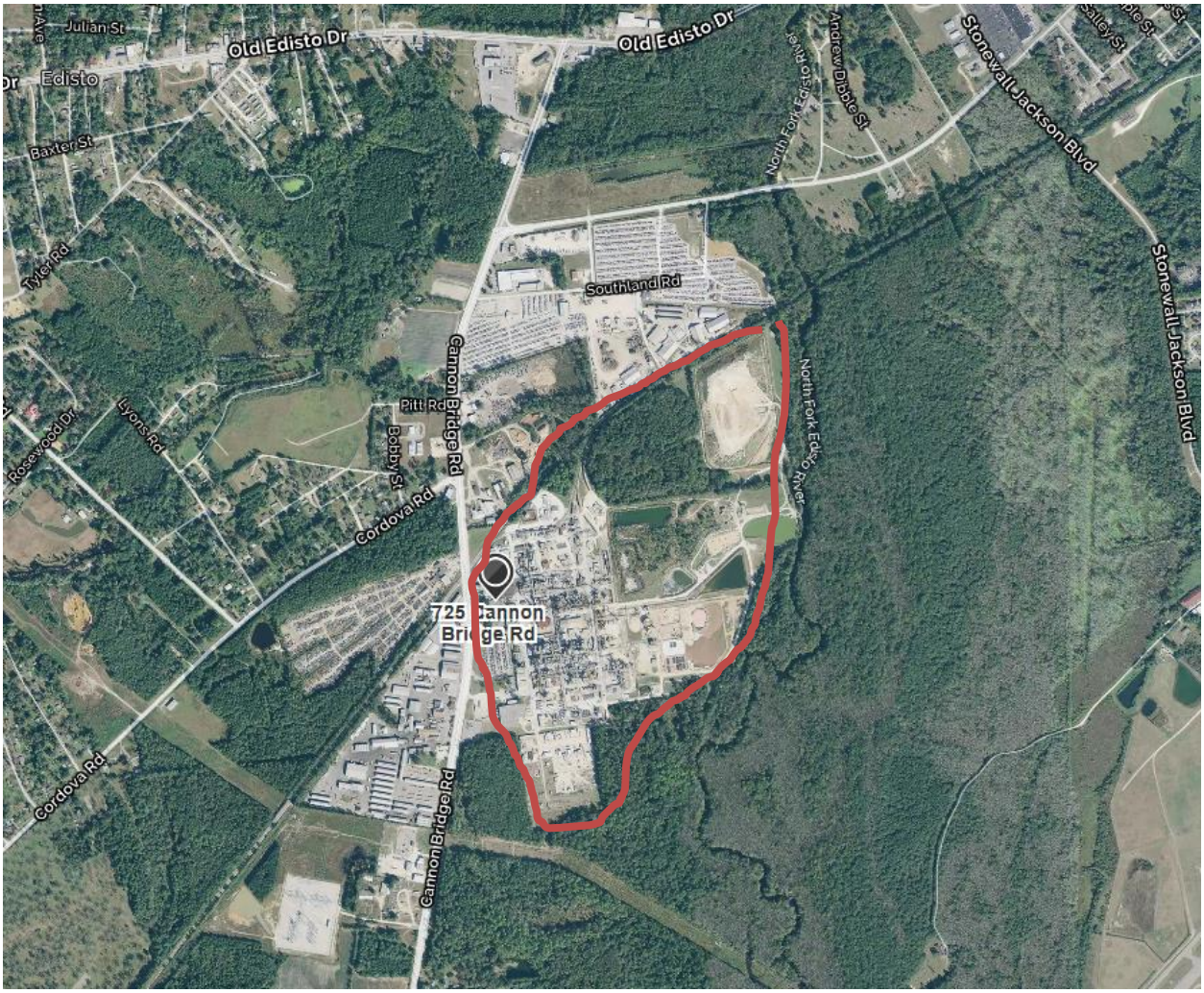
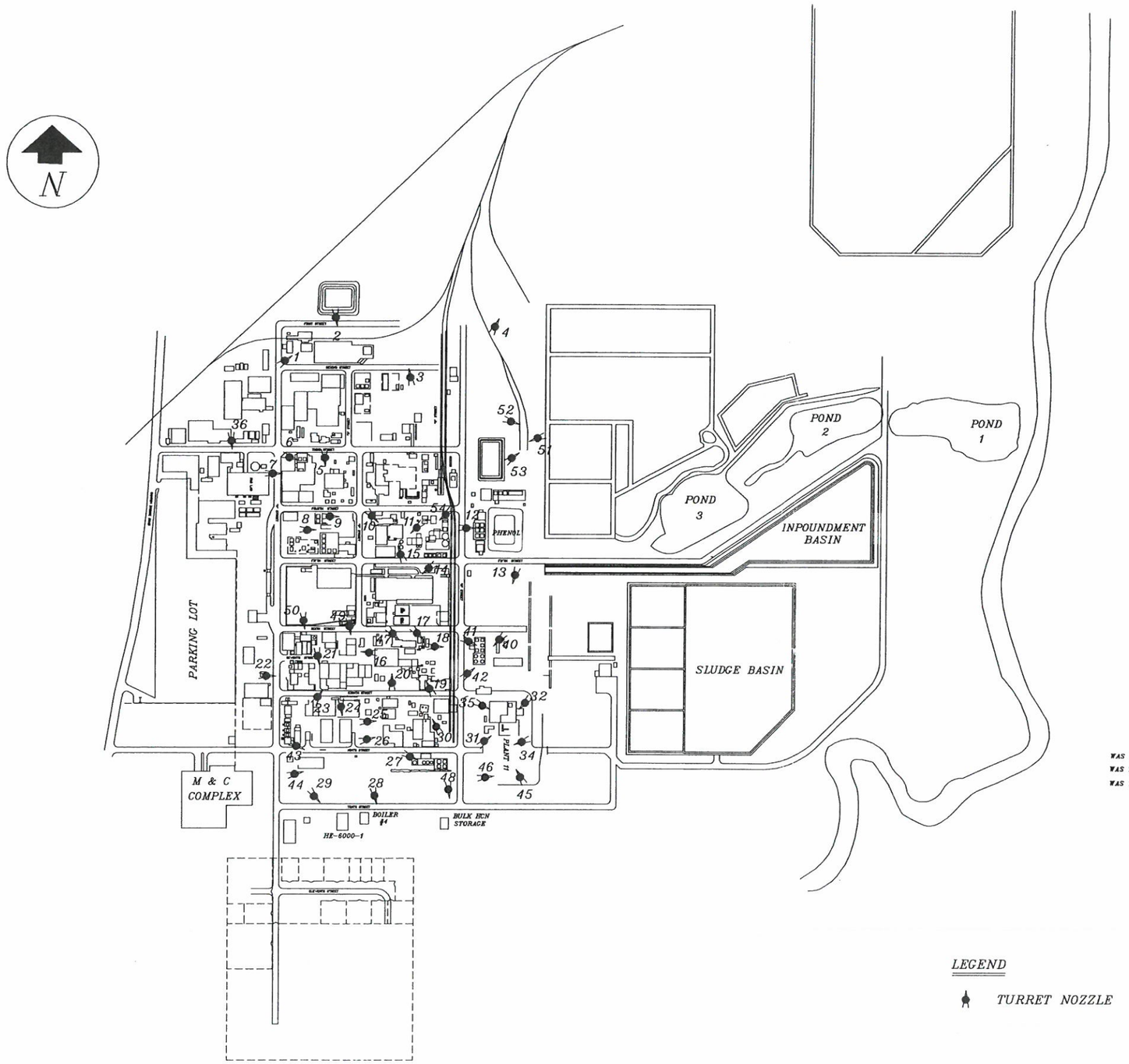


Figure C - Locations of Water Turrets

Water turrets are used at the site for fire suppression. All turrets have a flow rate of 350 gpm. There are 52 turrets strategically distributed throughout the plant, along with 13 fire hydrants. The onsite fire truck can be connected to all turrets, as well as hydrants.



LEGEND

TURRET NOZZLE

TURRET NOZZLES
IMMERSION HEATER ELECTRICAL DATA

TN NO	PIV- #	AREA	LOCATION DESCRIPTION	LOAD CENTER	CB	DWG NO.
1	NONE	17	2nd & A STREET			
2	NONE	16	1st STREET-NORTH SIDE			
3	PIV-	18	QUID PACKAGING AREA - SOUTH SIDE			
4	PIV-	26	CYLINDER RESTORATION AREA			
5	PIV-	9	T-10M-11 - SOUTHEAST SIDE			
6	PIV-	9	T-5M-12 DIKE - NORTH OF DIKE			
7	NONE	2	EAST SIDE OF DIESEL PUMP HOUSE # 1			
8	NONE	10	TANK FARM SOUTH OF AREA SUBOFFICE			
9	NONE	10	TANK FARM EAST OF AREA SUBOFFICE			
10	NONE	20	PLANT 5 MMT TANK FARM 4th STREET SIDE			
11	NONE	20	MMT TANK FARM CONTROL ROOM SOUTHWEST SIDE			
12	NONE	29	MAALOX AREA D STREET @ T-30M-14			
13	PIV-	30	5th STREET NORTH OF PRIMARY CLARIFIER			
14	NONE	21	CHEMICAL WHSE. 5th STREET BY LOADING RAMP			
15	PIV-	20	PLANT 5 5th STREET BY SPRINKLER HOUSE			
16	NONE	22	WEST SIDE OF PLANT 15, END OF 7th STREET			
17	PIV-	22	NORTH SIDE OF PLANT 15, ON 6th STREET			
18	NONE	22	EAST SIDE PLANT 15			
19	NONE	22	AT LIME SILO PLANT 1			
20	NONE	22	PLANT 15 SOUTH SIDE			
21	PIV-	12	PLANT 9 SOUTH OF OS1 COLUMN			
22	PIV-	04	PLANT 9 WEST SIDE OF "A" STREET			
23	PIV-	13	SOUTHEAST CORNER OF PLANT 9			
24	NONE	13	NORTH SIDE OF HCN BUILDINGS			
25	PIV-	23	PLANT 10 SOUTH SIDE - D9446			
26	PIV-	23	SOUTHWEST CORNER OF PLANT 10			
27	PIV-	24	PLANT 14 NORTH OF T1033			
28	PIV-	23	NORTH OF BOILER # 4			
29	PIV-	14	NORTHWEST OF BOILER # 4			
30	PIV-	23	NORTHEAST CORNER OF PLANT 14			
31	PIV-	32	SOUTH SIDE OF PLANT 11			
32	PIV-	32	NORTHEAST CORNER OF PLANT 11			
33	PIV-	32	PORTABLE 4th STREET SHED			
34	PIV-	13	NORTH WEST CORNER OF DIBBLE TANK FARM	LC-13-C	#2	
35	PIV-	14	PLANT 11 NORTHWEST SIDE - COOLING TOWER #15			
36	PIV-	2	WEST SIDE OF PT LAB STORAGE BUILDING			
37						
38						
39						
40	PIV-	32	PLANT 11 NORTH SIDE - COOLING TOWER #12			
41	PIV-	32	NORTHWEST DII TANK FARM CORNER 6th & D STREET			
42	PIV-	32	SOUTHWEST DII TANK FARM CORNER 6th & D STREET			
43	PIV-	02	PLANT 9 NORTH SIDE 9th STREET			
44	PIV-	14	PLANT 9 SOUTHWEST OF DIBBLE TANK FARM			
45	PIV-	32	PLANT 11 SOUTHEAST CORNER - SCRUBBER C1172			
46	PIV-	32	PLANT 11 SOUTHWEST CORNER			
47	PIV-	32	PLANT 15 NORTHWEST CORNER TANK FARM			
48	PIV-	02	NORTH SIDE BULK HEXANE STORAGE			
49	PIV-	11	CORNER OF 6th & B STREET			
50	PIV-	11	NORTH OF 6th STREET NEAR DR-3 DRUMMING			
WAS TN-2-1 51	PIV-	28	EAST OF OLEFINS RAIL UNLOADING			
WAS TN-2-2 52	PIV-	28	NORTHWEST OF OLEFINS RAIL UNLOADING			
WAS TN-2-3 53	PIV-	28	SOUTHWEST OF OLEFINS RAIL UNLOADING			
54	PIV-	20	CORNER OF FOURTH STREET AND RAILROAD TRACKS			

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJ COOR	APP'D
0	INITIAL ISSUE FOR REFERENCE	3/13/95 JWT	3/13/95 JWR	3/13/95 JWT	3/13/95 JWR		3/13/95 RRS
1	REVISED PER PROJECT #0-36201 AR BOOK 0124	2/15/02				2/15/02	2/15/02
	ADD TURRET NOZZLE AT 6th & B ST #49	ROS				BBA	RLT
2	REVISED PER PROJ # 4050 FIRE PROTECTION UPGRADE (ADDED TN #50)	1/5/04 JWR					
3	ADDED TURRET NOZZLE #54 FIRE PROTECTION UPGRADE	2/17/16 H BASS	2/17/16 JR		2/17/16 H BASS	2/17/16 H BASS	2/17/16 HWW

SI Group — Its substance inside

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PLANT-WIDE FIRE PROTECTION
TURRET NOZZLES
LOCATION KEY PLAN

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00P021	3
SCALE: 1"=200'	OPERATING AREA: -	BUILDING NO: -

1.0 General Facility Information

1.1 Contact Information

FACILITY INFORMATION		
Facility Name	SI Group Inc.	
Physical Address	725 Cannon Bridge Road Orangeburg, SC 29115	
Mailing Address	PO Box 1028 Orangeburg, SC 29116	
County	Orangeburg	
Phone	803-539-5378	
Fax	803-539-5178	
EPA ID No.	SCD 043 384 072	
KEY PLANT PERSONNEL		
Sr. Director, SE Operations	Tom Carroll	(W) 803-539-5314 (C) 803-707-2407
Manager – EHS	Lisa Luna	(W) 803-539-5490 (C) 803-480-9109
Sr. Safety Supervisor	Julian Smalls	(W) 803-539-5303 (C) 803 290-9544
Emergency Response Specialist	Russell Smoak	(W) 803-539-5390 (H) 803-531-2117
Contingency Plan Contact	Lisa Luna	(W) 803-539-5490 (C) 803-480-9109
ON SITE RESPONDERS		
Emergency	5313	
Guard House	539-5230	
EMT	539-5311	
OFF SITE RESPONDERS		
Emergency Assistance	911	
Orangeburg County Sheriff	803-531-4647	
South Carolina Highway Patrol	803-531-6849	
The Regional Medical Center	803-395-2200	
AGENCY NOTIFICATION		
National Response Center	800-424-8802 202-267-2675	
EPA, Region 4 (Emergency Response)	404-562-9900	
SC DHEC (Columbia Office)	888-481-0125	
SC DHEC (District Office)	803-533-5490	
Orangeburg County Dept. of Public Safety (Fire and Police)	803-534-2812	
Orangeburg County Emergency Preparedness Office (LEPC)	803-531-3020	
Charleston Public Works	843-863-4019 843-727-6800	

1.2 Purpose and Scope of Plan

(264/265.51)

This Resource Conservation and Recovery Act (RCRA) Contingency Plan (Plan) is for the SI Group, Inc. (SI Group) Orangeburg, South Carolina facility, which generates and treats hazardous waste.

The purpose of the Plan is to describe the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water. The Plan is to be immediately activated whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents which could threaten human health or the environment.

This Plan covers areas where hazardous waste is accumulated, stored, loaded, unloaded, and/or treated. The site is permitted under 40 CFR Part 270 with a RCRA Part B permit for burning of hazardous waste in a Boiler, Industrial Furnace (BIF).

This Plan was prepare to meet State and Federal requirements including those requirements outlined in South Carolina DHEC Regulation 61-79.264 Subpart D, 61-79.264.196, and 61-79.270.14(b)(7) and in *Code of Federal Regulations* 40 CFR Part 264 Subpart D, 40 CFR 264.196 and 40 CFR 270.14(b)(7).

1.3 Overview of Facility Operations, Wastes, and Processes Generating Wastes

SI Group is in central Orangeburg County, South Carolina, approximately 1 mile southwest of the city limits of Orangeburg. The plant property occupies approximately 300 acres and employees approximately 350 persons. Manufacturing operations are 24 hours a day, 7 days a week. Security personnel are also maintained on-site 24 hours a day, 7 days a week.
The Orangeburg site is a chemical production facility which manufactures antioxidants, catalysts, and active pharmaceutical ingredients (API). The facility is broken into two operational areas. Hazardous waste is generated from the production processes as well as from ancillary supporting services, such as the on-site Analytical Services Lab and Maintenance activities. Additionally, SI Group toll manufactures for two separate chemical companies at the site, which also generate hazardous waste under the site's EPA ID number.

Access to the site is controlled by monitored gates. Electronic badges are required for personnel to access the administrative buildings and plant. Contractors and visitors are required to be escorted at all times or obtain security clearance and an access badge.

A general location map is included in Figure 1. The facility layout is shown in Figure 2, which includes the < 90 day storage areas, Satellite Accumulation Areas (SAAs), Boiler No. 4 and associated storage tanks.

Apart from the RCRA Part B permitted Boiler and four associated storage tanks, the site is a Large Quantity Generator (LQG) for hazardous waste. The Contingency Plan was prepared per the requirements of 40 CFR Part 264 (permitted facilities) which are more stringent.

1.4 TSDF Description

Boiler No. 4, four storage tanks (T-100M-5, T-10M-32, T-30M-61, and T-30M-66), and ancillary equipment comprise the RCRA Part B Permit (Permit No. SCD 043 384 072), which was issued on February 27, 2006. A renewal application was submitted on September 29, 2015. A subsequent revised application was submitted in August 2018. Bulk solvent wastes are burned for steam production in Boiler No. 4. Boiler No. 4 operations are staffed 24 hours a day, 7 days a week.

Figure 3 shows the permitted TSDF Boiler and associated storage tanks.

Under the site's RCRA Part B permit, waste codes D001, D018, F003, and F005 are authorized to be burned in Boiler No. 4. Typically spent organic waste solvents are burned in the boiler under these allowable waste codes. The solvents are stored in the four permitted storage tanks noted above and can be transported to the storage tanks via direct pipeline or tankers.

- Average monthly amount of solvents burned in the Boiler: 450,000 lbs/month (57,000 gallons)
- Total waste storage capacity among the four storage tanks: 170,000 gallons

1.5 Plan Availability

Copies of this Plan are retained in the Environmental, Health, Security and Safety (EHSS) Conference Room at the Orangeburg Site and electronically on the site's server. Copies are also submitted to the following agencies per 40 CFR 264.53/265.53:

- South Carolina Emergency Response Commission
- The Regional Medical Center
- Orangeburg County Emergency Preparedness Office
- Orangeburg Fire Department

1.6 Site Emergency Response Plan

This Contingency Plan is **not** meant to be a standalone document, as the site has a highly trained Emergency Response Team (ERT) and a separate detailed Emergency Response Plan.

2.0 Emergency Response Coordinators and On-Site Emergency Response Team

(264.55/270.52 (d))

The Emergency Response Coordinate (EC) (or alternate) has full authority to commit resources needed to respond to emergencies within their ability and to direct other trained employees to assist in the implementation of this contingency plan. The EC is responsible for the coordination of the ERT and off-site emergency responders. **NOTE: The EC is called the Incident Commander at the site.**

At all times, there must be at least EC and 6 ERT members at the facility.

A list of primary ECs and alternate ECs are provided in Table 2-1. This listing includes the names, titles, and home/office/cell phone numbers of each EC. The primary EC or alternate EC will continue executing EC duties until either a higher authority EC arrives on the scene to assume the EC role, or the EC role is transferred to a more qualified outside emergency responder. In all cases, the EC on duty will promptly update any new EC on the status of an incident.

Table 2-1 Emergency Coordinators

Name	Address	Telephone Number (home)	Telephone Number (Work)
Facility Coordinator			
Russell Smoak	302 Sabb Road, Cope, SC 29038	531-2117	539-5390
Primary Coordinators			
Terrance Hunter	128 Hobcaw Lane, Orangeburg, SC 29118	937-5006	See note below
Mark Holstein	119 Mount Lebanon Road, Cameron, SC 29030	823-2862	See note below
Ericka Morgan	1023 Wedgewood Road, Orangeburg, SC 29118	937-6872	See note below
Keith Furtick	307 Cleveland Court, Branchville, SC 29432	274-8014	See note below
Jared Robinson	5474 North Road, Orangeburg, SC 29118	707-8125	See note below
Jason Chavis	310 Lake Francis Drive, Columbia, SC 29170	378-6684	See note below
Chris Glover	142 Oakmont Drive, Orangeburg, SC 29118	533-1013	See note below

Note: ECs can alternate per shift. Office phone numbers: 539-5238 and 539-5350. Radio channels: North Production and South Production.

All personnel acting as an EC receive extensive training, which is detailed in Sections 2.4 and 2.5. Personnel acting as an EC will also be familiar with the following:

- Contingency Plan
- Boiler No. 4 waste operations at the site
- Properties of the hazardous waste accumulated and treated on site
- Locations of pertinent records within the facility
- Layout of the facility

The minimum qualifications for personnel designated as ECs are as follows:

- Must complete the "Incident Command System" class.
- Must have attended basic fire school and Texas A&M Industrial Fire School.
- Must understand the SI Group Emergency Response Plan Procedures
- Must be HAZWOPER 24-hour technician level certified
- Must have general knowledge of confined space rescue and search and rescue procedures
- Must have Medical Department approval

- Must be knowledgeable of the plant fire water system and the location of the underground valves that can be opened and closed to by-pass the river water makeup tank

2.1 Emergency Response Team (ERT) and On-Site Medical Personnel

The on-site ERT provides support to the EC during an emergency response. The ERT consists of individuals ready to serve as required in the following functional areas (as appropriate) and can include the following:

Safety Officer
Fire Fighter
Hazmat Tech
Fire Truck Operator
Ambulance Driver
Operations Chief

The site has four certified Emergency Medical Technicians (EMTs) and 16 Advanced First Aid personnel. At all times there is at least one EMT on site. The site has a dedicated ambulance, which is used to transport patients directly to the Regional Medical Center in Orangeburg, SC, if required.

2.3 Offsite Emergency Responders

Table 2-2 lists the entities external to the site operations that may be called upon to respond to emergencies. A copy of this Plan has been distributed to the organizations listed in Section 1.5. The EC has the discretion to request offsite assistance as needed.

Table 2-2 Off-Site Emergency Responders

Name	Address	Phone
Orangeburg County Emergency Services	1558 Ellis Avenue, Orangeburg, SC 29118	803-533-6265
Orangeburg County Sherriff's Office	1520 Ellis Avenue, Orangeburg SC 29118	803-531-4647
Orangeburg County Fire Department	1520 Ellis Avenue, Orangeburg SC 29118	803-534-2812

2.4 Training

ERT members and ECs receive general emergency response training (40-hour Hazardous Waste Operations and Emergency Response per 29 CFR 1910.120. In addition, they receive site-specific training including fire truck operations, CEVO Ambulance, and Blood-Borne Pathogens. Annual refresher training includes 8-hr Initial Refresher, HazMat Technician Refresher, Blood-Borne Pathogens Refresher.

ERT members attend off site training at the following: Texas A&M Fire School (one week every other year), and FM Global Emergency Response Consultants Rope Rescue Training

2.5 Drills and Exercises

Drills and exercises to improve emergency preparedness are conducted routinely with the ERT. Representatives of outside emergency response organizations may be invited to participate in these exercises.

The purpose of these drills and exercises is to ensure that:

1. evacuation of personnel, when necessary, will be conducted in an orderly manner,
2. emergency response actions are functional, and
3. coordination with outside emergency responders is effective.

All exercises, as well as actual emergencies, are critiqued for response and learning opportunities. A copy of the exercise critique is sent to the EC. Exercises may be "table top", drill, or field exercises. A summary of these exercises follows:

Table Top Exercise:
The table top is an exercise that takes place in a control room or meeting room setting. The table top exercise is designed to generate a discussion of the emergency plans, procedures, policies, and resources, and reviews what actions are taken in certain situations. This exercise may be a set of questions asked to an operator, engineer, or management personnel regarding their duties during gas releases, fires, bomb threats, or other unplanned events.

Drill Exercise:
This exercise usually follows a few weeks or months after a table top exercise. The drill is a supervised activity that tests, develops, or maintains skills in a single emergency response function (i.e., communications, gas release, evacuation, medical emergencies). The drill normally involves actual field response. A drill exercise may be announced or unannounced.

Field Exercise:
This exercise practices all or most of the basic functions of the response system simultaneously. This exercise requires personnel to go through the motions of what they would do if there were an emergency. Field exercises take time to plan and conduct. Field exercises can be announced. If they are announced, the learning phase is done at the critique after the drill.

3.0 Circumstances Prompting Implementation

(264.51, 264.52(a), 264.56(a) and (b))

The objectives of enacting emergency procedures are to protect employees, public health, and the environment. When possible, and without compromising the aforementioned objectives, actions are also taken to protect the integrity of the plant and its equipment.

As a rule, the first priority of response action is to prevent additional personnel injury. Recognizing that incidents that lead to personnel injuries during the early stages of an event are likely to impose additional threats on the scene, staff are trained to recognize hazards and are familiar with incident reporting procedures and personnel evacuation procedures.

When a release of hazardous waste at the site presents a hazard to the public health or the environment, the determination of the need to implement the Contingency Plan will be decided on a case-by-case basis by the EC. The Contingency Plan will be implemented for fires, explosions, spills, and releases that could threaten either human health or the environment. However, the Contingency Plan will not be activated for a small spill that does not threaten human health or the environment. These spills will be cleaned up as part of the normal site operations.

The EC will assess each incident to determine the response necessary to protect personnel, the facility, and the environment. The EC will utilize facility records, such as waste manifests, inspection forms, signage, and other readily available information to identify and assess the nature and associated hazards with any release, fire or explosion of hazardous waste. If required, samples can be taken of the waste and analyzed at the site's Analytical Services lab. Tables 2-1 and 2-2 provide the phone numbers for ECs and several off-site agencies that may be needed to be contacted.

As soon as possible, after stabilizing event conditions, the EC shall determine if notification to the SC DHEC or other regulatory agencies is required to meet reporting requirements. Any releases above the 'reportable quantity' must also be reported to the National Response Center (NRC). Procedure OB62100 - Reporting Chemical Releases (Appendix A), is utilized to determine the proper reporting and notification for spills, including hazardous waste. The EC is responsible for initiating any protective actions based on his or her best judgement of the incident.

All emergency incidents including spills of any amount, are recorded in the site's RIVO Incident Reporting software. RIVO logs all critical parameters associated with an event, including date, time, process area, chemical involved, amount released (as applicable), initial cause, and event termination details.

4.0 Emergency Response Procedures

(264.52(a), 264.56)

These procedures will be implemented to minimize the potential impact on human health and the environment in the event of an emergency incident. The first rule of any emergency response is to ensure the safety of the responding personnel. It is the site's policy that no workers or persons, including emergency responders, are expected to take unreasonable risk by entering hazardous circumstances while responding to an emergency. The hierarchy of importance will be as follows: personnel safety, long-term environmental impact, plant/equipment integrity, short-term environmental impact.

It is within this framework that the emergency response organization is structured and that all response actions are carried out.

4.1 General Emergency Procedures

Actions to be taken to control hazards for specific situations are described in the following sections.

4.1.1 Fire/Explosion

In the event of a fire or explosion, the following steps are performed:

1. The first person on the scene should activate the nearest pull station alarm (which notifies the ERT and the Main Gate Security Team).

2. The EC on shift will establish Incident Command system.
3. The person at the scene uses a portable fire extinguisher to control the fire if ALL the following conditions are met:
    a. The person is trained to use the fire-suppression devices effectively,
    b. The fire is assessed to be controllable with the fire extinguisher device available to the person and is not threatening further danger by explosion or contact with toxic gases,
    c. An escape path exists and is not likely to be blocked by advancing fire, and
    d. The fire-fighting attempt does not expose the person to hazardous materials.
4. In any event, if the fire is not extinguished within a few minutes, the person will abandon the effort and ensure that non-emergency personnel evacuate the area.
5. The EC will assess the situation, including possible hazardous to human health or the environment, and create a strategy for the ERT response as needed. If the fire is large, spreading rapidly, or threatens further danger, facility personnel will be evacuated. The EC will consider both direct and indirect effects of the release, fire, or explosion, such as the following:
    - effects of any toxic, irritating, or asphyxiating gases that may be generated
    - effects of any hazardous surface water runoff from water or chemical agents used to control the fire or explosion
6. The EC may also utilize the Emergency Response Guide (ERG) book to determine proper response as well as evacuation distances, if applicable.
7. Only personnel and outside emergency responders who are wearing appropriate protection equipment shall be allowed in the vicinity of the fire-fighting operations.
8. Affected areas will be monitored for potential release of hazardous materials.
9. If an evacuation is necessary, the Evacuation Plan (Section 6) will be implemented.

4.1.2 Vehicle Fires/Brush Fires

Due to the likely presence of highly flammable gasoline or diesel fumes, workers are not expected to attempt to extinguish vehicle fires. Similarly, workers are not expected to fight brush fires as the ERT will respond to these types of fires. The ERT and/or Site security are responsible for diverting any on-site traffic away from the accident area and securing all access control stations to eliminate additional traffic.

4.1.3 Spills and Releases

In response to a spill and release, setting up down-wind evacuation distances are dependent on the nature and magnitude of the spill. For this Contingency Plan, small and large spills are defined according to the ERG book. A small spill is typically less than 200 liters (approximately 52 gallons) and a large spill is typically greater than 200 liters (approximately 52 gallons).

In general:

1. Standing liquids will be bermed to prevent run-off. If pumpable, liquids will be pumped out in containers and then absorbents will be applied as soon as possible.

2. Absorbents containing hazardous liquids will be placed in containers and contaminated solids (no free liquids) will be placed in separate containers. All collected waste will be assessed for regulatory waste determinations and stored at the appropriate waste accumulation area.
3. Clean and/or decontaminate contaminated surfaces according to Section I of the RCRA Part B Permit Renewal Application, if appropriate.
4. Verification will be made that contaminated surfaces are appropriately cleaned and/or decontaminated.
5. Incompatible wastes generated during an incident will be separated by means of a berm. No waste that might be incompatible with released material will be treated or stored in impacted equipment or containment area until cleanup is completed.
6. Procedures for handling drums and containers of hazardous wastes is contained within the environmental procedure OB62312 and OB 62315.

4.1.4 Shutdown of Operations

4.1.4.1 EC Directed Shutdown

If required, the EC will communicate the need to shut down operations, if evacuation is required and if potential downwind receptors need to be notified. If time allows, one of the following shutdown procedures will also be initiated as appropriate:

1. Proper isolation or containment of the emergency, which does not require shutdown of the operating unit or plant.
2. Normal operating unit or plant shutdown (30 minutes or less).
3. Rapid securing of the operating unit or plant shutdown (15 minutes or less).
4. Immediate securing of the equipment or plant shutdown (less than 5 minutes).

4.1.4.2 Boiler No. 4 Automatic Waste Feed Cut Off (AWFCO)

During emergencies involving Boiler No. 4 and/or associated equipment, the AWFCO will be activated from the control room and the waste feed to the Boiler will be stopped. Operation action is required to reinitiate waste feed to the system. The automatic interlock will shut down the waste feed to the Boiler. During the transition from Waste Oil to natural gas the Waste Oil valve solenoid is de-energized first, closing the valve and preventing further waste feeding. The natural gas valve solenoid is energized, opening the natural gas valve and continuing to fire the boiler using natural gas.

4.1.4.3 Monitoring Under Emergency Shutdown Conditions

If the Boiler No. 4 stops operations in response to an emergency, the EC or designee will monitor valves, piping and other equipment for leaks, pressure buildup, gas generation, or ruptures, as appropriate. Any areas that appear to have the potential for ignition of a fire or explosion will be isolated.

4.1.5 Tank System Releases

Leaking tank systems will be removed from service immediately. A visual inspection of the release will be conducted to determine the cause of the release. Further releases form the tank will be

prevented. Waste will be removed from the secondary containment system within 24 hours to prevent further release of hazardous waste to the environment and to allow inspection and repair of the tank system to be performed. The removed waste will be properly containerized and managed. If the integrity of the tank system is compromised by the release, the tank system will be returned to service only when the major repairs are certified in accordance with 40 CFR 264/265.196(f).

4.2 Area Decontamination and Cleanup Levels

Immediately after a release is under control, cleanup actions will commence. The ERT will ensure that:

1. All cleanup personnel are issued the necessary respiratory and personal protective equipment,
2. The impacted area is monitored for dangerous vapors and radiation levels and the extent of release of hazardous materials is determined,
3. Corrosive spills are neutralized (pH adjustment),
4. Reactive materials are chemically treated,
5. Contents from leaking containers are transferred or the container and contents are over packed,
6. Solid surfaces impacted by released material are decontaminated, (e.g., exterior surfaces of intact containers, equipment, floors, containment systems, etc);
7. Contaminated soil and any contaminated porous materials that cannot be decontaminated are disposed,
8. Recovered materials are sampled and placed in containers for classification and determination of proper disposal technique,
9. Decontaminated surfaces are sampled to determine adequacy of cleanup, and
10. Cleanup is performed to meet background or non-detect levels or levels established based on standard risk assessment procedures and/or criteria (i.e., South Carolina groundwater standards).

Refer to the site's Decontamination Procedures contained in Appendix D.

4.2.1 Disposal of Released Material

Released material and associated contaminated debris will be properly containerized by the ERT. The Env. Department will determine waste classification using process knowledge, analytical data, and/or Safety Data Sheets (SDSs). Upon appropriate classification, the containers will be labeled (hazardous or non–hazardous), date with the initial accumulation date (e.g. date of the spill), and immediately transferred to the appropriate waste accumulation area. Hazardous waste can be stored at either the < 90 day storage shed or the No. 4 Boiler Trailer Pad prior to disposal at a licensed TSDFs. Non-hazardous waste is stored only at the non-hazardous accumulation area.

4.3 Separation of Incompatible Waste

Released material and contaminated debris resulting from the emergency response are managed in a manner similar to that for hazardous waste generated at the site. They are checked for compatibility before they are placed into containers, so that incompatible wastes are not stored

in the same container.

4.4 Incident Command and Notification

(40 CFR 264.56(a))

4.4.1 Responding to an Incident Alarm

Upon the discovery of any imminent or actual emergency, personnel will activate the pull station and notify their supervisor and the EC of the situation. Emergencies can also be initiated by dialing ext. 313, which notifies the Main Security Gate.

4.4.2 Activating the Incident Command System

After being notified an incident has occurred, the EC will establish an Incident Command. The EC will assess the situation and arrive at a course of action based on the answers to the following questions:

- What is the location of the incident?
- What personnel injury, if any, has occurred?
- What is the likelihood that the situation will continue to threaten personnel safety and to cause additional personnel injury?
- What are the consequences, in terms of personnel safety, long-term environmental impact, equipment integrity, and short-term environmental impact, if there is no intervention?
- What does it take to rescue and protect the injured from further harm? Does it pose unreasonable risk to responder's safety?
- What does it take to stabilize the emergency condition, in terms of human resource and equipment? How much time would be required before these human resources and equipment can be deployed?
- What is the end result of a "successful" response, as measured by personnel safety, long-term environmental impact, equipment integrity, and short-term environmental impact, assuming a best-case scenario?

The EC assesses the situation and initiates the alert.

4.4.3 Initial Notifications

- Federal, State, and Local Agencies

For spills and/or leaks to the environment of hazardous materials, the EC or designee will contact the on-call Spill person, who will ensure that the appropriate federal, state, or local regulatory authorities are contacted as required. Notifications shall be at the earliest time consistent with the emergency response effort, but will not be later than 24 hours from the onset of the incident.

The on-call Spill person or designee will immediately report to South Carolina Department of Health and Environmental Control (SC DHEC), but in no case longer than 24 hours, spills and/or leaks to the environment of hazardous materials. A written report will be submitted within 15 days, if required.

The National Response Center will also be notified by the on-call Spill person if the emergency

response involves a release of more than a reportable quantity to the environment greater than the minimum reportable quantities of release listed in 40 CFR 302. This notification will occur within 15 minutes of the release.

- Off-Site Emergency Response Providers

If necessary, the EC, or designee, will contact outside emergency service providers. The EC, or designee, will evaluate the severity and nature of the incident, and the character, source, quantity, and areal extent of the released materials. Contact information for outside emergency response providers to be notified in the event of a fire, release, or explosion with the potential to threaten human health or the environment is provided in Table 2-2.

4.5 Identification of Dangerous Materials

(264.56(b))

For liquid spills and releases, the EC (or designee), with the ERG, will attempt to identify the character, source, quantity, and extent of the released materials through some or all of the following methods and sources of information, as required:

1. Container labeling
2. Eyewitness accounts.
3. Visual inspection of areal extent, fumes, odors, or reactions.
4. Origin of release including equipment involved (e.g., specific tank or container), type of waste stored or treated.
5. In-plant records, including inspection of containers, waste tracking data or other inventory records, manifests, and generator waste profiles.

If the proper identification cannot be made using available information, it can be obtained by sampling. Samples will be taken for chemical analysis to the on-site Analytical Services laboratory or sent to a certified off-site laboratory in the unlikely event that the chemicals of concern and their concentrations cannot be identified from existing records.

4.6 Hazard Assessment and Report

(264.56(c) and (d))

The EC shall assess possible hazards to human health and the environment and select appropriate response actions. This may depend on the consideration of the following factors:

1. The severity and nature of the incident (i.e., fire, explosion, or material release).
2. The potential for severe consequences.
3. The location of the incident.
4. The potential for other areas becoming involved. The potential to place persons off-site in danger.
5. The potential for surrounding property to be damaged or contaminated.
6. The severity of a threat to surface or ground water.
7. The current weather conditions (temperature, wind direction, and velocity) and how these parameters will affect response activities.

Hazard assessment criteria and a hazard category for an incident allow effective communication between persons involved in the incident (person-on-the-scene, ERG members, and outside emergency response agencies). The criteria also provide a basis for an assessment of the hazards to human health and the environment.

If the EC determines that the incident could threaten human health and the environment, he/she will coordinate communications through WISER.

4.7 Prevention of Recurrence or Spread of Fires, Explosions, or Releases

(264.196, 264.171, 264.56(e) and (f))

The EC will take all reasonable measures necessary to ensure that fires, explosions, spills, and releases do not occur, recur, or spread to other dangerous waste at the facility. These measures may include, if applicable, stopping processes or operations, collecting and containing released waste, and removing or isolating containers.

The possibility of release of wastes is minimized through personnel training, record keeping, routine inspections, and incorporating engineering design and operational controls. Secondary containment for tanks and containers decreases the potential for any liquid and solid release from reaching navigable or ground water. Process gas releases are generally contained and treated by the process's air pollution control device (e.g. Flare for Boiler No. 4 storage tanks).

5.0 Final Notification to Authorities

For any incident that requires implementing the Contingency Plan, the time, date, and details will be recorded in the site's RIVO EH&S software system. In addition, depending on the nature of the incident, final follow-up reports with regulatory agencies may be required. Refer to Appendix A for details on content of follow up reports.

For incidents involving releases of hazardous waste from a hazardous waste storage tank (or associated ancillary piping) to the environment an immediate notification to SC DHEC is required within 24 hours in accordance 40 CFR 264.196(d)(3). A follow up report is required within 15 days, containing the following information:

1. Likely route of migration of the release;
2. Characteristics of the surrounding soil (soil composition, geology, hydrogeology, and climate);
3. Results of any monitoring or sampling conducted in connection with the release (if available);
4. Proximity to down-gradient drinking water, surface water, and populated areas; and
5. Description of response actions taken or planned.

6.0 Evacuation Plan

(264.52(f))

The purpose of evacuation is to remove unprotected persons from the affected area so that these persons are not exposed to injurious situations. An evacuation order does not have to be issued before personnel can leave a threatened area. All persons are required to evacuate a threatened area based on his/her judgment of the situation. Where time and the situation allow, a person may attempt to secure the operations within his/her control in order to prevent the development of secondary hazards (e.g. chemical spill due to a running pump, or fire from an open reagent drum).

Should it become necessary for all plant personnel to leave their work areas, the plant alarm system will be sounded and an announcement will be made on the plant public address system. All personnel will immediately secure their work stations and report to Assembly Area 3 north of the cafeteria. Employees should take note of the wind socks to ascertain wind direction and best route for relocation to the assembly area.

There is a secondary evacuation site located on the south side of the Maintenance Complex. This site is only used if the Incident Commander deems evacuation Area 3 is unsafe. This will be announced over the intercom by the guard.

Analytical Services Lab WISER trained employees will be deemed the Accountability Officer. They will break the red safety seal on the black mailbox located left of the door to the Old Guard Shack in the red painted block to retrieve the key. The accountability officer will start the computer by the directions located to the right of the computer and initiate the accountability process, all personnel to include Contractors will utilize the card swipe for accountability. Truck drivers and visitors will be accounted for using the Intertrax System which will require a manual roll call with information provided by the Guards. The ERT will be accounted for using Mobile Express also accessed from the Intertrax System.

Signs are located in the Assembly Area to provide quick instructions.

If any employee cannot be accounted for, the parking lot will be checked for their vehicle. A call may also be placed to their home or cell in an effort to locate them. Full accountability of all personnel is required before the "All Clear" can be given.

Once all individuals have been accounted for, the Accountability Officer will notify the EC. The WISER Operator will notify the EC that all personnel have been accounted for.

In the event, that the situation warrants complete evacuation of the facility, the IC will make the call to include specific instructions on next steps.

Employees are to remain in Assembly Area 3 until the "ALL CLEAR HAS BEEN GIVEN" by the Incident Commander before returning to their assigned work stations.

6.1 Shelter-in-Place

Employees, visitors, clients, customer personnel, etc. located in any of the buildings west of A Street may be instructed in an emergency where hazardous materials may have been released to shelter-in-place. Persons located in the cafeteria, north break room, change house, weld shop or T&V shop shall remain at that location. Anyone located in any of these areas shall contact their host or supervision (radio, telephone, etc.) to inform them of their location. The host or supervision receiving this information shall contact the Emergency Operations Center (EOC) at extension 5160 (WISER Room) with the name and location of these people. This is a precaution aimed to keep personnel safe while remaining indoors. (This is not the same thing as going to a shelter in case of a storm.).

Shelter-in-Place at Work:

- Close all windows, exterior doors, and any other openings to the outside.
- If there is a danger of explosion, close the window shades, blinds, or curtains.
- Have employees familiar with your building's mechanical systems turn off all fans, heating and air conditioning systems.
- If possible, go to an interior room(s) with the fewest windows or vents. The room(s) should have adequate space for everyone to be able to sit in. Avoid overcrowding by selecting several rooms if necessary. Avoid selecting a room with mechanical equipment like ventilation blowers or pipes, because this equipment may not be able to be sealed from the outdoors.
- It is ideal to have a hard-wired telephone in the room(s) you select. Have the phone available if you need to report a life-threatening condition.
- Bring everyone into the room(s). Shut the door(s).
- Take note of the names of everyone in the room. If everyone in your area is accounted for, pass that information to the EOC via phone ext. 5160 (WISER Room). If anyone is missing or extra, report the names (as well as the names of any visitor, client, or customer personnel.) to the EOC via phone ext. 5160 (WISER Room). Leave your contact number with the EOC.
- If contact by phone use is not possible, use the radio on the Safety channel.
- Keep listening to the radio, PA and/or other emergency signals until told all is safe or told to evacuate.
- The Incident Commander may call for a general evacuation or a specific area at the greatest risk.

In the event there is an incident that requires the Incident Commander to call for a "Shelter-In-Place", it is the responsibility of the Supervision responsible for that building or section of a building to have someone assigned to insure that the HVAC unit is turned off and all employees, visitors, customers, clients, etc, are accounted for and their names are documented on the attached form below in the correct spaces. This information is to then be forwarded to the EOC (WISER Room Ext. 5160) by that person.

6.2 Access and Evacuation Routes

Evacuation routes are shown on Figure 4. Staff should evacuate at right angles to the wind direction following the preplanned route and destination. Figure 5 also shows a wind rose for the region. The EC will be notified when the group reaches the preplanned destination.

6.3 Emergency Lighting

Within a building, emergency lighting illuminates exits if the power fails. Hallways and office areas are lit well enough to permit one to navigate to the nearest exit. Outside emergency lighting allows for safe movement within the plant.

7.0 Post-Emergency Actions

(264.56(g) and (h))

7.1 Area Decontamination and Cleanup Levels

Immediately after an emergency is under control, cleanup actions will commence.
The ERG will ensure that:

1. all cleanup personnel are issued necessary respiratory and personal protective equipment,
2. the impacted area is monitored for dangerous vapors and the extent of release of hazardous materials is determined.
3. corrosive spills are neutralized (pH adjustment);
4. contents from leaking containers are transferred or the container and contents are over packed;
5. solid surfaces impacted by released material are decontaminated (e.g., exterior surfaces of intact containers, equipment, floors, containment systems, etc.);
6. contaminated soil and any contaminated porous materials that cannot be decontaminated are disposed;
7. recovered materials are placed in containers for classification and determination of proper disposal technique and are sampled if appropriate;
8. decontaminated surfaces are sampled to determine adequacy of cleanup.
9. cleanup is to background or non-detect levels or levels established based on standard procedures and/or criteria. (Refer to Section I of the RCRA Part B Permit Application Renewal).

7.2 Personnel Decontamination

Emergency showers/eye bath equipment are placed in various locations throughout the facility.

The steps taken to decontaminate personnel impacted by a chemical release are as follows:

1. Any personnel exposed to chemicals shall have the area affected subjected to an immediate water flush for 15 minutes in a safety shower or sink or eye wash, as appropriate. Personnel will remove contaminated clothing and will be required to take a 2-hour shower (which is monitored by an EMT).
2. Clothing considered contaminated by chemicals must be treated or disposed of in accordance with applicable regulations. If immediate transportation to an outside medical facility is necessary, the medical staff will remove contaminated clothing from the individual(s).

7.3 Emergency Equipment Decontamination and Replacement

Emergency equipment decontamination and replacement facilitates the return to normal operations and enables the ERT to be ready to respond in the event of another incident. To establish readiness, the EC ensures the following actions are taken:

1. All equipment used during an emergency response is decontaminated, or if not practical to do so, disposed of and replaced. Methods of decontamination include, but are not limited to, steam cleaning, air purge, and chemical neutralization.
2. Decontaminated equipment is checked for proper operation before storage.
3. Depleted consumable materials such as neutralizing and absorbent materials will be restocked.
4. Fire extinguishers will be recharged or replaced.
5. Self-contained breathing apparatuses will be cleaned and breathing air cylinders will be refilled.
6. Protective clothing will be cleaned or disposed of and restocked.

7.4 Incident Termination

The objective of response actions is to terminate an incident quickly with minimal adverse effects to human health, environment, and plant equipment. Response operations are also intended to prevent a secondary incident. When an incident has been brought under control and its threat to human health or the environment has been removed, the EC initiates the procedures described in this section to return the site to normal operation.

These procedures include inspecting for:

1. the absence of leaks, cracks, or other damage to the containment system,
2. absence of toxic vapor generation,
3. proper isolation and containment of residual waste materials and debris,
4. adequate cleanup of residual waste materials, and
5. affected areas and process equipment function

For emergencies that do not activate the Contingency Plan, the EC is responsible for ensuring that adequate conditions are restored before operations are resumed. If emergency response procedures were undertaken, and the emergency phase is complete, a special recovery organization may be appointed, at the discretion of the EC, to restore conditions to normal. The makeup of this organization depends upon the experience of the individuals involved as well as extent of the damage and its effects.

8.0 Emergency Equipment

(264.52(e))

Repositories of emergency response equipment are located throughout the site. General locations of safety and emergency equipment are shown on Figure 2. Additional equipment details are as follows. Appendix B contains a listing of all emergency equipment at the site. The Emergency Response Coordinator is responsible for evaluating new technologies and equipment developed

for the improved protection of employees working with hazardous waste clean-up operations.

8.1 Plant Alarms

8.1.1 Plant Alarm

Numerous alarm stations are distributed throughout the plant. The alarms, which are sounded through the PA system, emit an audible signal followed by a voice that identifies the location of the specific alarm that was activated. When an alarm station is activated, the security guard also receives a signal indicating the specific station.

Plant Emergency Alarm Test: The plant alarm system is tested each Wednesday at 11:30 AM. The Guard will activate an announcement on the PA system prior to sounding the alarm: "THIS IS A TEST OF THE EMERGENCY ALARM SYSTEM." The Guard will then activate the alarm allowing it to sound for three (3) cycles of the code before silencing.

Complete Plant Evacuation Alarm Test: The plant evacuation alarm is tested each Monday at 11:30 AM. The Guard will activate an announcement on the PA system prior to sounding the alarm: "THIS IS A TEST OF THE PLANT EVACUATION ALARM."

8.1.2 HCN Siren

Located on the third floor level of the DR-3 plant. This siren is to be used only in the event of a major release and is manually activated at A Street DR-3 packaging warehouse in the DR-3 plant yard area. An electronic siren sound generator has been connected to the plant public address system and is interlocked with the HCN siren.

The HCN siren is tested each Friday at 11:30 AM.

8.1.3 HCN Annunciator Alarm

Located in the OSI control room. HCN detectors located in D-1125, R-1122 & 9962 reactor cells automatically activate the annunciator. The Operator Interface computer for the HCN synthesis cell displays alarms triggered by the HCN detectors in the HCN synthesis cell.

HCN Detector Tests: Detectors will be inspected and tested in accordance with our preventative maintenance program to assure the detectors are operating properly.

8.1.4 Community Siren

The Orangeburg site has 3 community sirens strategically placed near the plant. Two of the sirens are located within the boundaries of the plant in the north east and south west quadrants while the third siren is located on Rivelon Rd. The siren is tested monthly on the second Friday of each month at noon. In the rare case of an emergency in which the nearby community would need to be notified, the community siren is manually activated by the WISER Operator. Annually, the plant provides a calendar that contains a map of the community and emergency information.

8.1.5 Hand-Held Radios

The 800 MHZ radio is a State-wide radio used for Emergency Management. This radio remains in the WISER room and the EC will use as required (e.g. landing zone for helicopters; outside communication through Unified Command, etc.). The 800 MHZ radio is tested immediately following the community siren test to ensure its operability.

This is the radio communication that will take place: "Orangeburg Central, this is SI Group WISER on disaster". (Wait for response). Orangeburg Central will answer, "Central, go ahead". "Central radio check." (Wait for response). "Radio check good".

Hand-held radios can be used to maintain communications with the plant from off-site or on-site locations. Hand-held radios will be carried by the EC and Safety Officer.

8.1.6 Plant PA System

A public address system is used for normal and emergency messages.

8.1.7 Plant Telephone System

The plant telephone system may be used to report emergencies on Extension 313.

8.1.8 Ambulance Communication Channels

The EMTs communicate with plant personnel using the plant mHz frequencies during an emergency until the time the patient is loaded into the ambulance for transport or until they determine that additional emergency medical assistance is needed.

At that time, their radios are programmed with the capability to change over to the public service frequencies, as needed. They can use these frequencies to contact the Orangeburg County Mutual Aid (channel 1); EMS Dispatch (channel 2); EMS Operations (Channel 3); TRMC (Channel 4); or Orangeburg County Disaster Preparedness (Channel 5), as needed, for additional support. Channel 4 is used to contact the trauma center (TRMC) while in transit with a patient.

The ambulance crew can maintain communication with both the plant and the public service system while in transit.

The ambulance can also be communicated with via cellular phone. The EMT may be reached by dialing 682-1656.

8.2 Personnel Protective Equipment (PPE)

Available PPE, in addition to the PPE issued to employees as part of their routine job, includes:

- Tyvek™ outer garments, located in the storeroom
- Chemical resistant suites located in the stockroom
- Chemical resistant nitrile gloves located in the stockroom
- Face shields located in the stockroom
- Chemical resistant over boots for safety shoes, located in the stockroom

8.3 Fire Extinguishers

Typically, a fire extinguisher is accessible within 50 feet from all points in the waste storage and processing areas of the plant. Portable fire extinguishers are also available at multiple locations throughout the plant.

8.4 Respiratory Protection

Air purifying half or full-face respirators with appropriate cartridges are available to all personnel. A specific list of available equipment and locations include:

- Air purifying respirators issued from the stockroom.
- Self-contained breathing apparatus (SCBAs), located in the Fire Truck/ERT Van.
- Spare bottles for SCBAs located in Fire Truck and EMT Shop
- Cartridges for air purifying respirators located in the stock room.

8.5 Decontamination Equipment

Refer to Appendix D for the site's Decontamination Procedures. Decontamination equipment includes buckets, brushes, hoses, and detergents.

8.6 Air Survey Instrumentation

Typical air survey equipment available at the site may include:

1. Carbon monoxide (CO) monitors,
2. Oxygen (0_2) monitors,
3. Hydrogen (H_2) monitors,
4. Radiation survey equipment, and
5. Photo-ionization detectors/flame ionization detectors.

8.7 First Aid Supplies/Ambulance

Typically, available first aid supplies include:

- Complete trauma kit located in the ambulance
- Advanced and Basic first aid kits located in the EMT jump bags
- Stretcher located in the ambulance
- Burn pack located in the ambulance

8.8 Communications Equipment

Telephones are installed in all buildings housing process operations. Hand-held, two-way radios are carried by the EC, the EC alternates, and unit supervisors. Hand-held, two-way radios will be available at the Incident Command Post.

8.9 Spill Control and Response Equipment

Typical spill control equipment includes:

- Recovery drums – located at Shipping Pad and Warehouse
- Absorbent material for containment/solidification – located in stockroom, ERT Van, and within spill kits throughout the plant
- Spill control berms/pads - located in stockroom, ERT Van, and within spill kits throughout the plant
- Shovels – located in the stockroom and ERT van

8.10 Miscellaneous Equipment

Heavy equipment, such as rack-hoes, bulldozers, bobcats, forklifts, etc. are available on-site for use during emergency response incidents. In addition, empty containers of various sizes as appropriate for the types of wastes scheduled for storage and treatment at the site will be on site and available to contain spilled or leaking materials.

9.0 Coordination Agreements

(264/265.52(c), 264.37)

Appendix C contains the coordination agreements with offsite emergency responders.

10.0 Plan Maintenance

(264/265.53 and 54)

Copies of this contingency plan and all revisions have been submitted to the response agencies noted below:

Mr. Kim Stenson
Director, SC Emergency Management Division
Chair, SC State Emergency Response Commission
2779 Fish Hatchery Road
West Columbia, SC 29172

Ms. Thelma Williams
The Regional Medical Center
3000 St. Matthews Road
Orangeburg, SC 29118

Mr. Mike Adams
Dept. of Public Safety
City of Orangeburg
1320 Middleton Street
Orangeburg, SC 29115

Mr. Billy Staley, Emergency Services Director
Orangeburg County Emergency Preparedness Office
PO Box 1000
Orangeburg, South Carolina 29116-9000

The Contingency Plan is reviewed annually. The plan will also be updated immediately whenever applicable regulations are revised, the plan fails during an emergency, the facility changes in such a manner that increases potential for fires, explosions, or releases of hazardous waste or changes the necessary response, the list of emergency coordinators change or the list of equipment changes. Table 10-1 documents the revisions made to the plan.

Table 10-1 Revision Log

Date	Description
January 7, 2015	Revised plan; new format.
August 1, 2016	Revised to incorporate Part B Permit checklist items.
February 2017	Incorporate changes per Part B permit application review by DHEC.
February 2018	Revised to incorporate New Generator Rule Improvement requirements for Executive Summary; updated phone numbers/listing of ECs.
January 2019	Updated EC listing, SAA map, emergency equipment listing
July 2019	Updated EC contacts, plant phone numbers, SAA map

Figure 1 – General Map

World_Imagery – Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

– SUBJECT PROPERTY

– 1,000 FOOT RADIUS

1000 0 1000

SCALE FEET

AERIAL MAP
SI GROUP
ORANGEBURG, SC 29116–1028

REQUESTED BY:	K.SASS
DRAWN BY:	BRONSON
DWG DATE:	09/14/15
DWG NO:	17298_B001

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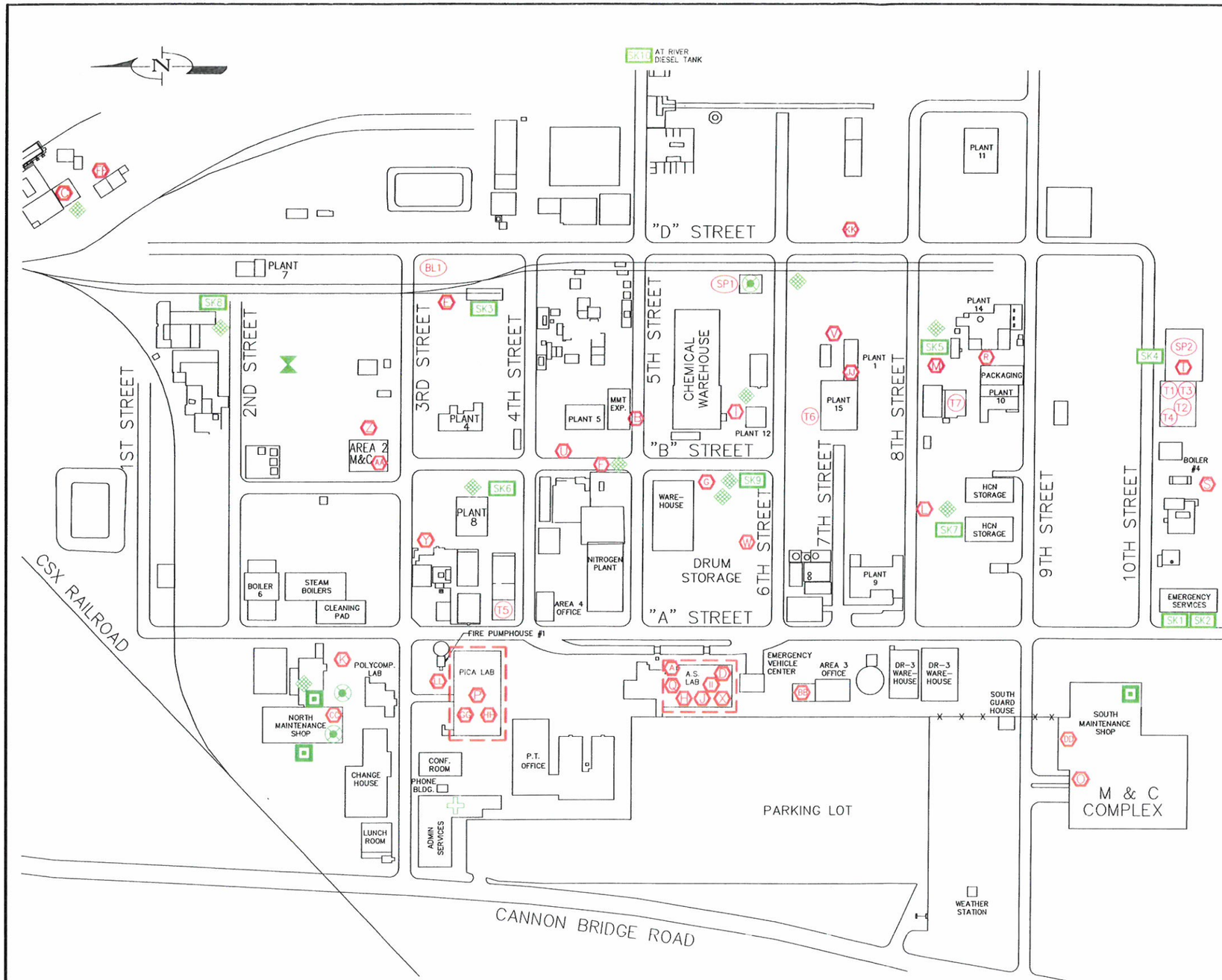
Figure 2 – Facility Layout



CURRENT LEGEND

SAA

A AS LAB	W PLANT 9 ETHANOX 4716
B MMT MCP FILTERS	X AS LAB XRF
C PLANT 7 – ACID FILTERS	Y PLANT 8 COLUMNS
D AS LAB SAMPLE JARS	Z AREA 2 MAINT SHOP
E MERCURY	AA AREA 2 MAINT SHOP
F PLANT 5 – B ST	BB AREA 3 MAINT SHOP
G PHENOL – D ST	CC NORTH MAINT SHOP
H AS LAB	DD SOUTH MAINT SHOP
I PLANT 12 – AN-702	EE THOMPSON CAPITAL SHOP
J AS LAB	FF PLANT 7
K NORTH MAINT SHOP	GG AT LAB
L PLANT 9 – 8TH ST	HH AT LAB
M PLANT 14-AN330 – 8TH ST	II AS LAB
N CB&I PAINT SHED	JJ PLANT 1 LCAP
O SOUTH MAINT SHOP	KK PLANT 9 ETHANOX 4716
P PICA LAB	LL PT LAB – MEOH WASTE
Q AS LAB	
R PLANT 14 AN-330 HEPTANE FILTERS	
S BOILER ASH	
T BOILER TRAILER PAD	
U PLANT 5	
V PLANT 14 AN-330 FILTERS	

SPILL KITS

SK1	FIRE TRUCK
SK2	FIRE STATION
SK3	90 DAY PAD
SK4	BOILER #4–PAD
SK5	AREA I–330
SK6	AREA II
SK7	AREA III–8TH STREET
SK8	NORTH TRAFFIC AREA
SK9	TRAFFIC DRUMMING SHED
SK10	AREA I–NEAR RIVER DIESEL

BOILER 4 TANKS

T1	T8331	(T–30M–66)
T2	T8332	(T–100M–5)
T3	T8333	(T–30M–61)
T4	T8345	(T–10M–32)

<90 DAYS STORAGE AREAS AND TANKS

SP1		DRUM SHED
SP2		BOILER 4 TRAILER PAD
T5	T8155	(T–15M–42)
T7	T1034	(T–10M–14)
BL–1		LAB SAMPLE DRUM

SYMBOLS

- SITE ACCUMULATION AREA
- HAZARDOUS WASTE TANKS
- SPILL KIT LOCATION
- <90 DAYS STORAGE
- MEDICAL (NURSE)
- USED OIL
- UNIVERSAL WASTE STORAGE
- ASBESTOS STORAGE
- GMA

SI Group The Substance Inside

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PLANT MAP HAZARDOUS WASTE SATELLITE LOCATIONS

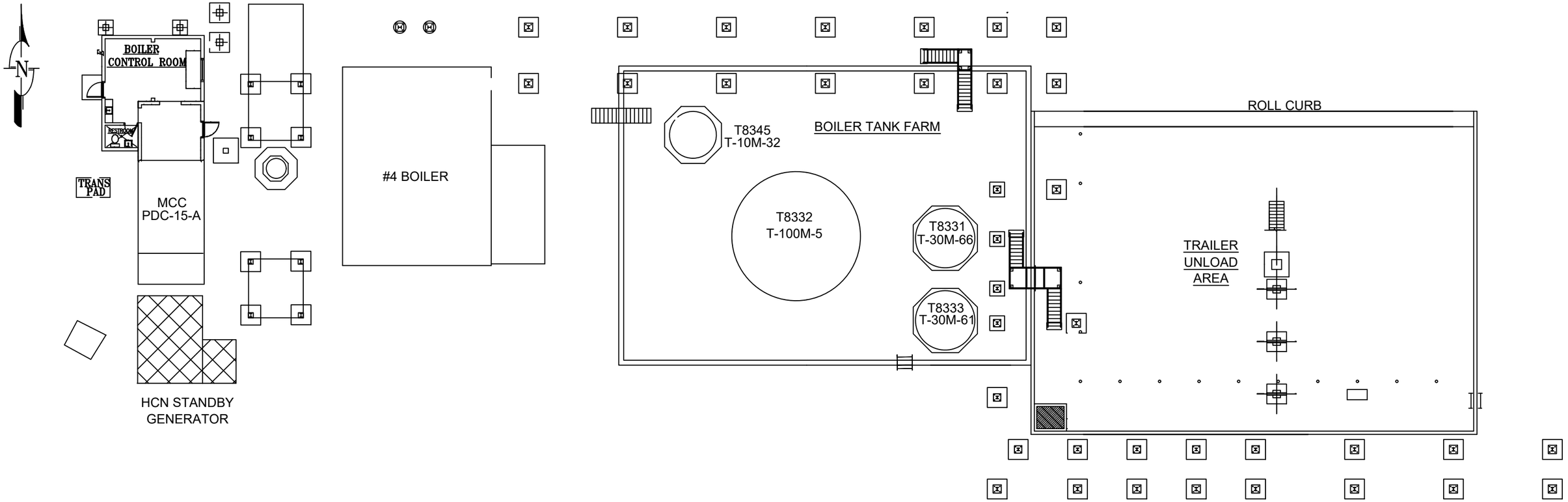
NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE FOR APPROVAL	4/12/95 RDS	4/12/95 JBK		4/12/95 HAB		4/12/95 RRS
26	TSR-14096, AS-BUILT PER LISA LUNA	4/13/16 H BASS	LL 4/14/16	LL 4/14/16	4/13/16 H BASS	4/13/16 H BASS	4/14/16 HWM
27	TSR-16151 AS BUILT PLANT MAP HAZARDOUS WASTE MAP	10/26/16 JSJ	11/16/16 LL	11/16/16 LL	11/15/16 HAB	11/15/16 HAB	11/17/16 HWM
28	TSR-17014, AS-BUILT PLANT MAP ADDED LOCATIONS II & JJ	3/13/17 H BASS	3/13/17 LL	3/13/17 LL	3/13/17 H BASS	3/13/17 H BASS	3/22/17 HWM
29	TSR-17069, MOC ETHANOX 4716-2017-8-2 NEW SAAs FOR PLANT 9 ETHANOX 4716 PROCESS	8/31/17 H BASS	8/31/17 LL	8/31/17 LL	8/31/17 H BASS	8/31/17 H BASS	9/8/17 HWM
30	TSR-18003, ADDED LL & T7 REMOVED T6	01/09/18 HAB	1/10/18 LL	1/10/18 LL	1/9/18 HAB	1/9/18 HAB	1/12/18 HWM

PROJECT NUMBER	0BH00A348 DRAWING NUMBER	30 REV.
SCALE: NONE	OPERATING AREA: –	BUILDING NO: –

0696

Figure 3 – Boiler No. 4 and Associated Storage Tanks

TENTH STREET



I:\CAD PROJECTS\SI GROUP\25569 SI GROUP\PLANS\25569_B008_HAZ WASTE_SI GROUP_SC.DWG

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	INITIAL ISSUE RCRA FACILITY LOCATION	8/6/04 RDS	8/9/04 RDS	8/9/04 MGC	8/9/04 JWR		8/10/04 RAT

S:\LIBRARY\SIG logo.png

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ALBEMARLE ORANGEBURG
HAZARDOUS WASTE MANAGEMENT UNITS

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A410	0
SCALE: NONE	OPERATING AREA:	BUILDING NO: –

Figure 4 – Evacuation Routes

N

WOODS / SWAMP AREA

LAND FILL

TRAILER STORAGE

ALKYL CLEANING FACILITY

FIRST STREET

TRAFFIC BLENDDING

PLANT 7

SECOND STREET

SECONDARY CLARIFIER

FIRE TRAINING

EFFLUENT MONITORING

RIVER PUMP HOUSE

BOILERS

SHOP

LUNCH ROOM

CHANGE HOUSE

THIRD STREET

ADMIN. SERVICES

CONF.

PT LAB

PLANT 8

PLANT 4

OLEFINS

MAALOX

POND 2

POND 3

PT OFFICES

ADMIN

FOURTH STREET

N2 PLANT

PLT. 5

MMT

POND 1

IMPOUNDMENT BASIN

EDISTO RIVER

CANNON BRIDGE ROAD

ENTER

Q.C. LAB

FIFTH STREET

RAW MATERIAL WAREHOUSE

CHEMICAL WAREHOUSE

TSA AREA

FLARE

PRIMARY CLARIFIER

SANDBED 4

SANDBED 3

SANDBED 2

SANDBED 1

SLUDGE BASIN

SIXTH STREET

PLT 12

CO AREA

DE-WATERING PLANT

EMPLOYEE PARKING LOT

SEVENTH STREET

PLT 9

PLT 15

PLT 1

TRAINING BLDG.

EXIT

DR-3 STOR.

DR-3 STOR.

DR-3 STOR.

EIGHTH STREET

GUARD HOUSE

HCN

HCN

PLT 10

PLT 14

PLT 11

NINTH STREET

NEW MAINTENANCE COMPLEX

HYDROGEN PLANT

TENTH STREET

TENTH STREET EXT.

DPU SUB STATION

EMERG. FACILITIES

JNCEN.

BOILER 4

BULK HCN

CONTRACTOR PARKING LOT

ELEVENTH STREET

LUNCH ROOM

CONTRACTOR'S AREA

STORES AREA

SANDBLAST AREA

XRAY AREA

BONEYARD

N 000

E 000

LEGEND:

ZONE BOUNDRY LINE

10 – ASSEMBLY AREA

NOTES:

1. THIS DRAWING IS NOT TO BE REVISED WITHOUT PERMISSION OF THE SAFETY DEPARTMENT.

FIGURE G-6

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
5	UPDATED LOGO, STATEMENT OF OWNERSHIP, USAGE AND CONFIDENTIALITY	02/02/15 CKW	02/02/15 JOL				02/02/15 JBP
4	DELETED ASSEMBLY AREA 12 & PLANT 11 TSR-11189	9/14/11 H BASS	9/23/11 KK		9/14/11 H BASS		9/23/11 RLT
3	MOVE ASSEMBLY AREA 1 TSR-3272	9/8/03 GFW	9/8/03 WSW	9/8/03 WSW	9/8/03 JWR	9/8/03 GFW	9/9/03 RAT
2	REVISED PLANT MAP ON THE EMERGENCY ASSEMBLY AREA MAP PER TSR-7359	01/07/98 RR	01/09/98 GWB	01/09/98 GWB	01/08/98 JWR	01/08/98 GFW	01/09/98 RLT
1	REVISED ASSEMBLY AREA LOCATION	11/18/94 RDS	11/21/94 JS	1/21/94 GWB	11/21/94 HAB	11/21/94 GFW	11/21/94 RRS
0	ISSUED FOR APPROVAL TO SAFETY DEPARTMENT	12/14/89 MRS					

SI Group The Substance Inside

THE INFORMATION CONTAINED ON THIS DRAWING IS CONFIDENTIAL, THE PROPERTY OF SI GROUP, SCHENECTADY, NEW YORK AND MAY NOT BE REPRODUCED IN ANY MANNER, DISCUSSED WITH, OR SUBMITTED TO ANY UNAUTHORIZED PERSONS OR ORGANIZATIONS WITHOUT PRIOR WRITTEN APPROVAL OF AN AUTHORIZED REPRESENTATIVE OF SI GROUP.

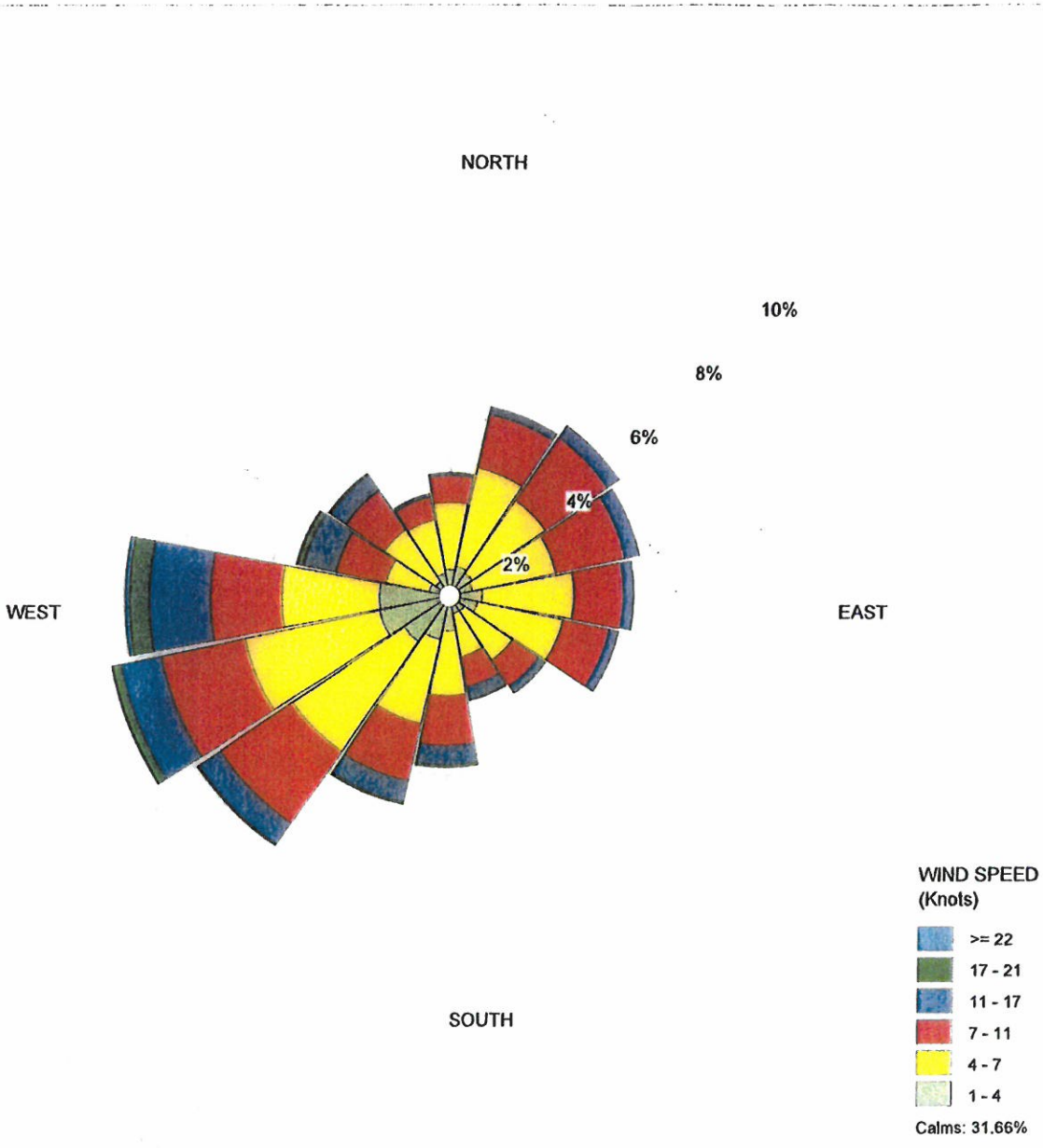
EMERGENCY ASSEMBLY AREA MAP

PROJECT NUMBER	DRAWING NUMBER	REV.
	0BH00A307	5
SCALE: NONE	OPERATING AREA:	BUILDING NO: –

Figure 5 – Wind Rose

Station #13883 - COLUMBIA/METRO ARPT, SC

DISPLAY:
Wind Speed
Direction (blowing from)



	DATA PERIOD: **2010 2011 2012 2013 2014 Jan 1 - Dec 31 00:00 - 23:00**	**Integrated Surface Hourly (ISH) Meteorological Data**	
	CALM WINDS: **31.66%**	TOTAL COUNT: **43783 hrs.**	**Liesa R. Elliott** Consulting Meteorologist
	AVG. WIND SPEED: **4.44 Knots**	DATE: **8/26/2015**	

WRPLOT View - Lakes Environmental Software

Appendix A – Reporting of Chemical Releases Procedure

SCOPE:

This procedure applies to all employees of the Orangeburg Plant. It provides a general perspective of how our Plantwide spill reporting system must function.

RESPONSIBILITY:

The Manager - **EHS** is responsible for the administration of this procedure.

IMPLEMENTATION:

The respective department managers are responsible for implementation within their areas.

DOCUMENT CONTROL:

This procedure must be reviewed by:

- Senior Production Managers North & South**
- Manager, Maintenance**
- **Sr. Supervisor – Health & Safety**
- Emergency Response Specialist
- Lead Environmental Engineer

It must be approved by the Manager - **EHS** who is the Master Copy Holder and is responsible for all revisions.

REGULATORY CITATION:

- 40 CFR 302 Comprehensive Environmental Response, Compensation & Liability (CERCLA)
- 40 CFR 355 Emergency Planning and Community Right to Know Act (EPRCA)
- 40 CFR 112 Spill Prevention, Control & Countermeasures (SPCC)
- 40 CFR 110 Discharge of Oil
- 40 CFR 264.196 Hazardous Waste - Treatment, Storage and Disposal Facilities (TSD's)
- 29 CFR 1910.119 Process Safety Management of Highly Hazardous Chemicals

DOCUMENT REFERENCES:

- HQ-EHS-00003 SI Group Incident Reporting Procedure

DEFINITIONS:

Spill/Release/LOPC

Any Loss of Primary containment (LOPC), whether to secondary containment or the environment, including unintended discharges to the stormwater impoundment basin (SWIB) or wastewater treatment system (WWTS). These three terms are used interchangeably.

Environment

Air, Soil, or Water (Edisto River or Groundwater). A spill to the "soil" means any spill to the earth or rock that is not contained on impervious pavement or other secondary containment.

Hazardous Waste

Waste with the potential to have harmful effect on human health or the environment. Hazardous waste may be characteristic (e.g. flashpoint, pH, etc.) or may be listed (specifically identified in regulations). Identifying and classifying hazardous waste requires interpretation of RCRA regulations. All determinations must be made by the Environmental Department.

Hazardous Waste Tank System

A stationary Storage or Treatment Tank designed to contain or accumulate Hazardous Waste and its associated ancillary equipment and containment system.

Hazardous Substance

CERCLA and EPRCA regulations provide a list of chemicals that are considered hazardous to human health or the environment.

Reportable Quantity (RQ)

A chemical specific threshold quantity. Lists of hazardous substances and their respective RQs are published in CERCLA and EPCRA regulations. A combined list can be found in the List of Lists (Attachment E). A release greater than or equal to the RQ for that chemical must be reported to outside government agencies (i.e. DHEC and LEPC).

Primary Containment

Process equipment or process piping used to contain and control process chemicals (e.g. tanks, reactors, pipes, etc.)

Evaporation Rate Factor

An estimate of how much liquid evaporates to the air. The factor gives a rate of lbs/min/ft2. Multiplying the factor times the area of the spill in square feet gives the evaporation rate in pounds per minute. See evaporation rate spreadsheet for formula and factors for current materials on spill report table. Materials with vapor pressures less than 1 mm Hg are considered negligible.

Process Safety Event (PSE)

An LOPC with consequence or potential for consequence. It is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials, from a process with the potential for consequences per the API 754 Guide. PSEs are classified by Tiers (1, 2, or 3) based on severity, with Tier 1 being most severe. SI Group corporate procedure HQ-EHS-00003 provides detailed guidance for identification and classification of PSEs.

Threshold Quantity (TQ)

LOPC quantities used to determine and classify PSEs. TQs are quantities that, if released, pose a danger due to toxicity or have the potential to result in significant events (e.g. fire, explosion, etc.) API 754 provides guidance for determining TQs based on physical and chemical properties of substances.

Acute Release

A "1-hour" rule applies for the purposes of PSE reporting. Specifically, the release of the material reaches or exceeds the reporting threshold in 1 hour or less. If a release does not exceed the Threshold Quantity (TQ) level over any 1-hour period, it would not be treated as a PSE. If the duration of the release cannot be determined, the duration should be assumed to be 1 hour.

PROCEDURE:

A. All spills/releases must be immediately reported to the Team Supervisor or Production Coordinator.
B. The immediate responsibility of those involved is to:
    1. Protect People
    2. Identify the Material
    3. Identify Appropriate Safety Equipment and PPE
    4. Protect the Environment
        a. Contain the Spill
        b. Notify ERT as necessary for spill containment.
        c. Keep spills away from drains, ditches and soil
    5. Notify Environmental Operations if spill is not contained and has the potential to make its way to the Wastewater Treatment Plant.
    6. Notify On-Call Spill Person as soon as possible if:
        a. There is a potential for offsite impacts (including spill to the river)
        b. A Reportable Quantity (RQ) has been exceeded
        c. A Level 3 spill has occurred
        d. If there are any questions concerning whether or not a spill is reportable
    7. If the primary On-Call Spill Person cannot be reached continue to use the listing below until you can reach someone on the On-Call Spill Team.
C. Spill Reporting
    1. All spills, regardless of quantity, must be documented via the Rivo Incident Reporting System.
        a. In general, this will be completed as soon as the spill has been contained and the plant has been placed in a safe condition.
        b. Incident Report must include, at a minimum:
            i. Material released

ii. Amount released
iii. Location (equipment number or description of physical location)
iv. Mode of failure (e.g. pump seal, gasket, pinhole in line, etc.)

2. Any spill/release exceeding a Reportable Quantity (RQ) must be reported to the National Response Center (NRC) immediately upon detection (within 15 minutes). The On-Call Spill Person will make this notification using the form contained in this procedure (Attachment C) to document the call.

On-Call Spill Personnel			
EMPLOYEE	**INITIALS**	**CELL PHONE**	**HOME/ALTERNATE**
Lisa Luna	LL	(803) 546-8652	(803) 309-3833 (803) 480-9109
Russell Smoak	JRS	(803) 515-3753	(803) 531-2117
Julian Smalls	JS	(803) 290-9544	(803) 531-5517
Jim Melton	JM	(803) 331-6826	(803) 794-3792
Wayne Fort	WF	(803) 682-1801	(803) 937-5206
Nick Fox	NF	(803) 570-0169	(803) 378-4010
**Luis Moran Delgado	LMD	(803) 707-6700	(787) 247-1788**

3. On-Call Spill Person
   a. The On-Call Spill Person is responsible for contacting the NRC, SC DHEC, the LEPC, and Charleston Public Works as required.
   b. If there is any question as to the reportability of the spill, the On-Call Spill Person should contact the NRC with an initial report of the incident and follow up with additional information once it is known.
   c. The On-Call Spill Person is also responsible for notifications to Site Management once all other required regulatory notifications have been made.

D. CERCLA/EPCRA Spills/Releases to the Environment
   1. The reporting requirements for the Comprehensive Environmental Response, Compensation, & Liability Act (CERCLA) and the Emergency Planning and Community Right-to-Know Act (EPCRA) differ slightly. To eliminate confusion and simplify reporting we have combined the reporting requirements of the two regulations and handle both types of spills in the same manner.
   2. For individually Listed Hazardous Substances under CERCLA and EPRCA, the spilled material can be analyzed for its components with the individual constituents compared to their respective RQs.
      a. Listed Hazardous Materials spilled or released to the Environment in excess of any listed RQ must be reported to the National Response Center (NRC), South

Carolina Department of Health and Environmental Control (SC DHEC) and the Local Emergency Planning Commission (LEPC) immediately upon their detection. If there is a release to the river that could impact the drinking water quality, then the Charleston Public Works must be notified.

3. Spills or Releases of anything other than pure water, including spills to the soil, spills to waters of the state (Edisto River), or releases to air, must be evaluated against the RQ list. Spills/Releases of material that contains a RQ listed chemical as a component must be evaluated based on the amount of the individual component released.

For example, Toluene has an RQ of 1000 lbs. A spill of 2000 lbs of IBB Crude containing 30% toluene would not exceed the RQ since only 600 lbs of toluene was spilled.

Attachment B includes some calculated amounts for some common intermediates based on typical worst-case compositions.

E. Hazardous Waste Spills/Releases
   1. To be considered a Hazardous Waste Spill for the purpose of determining Reportable Quantities, a decision must have been made to declare the material a Hazardous Waste prior to it being released or spilled to the environment.
   2. For Hazardous Waste Spills always collect a sample of the spilled material and have both a Flashpoint and pH determination conducted by the lab as soon as possible. Several of the Hazardous Waste Streams at the plant are only considered Hazardous Waste because they sometimes exhibit the Characteristic of "Ignitability" or "Corrosivity" as defined in the Hazardous Waste regulations.
      a. Use ASL Unit 50, Code 75 for all Spill Determinations regarding pH and Flashpoint.
      b. Relay the results of this analysis to the On-Call Spill Person.
   3. A Hazardous Waste spill >1 lb. from a Hazardous Waste Tank System (hazardous waste tank and associated piping, pumps, etc.) to the environment (soil or water) must be reported to SC DHEC within 24 hours of the spill/release. See definition of a Hazardous Waste Tank System in the DEFINITIONS Section above.
      a. Hazardous Waste Storage Tank Systems include the following:
         i. T-15M-42 (T-8155) – North Haz Waste Storage Tank
         ii. Boiler # 4 – Haz Waste Boiler
         iii. T-100-M-5 (T-8332) – Boiler #4 Storage Tank
         iv. T-30M-66 (T-8331) – Boiler #4 Storage Tank
         v. T-30M-61 (T-8333) – Boiler #4 Storage Tank
         vi. T-10M-32 (T-8345) – Boiler #4 Storage Tank
         vii. T-10M-14 (T-1034) – 330 Heel Tank
         viii. Transfer Lines from any of these vessels
      b. Drums, Totes and Trailers are not stationary tanks and are therefore not considered to be Hazardous Waste Tank Systems. Since the 1 lb. rule only applies to tank systems, spills from drums, totes, and trailers must be compared to RQ thresholds as noted in E.5 below.

c. Stationary Process Vessels containing materials in which a waste determination has not been made are not considered Hazardous Waste Storage Tanks as the material being accumulated may be recovered or reprocessed at times.

4. Hazardous Waste spilled or released to the Environment in excess of the Reportable Quantity (RQ) needs to be reported to the National Response Center (NRC), South Carolina Department of Health and Environmental Control (SC DHEC) and the Local Emergency Planning Commission (LEPC) immediately upon detection. If there is a release to the river that could impact the drinking water quality, then the Charleston Public Works must be notified.
5. Determining reportability of Hazardous Waste Spills is slightly more complicated than other spills and the determination varies somewhat depending on whether the waste is Listed or Characteristic Hazardous Waste.
    a. When looking at Listed Hazardous Waste (e.g. F003, U133), you need to first make a determination based on the quantity of the overall spill against the RQ for the specific waste code. If the overall quantity exceeds the specific waste code RQ, you will need to review the overall composition of the waste and then compare the individual components to the individual component RQ's and count everything spilled to the environment to include Soil, Water and Air (evaporation).

    Example: 4000 lbs of F001 methylene chloride spent solvent to be burned in Boiler 4 as D001 Hazardous Waste is spilled onto the ground from a trailer. This exceeds the 1000 lb RQ. The waste is a mixture containing 200 lbs. methylene chloride (RQ 1000 lbs.) and 3800 lbs. water. Since the amount of methylene chloride spilled does not exceed the RQ for methylene chloride, this spill does not have to be reported. If, on the other hand, the mixture contained 2000 lbs of methylene chloride and 2000 lbs of water, then the RQ would have been exceeded and the entire 4000 lb spill would have to be reported as a spill of F001 methylene chloride spent solvent hazardous waste.

    b. When looking at Unlisted Hazardous Waste (Characteristic Hazardous Wastes based on Ignitability, Corrosivity, Reactivity or Toxicity) the total amount released to the environment is used to determine if the RQ has been exceeded.
        i. If the composition of the waste is known (constituents and concentrations) and the constituents have RQs, then the RQs for individual constituents may be used to determine if reporting is required (just like any other spill).
        ii. If the constituents are known, but not the concentrations, and all constituents have RQs, then the total volume of the spill must be compared to the RQ for each constituent.

        Example: A trailer of 4716 Methanol is spilled during transport to Boiler 4. The concentration of methanol is unknown. The entire spill amount must be compared to the RQ for methanol.

iii. If the constituents are unknown or do not have RQs, then the total amount spilled must be compared to the RQs for the appropriate Waste Codes found in Appendix C of the List of Lists.

Example: D001 (Ignitable) Hazardous Waste containing spent isopropanol (50%) and ethanol (50%) spills from a drum. Constituents and concentrations are known, but neither chemical has an RQ. So, the RQ for D001 Hazardous Waste must be used.

6. Reporting of Hazardous Waste spills as "Hazardous Waste" only includes solids or liquids spilled to soil or water as uncontainerized gases are not considered Hazardous Waste.

F. Oil Releases to the River
   1. Discharge of Oil Regulation ("Sheen Rule") Requirements
      a. The On-Call Spill Person will report the discharge to the National Response Center (800-424-8802) within 24-hours of discharge IF the release:
         i. Reaches a navigable water or adjoining shoreline; or
         ii. Could violate water quality standards; or
         iii. Causes sheen on nearby surface water; or
         iv. Could cause a sludge or emulsion to be deposited beneath the surface of navigable waters or upon adjoining shorelines
   2. Additional SPCC Requirements
      a. If a single spill greater than 1,000 gallons reaches navigable waters (Edisto River), or two spills each greater than 42 gallons within any 12-month period, the Environmental Manager shall, in addition to the notification procedures above, provide written information to the EPA Regional Administrator as required by the Federal SPCC rules. A copy of this information must also be provided to DHEC. (Note: This refers to the amount of oil that actually reaches navigable waters or adjoining shorelines, not the total amount of oil spilled.)
   3. If there is a release to the river that could impact the drinking water quality, then the Charleston Public Works must be notified.

G. Spill Cleanup
   1. Spills or Releases should be contained and cleaned up within 24 hours or as soon as possible.
   2. A determination of what can be done with the material once it has been recovered will be made by the Environmental Compliance Department.
      a. Do not label cleaned up or recovered spill material as a "Waste" or "Hazardous Waste." The terms "Waste" and "Hazardous Waste" have specific definitions in environmental regulations; so, the determination should only be made by the Environmental Compliance Department.
      b. Use the "Hazardous Waste – Pending Analysis" label on containers of recovered or cleaned up material until the Environmental Department can make a determination and provide the appropriate label.

c. Move the drums containing the spilled material to the <90-day storage area and place in the Hazardous Waste storage space until the final determination of the classification of the material is complete.

3. In general, Hazardous Waste spills cannot be processed through the Wastewater Treatment Plant. However, there are some exceptions. The Environmental Compliance Department will make all determinations regarding disposition of Hazardous Waste spills.
4. BEFORE pumping spilled material back to a tank or piece of process equipment, escalate to Operations Supervision for approval. Consider sampling to analyze for quality of the spilled material and to look for likely contaminants from the dike/containment area. This is to avoid potential quality or safety impacts from the spill.

H. Process Safety Events
1. As mentioned in the DEFINITIONS section above, a Process Safety Event (PSE) is a Loss of Primary Containment (LOPC) with consequence or potential for consequence. It is an unplanned or uncontrolled release of any material, including non-toxic and non-flammable materials, from a process with the potential for consequences per the API 754 Guide.
2. PSEs are classified by Tiers (1, 2, or 3) based on severity, with Tier 1 being most severe. Classification of PSE releases is based on the physical and chemical properties of the material released (e.g. toxicity, flashpoint, etc.). SI Group corporate procedure HQ-EHS-00003 provides detailed guidance for identification and classification of PSEs.
3. A “1-hour” rule applies for the purposes of PSE determination. Specifically, the release of the material reaches or exceeds the reporting threshold in 1 hour or less. If a release does not exceed the Threshold Quantity (TQ) level over any 1-hour period, it would not be treated as a PSE. If the duration of the release cannot be determined, the duration should be assumed to be 1 hour.

I. Spill Classification and Notification Requirements
1. Spills must be evaluated against Process Safety Event (PSE) criteria.
2. Spills are classified using Levels and Tiers, as defined below:
   a. Tiers are only used to classify severity of PSEs. Tier 1 is the most severe.
   b. Levels are used by SI Group to classify all incidents, including spills, by severity. Level 3 incidents are the most severe.
   c. All PSE Tier 1 and Tier 2 spills are classified as Level 3 incidents. However, a spill does not have to be a PSE to be classified as a Level 3 incident.
   d. PSE Tier 3 spills may be classified as Level 3 if the total amount released exceeds 500 kg (1100 lbs). If the spill does not meet the criteria for Level 3, then Tier 3 spills are classified as Level 2.
   e. SI Group corporate procedure HQ-EHS-00003 provides detailed guidance for identification and classification of PSEs and Level 3 incidents.
3. Internal and external reporting requirements are summarized in the table below in order of decreasing severity:

Spill/Release Classification	External Reporting Required	Notification to Site Management	Corporate Notification by Site Management	Investigation	Fact Sheet Required?
Spills or releases that cause serious off-site impact	Immediate (within 15 minutes)	Immediate	Immediate	Formal (Lead Investigator Assigned)	Yes
Release to Environment ≥ RQ	Immediate (within 15 minutes)	Immediate	Within 3 Hours	Formal (Lead Investigator Assigned)	Yes
Hazardous Waste Release ≥ 1 lb to Environment from Tank System	24 Hours (DHEC only)	Immediate	Within 3 Hours	Formal (Lead Investigator Assigned)	Yes
Spills or releases not meeting the criteria listed above:					
PSE Tier 1 (Level 3)	No	Immediate	Within 3 Hours	Formal (Lead Investigator Assigned)	Yes
PSE Tier 2 (Level 3)	No	Next Business Day	No	Formal (Lead Investigator Assigned)	Yes
Level 3 (not PSE Tier 1 or 2)	No	Next Business Day	No	Formal (Lead Investigator Assigned)	Yes
Level 2 spill or release	No	No	No	Informal (Team Supervisor Leads)	No
Level 1 spill or release	No	No	No	No	No

In addition to the requirements in the table above, any PSE Tier 1 or Tier 2 release requires notification to the Process Safety Advisor (PSA) by the Next Business Day.

J. Follow-Up Reporting
   1. Spills requiring external reporting to DHEC and/or EPA will require a formal written follow-up report to DHEC and/or EPA within 30 days. The Environmental Department will prepare and submit the report, which must include:
      a. Date and Time of Release
      b. Description of Event to include Quantity and Composition of Material Released
      c. Likely route of migration of the release
      d. Characteristics of the surrounding soil
      e. Results of any monitoring of sampling conducted in connection with the release.
      f. Proximity to downgradient drinking water, surface water and populated areas
      g. Description of the response action taken or planned to include cleanup and reclamation or disposal of material.
   2. All spills and releases are tracked by the Environmental Depart and will be included in the Monthly EHS Report or other modes of communication to Corporate as appropriate.

ATTACHMENTS:

Attachment A: Spill/Release Flow Chart

Spill Logic Diagram 2019.docx

Attachment B: Site Specific Reportable Quantities

Site Specific Reportable Quantiti

Attachment C: Superfund Release Reporting Form

Spill Release Report Form.docx

Attachment D: List of Lists - Reportable Quantities

List of Lists.pdf

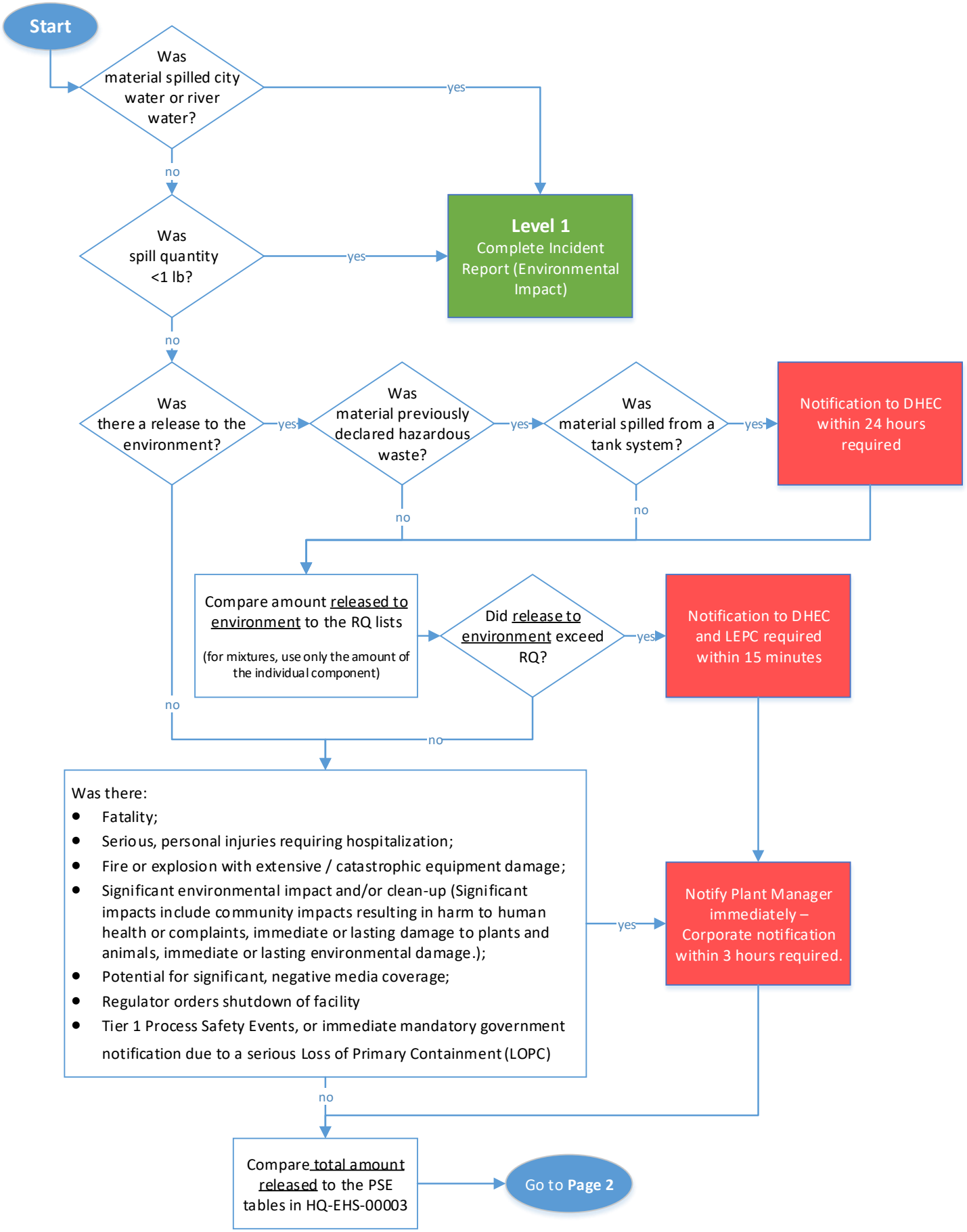
Attachment E: Evaporation Rate Factors Calculation Spreadsheet

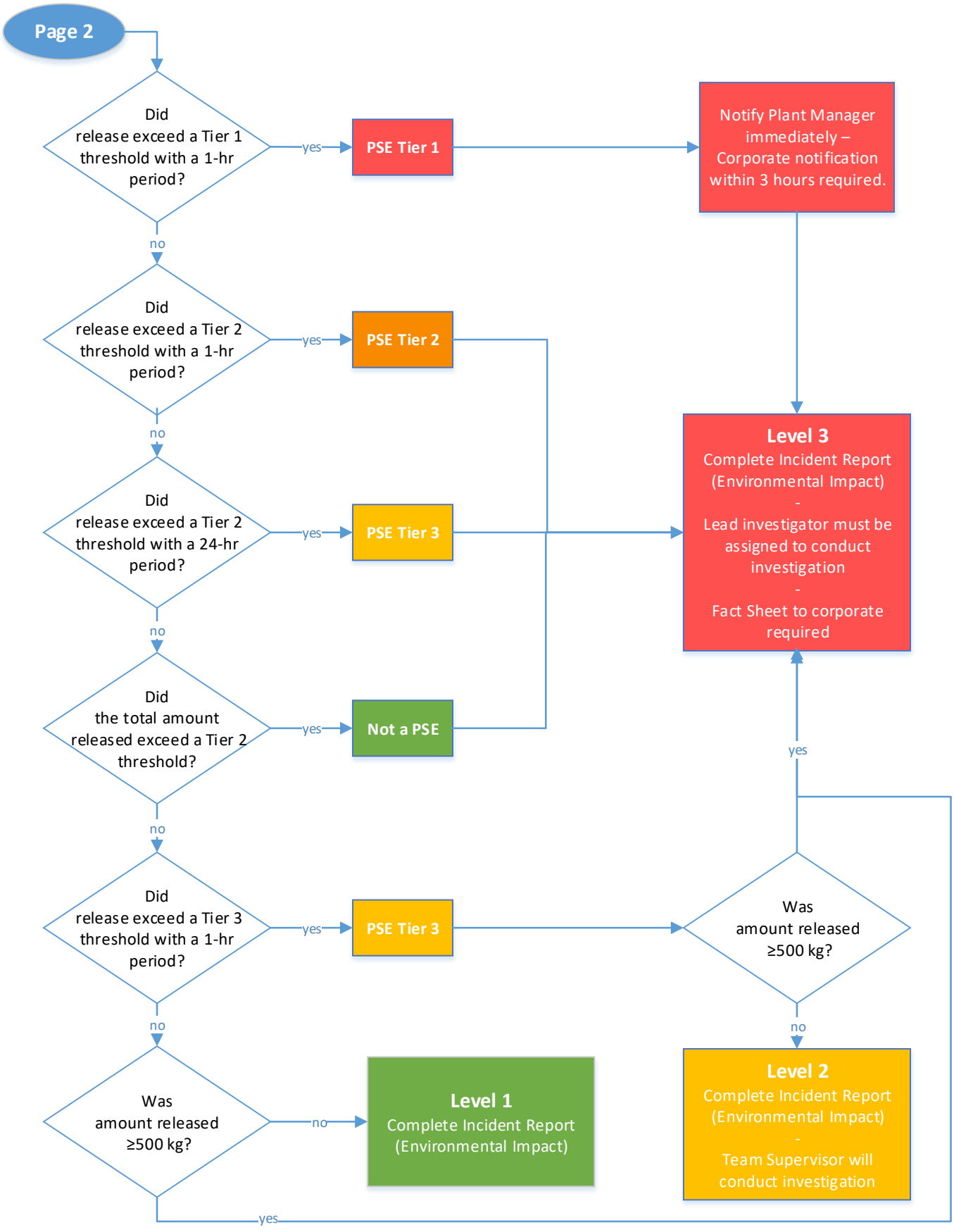
Evaporation Rate Factor Calculation.p

DATE	DESCRIPTION OF CHANGE
	Previous versions of this policy may be viewed in the Archived section.
5/31/07	**Correct line-up of chemicals and lbs. in Spill Report Reportable Quantities/Logic Diagram table. No other changes. Sent to Scott Wells only for approval.**
12/21/2007	**Removed incorrect table of REPORTABLE QUANTITIES/LOGIC DIAGRAM and added link to EN-PP-001A where correct table is located.**
07/30/2008	**Corrected link to the Spill/Release Reporting form. No other changes. To Scott Wells only for approval.**
05/20/2009	**Revise titles throughout procedure. Changed approver from Scott Wells to Mike Brown. Changed reviewer from Mike Clisby to Tom Kerr. Revised table of REPORTABLE QUANTITIES/LOGIC DIAGRAM. Added new MSWord attachment for Superfund Release Reporting and new MSWord powerpoint attachment.**
09/15/2009	**Revised CERCLA flow diagram and reportable quantities from EN-PP-001A.**
10/01/2009	**Updated Spill Release Flow Chart.**
01/15/2010	**Complete update of Procedure to include combining both EN-PP-001 and EN-PP-001A into a new SOP EN-PP-100.**
01/21/2010	**Updated reporting language for Hazardous Waste. Expanded Spill On-Call listing to include important phone numbers other than On-Call Spill Team. Included Attachment F: List of Lists - Reportable Quantities.**
01/28/2010	**Update Attachment B - Spill Flow Chart. Changed internal Albemarle Only reporting to Level 1 to avoid confusion in reporting requirements. SPCC Spills in excess of 1Lb will not be classified as Level 1 Spills.**
02/23/2010	**Updated Attachment C.....added product Diethyl ether (ethyl ether) (EHM) 100 lbs.**
05/12/2010	**Updated Attachment C....added sodium bichromate (dichromate) 10 lbs. Added Oil and Lubricants to SPCC listing. Updated several items to be included as Albemarle Hazardous Material.**
05/17/2010	**Updated Attachment C - Added information for approximate Brine spill in gallons that would contain reportable quantity of listed corrosion inhibitor.**
07/07/10	**Updated Attachment C - Added CA-300 & Hydrobrite to SPCC list of materials.** amg
12/16/10	**Updated Attachment C - Added Diethanolamine for 4716 process** **Updated Attachment E - On Call Spill Team Numbers and Key Team Numbers.** amg
12/17/10	**Updated Attachment E - On Call Spill List - Added Jeff Broeker** amg
02/24/2011	**Updated to include new backup NRC phone number.** **Updated minor typos on Spill Report Logic Diagram.** **Updated Page 2 of Spill Report Logic Diagram to insert Question regarding if spill went to Soil or Water between RQ and Tank System Question regarding spills.** **Updated SOP to include rational for HW Releases to environment do not include to air releases as they are not containerized.**
11/03/2011	**Minor Updates to names and numbers.** **Define Spill Reporting Levels.** **Reformatting Reportable Quantities Listing.** **Removed Keith Black from Reviewer List and added Russell Smoak.**
03-20-2012	**Minor correction to flow chart.**

6/2/12	**clarified storage of drum containing spillage when classification of spilled material has not been completed.**
06/04/12	**Added Jim Melton to Spill Duty Table.**
6/20/12	**Resent to get full approval. Added 90 day storage explanation**
06/28/2012	**Re-Approved to clear save conflict error.**
12/18/2012	**Revised procedure to add notification of Charleston Public Works if there is a potential impact to the river. Modified spill reportable quantity sheet, and release reporting form for above, and to add sodium cyanide. Added PSM spill evaluation to flow chart.**
2/1/2013	**Added Bromine to spill release reportable quantities list for FR-63**
2/12/2013	**Deleted Type E spill and revised Type D to be < 20 lbs released from primary containment. Updated Spill Flow Chart to R4**
4/5/2013	**Revised Type B spill to be any spill (other than pure water) that is > 20 lbs and reaches the "Soil". Deleted previous "hazardous material > 20 lbs to soil" category. Added PSM spill level definitions to procedure. Updated spill reportable quantities sheet to delete yellow highlighting. Added evaporation rate factors definition. Added Evaporation rate spreadsheet. Added evaporation rate values to RQ sheet. Updated Flow chart.**
10/24/2013	**Revised HRBI spill to be any spill (other than pure water) that is > 4.4 lbs and reaches the "Soil" or is > 22 lbs Outside primary containment. Changed descriptions of spill types from Type A, B, etc to Level 1, HRBI, Level 2 and Level 3 to match new Corporate designations. Updated Flow chart. Deleted Mike Brown from on-call list. Added Lisa Luna and Joey Sloop to on-call list. Updated Plant Spill Response Call Numbers.**
12/29/2013 **1/16/2014**	**H. Spill Cleanup - Added section 4 to require sampling and analytical prior to returning spilled materials back to the process equipment.** **Updated spill release flow chart. Removed old brine corrosion inhibitors from spill RQ list.**
2/1/2014	**H. Spill Cleanup - Wording in section 4 tweaked to consider sampling instead of making it manditory. Escalation to operations supervision is still required.**
5/27/14	**Placed in correct "100" section. Added MAR as on-call spill duty. Revised LL cell phone.**
08/15/14	**Changed job title to HSE Manger in Responsibility and Document Control sections to reflect organization change. Added PSM regs to Regulatory Citation section. Changed Artea 2 to Area II to reflect organization change. Updated Spill Reporting Type section to reflect new Corporate PSM policy. Replaced Spill Release Flow Chart R8 with R9 (PSM section was updated to comply with new corp policy).**
02/19/15	**Revised to remove pager numbers....no longer have them available. Changed titles as indicated above in red type.**
3/3/2015	**Updated Procedure and Logic Flow Diagrams (Attachment A) to reflect the SI Group corporate criteria for spill reporting. Added corporate policy HQ-EHS-00003 as a document reference. Added definition of Acute Spill. Added criteria for PSI spill. Updated other attachments to reflect personnel changes and company name change.**
5/5/15	**Changed EAT to ERT.**
6/17/15	**Corrected formatting issues**
12/22/15	**Updated job titles on Attachment D. Added procedure reference to attachments.**

09/12/17	**Revised to capture correct number sequence in SharePoint. Changed titles throughout.**
09/12/17	**Updated reporting criteria to align with HQ-EHS-00003. Added alternate tank numbers of haz waste tanks. Minor grammar and syntax corrections.**
5/16/19	**Revision 2 is a major rewrite of Revision 1 and all of the attached documents. Changes are too numerous to list here.**
12/11/19	**Changed title of reviewers & added Luis Moran Delgado to spill coverage.**
02/05/2020	**Biennial review – title changes.**


Start
Was material spilled city water or river water?
yes
no
Was spill quantity <1 lb?
yes
Level 1
Complete Incident Report (Environmental Impact)
no
Was there a release to the environment?
yes
Was material previously declared hazardous waste?
yes
Was material spilled from a tank system?
yes
Notification to DHEC within 24 hours required
no
no
Compare amount released to environment to the RQ lists
(for mixtures, use only the amount of the individual component)
Did release to environment exceed RQ?
yes
Notification to DHEC and LEPC required within 15 minutes
no
no
Was there:
Fatality;
Serious, personal injuries requiring hospitalization;
Fire or explosion with extensive / catastrophic equipment damage;
Significant environmental impact and/or clean-up (Significant impacts include community impacts resulting in harm to human health or complaints, immediate or lasting damage to plants and animals, immediate or lasting environmental damage.);
Potential for significant, negative media coverage;
Regulator orders shutdown of facility
Tier 1 Process Safety Events, or immediate mandatory government notification due to a serious Loss of Primary Containment (LOPC)
yes
Notify Plant Manager immediately – Corporate notification within 3 hours required.
no
Compare total amount released to the PSE tables in HQ-EHS-00003
Go to Page 2



Note: Level 1 & 2 are determined above by released material only (Environmental Impact). Other impacts may elevate incident level (e.g. People Impact, Property Impact, etc.).

SPILL / RELEASE REPORTABLE QUANTITIES
(Individual Component Listing)

Note: RCRA Waste Codes U and P indicate that material from spill cleanup may be listed hazardous waste when disposed. It does not imply that the spill is considered a hazardous waste spill, unless the material spilled was previously declared a hazardous waste. All hazardous waste determinations, including material from spill cleanup, should be made by the Environmental Department.

Material	CAS Number	EPA/DHEC Reportable Quantity (Lbs)	RCRA Waste Code	Evaporation Rate Factor Lbs/min/ft^2
Acetic Acid	64197	5000		0.002672566
Acetic Anhydride	108247	5000		0.00132079
Acetone	67641	5000	U002	0.04123321
Acetonitrile	75058	5000	U003	0.01271525
Acetyl Chloride	75365	5000		0.05968241
Ammonia Anhydrous	7664417	100		0.563533589
Ammonia Chloride	12125029	5000		Negligible
Ammonium Hydroxide	1336216	1000		Negligible
Aniline	62533	5000	U012	Negligible
Cyclohexane	110827	1000	U056	0.022774872
Cyclohexanone	108941	5000	U057	0.00123692
Diethanolamine (29% in Acronel WS-27)	111422	100		Negligible
Diethylamine	109897	100		0.044728536
Diethyl ether (Ethyl Ether)	60297	100	U117	0.109751625
Dimethylamine	124403	1000	U092	0.224683954
Ethyl Acetate	141786	5000	U112	0.020718185
Ethylene Glycol	107211	5000		Negligible
Formaldehyde	50000	100	U122	0.424508584
Hexane	110543	5000		0.034026529
Hydrogen Chloride	7647010	5000		4.473114524
Hydrogen Cyanide	74908	10	P063	0.075416288
MMT	12108133	100		Negligible
Mercury	7439976	1	U157	Negligible
Methanol	67561	5000		0.014656058
Methyl Chloride	74873	100	U045	0.68927946
Methyl Ethyl Ketone (MEK)	78933	5000	U159	0.018125733
Methylene Chloride	75092	1000	U080	0.098393892

SPILL / RELEASE REPORTABLE QUANTITIES
(Individual Material Listing)

Raw Material	CAS Number	EPA/DHEC Reportable Quantity (Lbs)	RCRA Code	Evaporation Rate Factor Lbs/min/ft^2
Nitric Acid	7697372	1000		Negligible
Paraformaldehyde	30525894	1000		0.424508584
Phenol	108952	1000	U188	Negligible
Phosphoric Acid	7664382	5000		Negligible
Potassium Hydroxide (KOH)	1310583	1000		Negligible
Propylene Oxide	75569	100		0.085351825
Sodium	7440235	10		Negligible
Sodium Bisulfite	7631905	5000		Negligible
Sodium Cyanide	143339	10	P106	Negligible
Sodium Hydroxide (Caustic)	1310732	1000		Negligible
Sodium Hypochlorite	7681529	100		Negligible
Sulfuric Acid	7664939	1000		Negligible
B22 Synthetic Acid Blend (50-54% sulfuric / 1.5-3.5% nitric)	7664939	1852		Negligible
Sulfur Dioxide	7446095	500		0.558210879
Tetrahydrofuran	109999	1000	U213	0.03239492
Toluene	108883	1000	U220	0.006641333
Xylene	108383	100	U239	0.002189943

Note: To estimate an evaporation rate, multiply the evaporation rate factor times the spill area in square feet. This gives the evaporation rate in pounds per minute.

SPILL / RELEASE REPORTABLE QUANTITIES
(Composite Materials)

<u>Important Note</u>: This table can be used as a general guideline for assessing whether an RQ may have been exceeded. Compositions of these intermediates vary. Use analytical data whenever possible for reportability determinations. Only use the values in this table if there is no lab data.

Intermediates	Typical (Worst Case) Composition	EPA/DHEC Reportable Quantity For Individual Component (Lbs)	EPA/DHEC Approximate Reportable Quantity For Overall Mixture (Lbs)	Hazardous Material
2,6-DTBP	**Phenol: 0.1%**	**1000**	**1,000,000**	**X**
IBB Crude	**Toluene: 30%**	**1000**	**3300**	**X**
IBAP		**--**	**--**	**--**
Recycle IBAP	**Hexane: 0.5%**	**5000**	**1,000,000**	**X**
MMT Crude	**MMT: 40%**	**100**	**250**	**X**
MMT Bottoms	**MMT: 15%**	**100**	**650**	**X**
Recycle MCP	**Xylene: 5%**	**100**	**2,000**	**X**
IBACH	**HCN:**			
HME Crude (from R9104 or R9102)	**--**			
HME	**--**	**--**	**--**	**--**
PSS (washed) (from C9075 or T9250)	**Hexane: 8%**	**5000**	**62,500**	**X**
PME	**--**	**--**	**--**	**--**
DR3 in Hexane (from R9101, D9166, Crystalizer)	**Hexane: 45%**	**5000**	**11,111**	**X**

Utilities	Composition	EPA/DHEC Reportable Quantity For Individual Component (Lbs)	EPA/DHEC Approximate Reportable Quantity For Overall Mixture (Lbs)	Hazardous Material
Acronel WS-27	**Diethanolamine: 29%**	**100**	**345**	**--**

SPILL / RELEASE
REPORTABLE QUANTITIES
(Hazardous Waste)

Hazardous Waste	Composition	EPA/DHEC Reportable Quantity (Lbs)	Hazardous Material
Hazardous Waste "Ignitable" D001	**Flashpoint ≤ 140 ºF**	**100**	**Yes**
Hazardous Waste "Corrosive" D002	**2 ≤ pH ≥ 12.5**	**100**	**Yes**
Hazardous Waste "Reactive" D003	**1) Normally unstable 2) Reacts violently with water 3) Forms explosive mixtures with water 4) Capable of detonation**	**100**	**Yes**
SI Group ID# 2 330/330 C Still Bottoms D001	**Fuel Oil: 0 to 50% Alkylated Phenols: 0 –to50% Normal & Isobutyl Benzene: 0 to 50%**	**100**	**Yes**
SI Group ID# 85 702/703 Still Bottoms D001	**Naptha: 0 to 25% 702: 0 to 50% 702: 0 to 50%**	**100**	**Yes**
SI Group ID# 104 DR3 Still Bottoms D001	**Water: 10 to 50% Hexane: 10 to 90% Organics: 10 to 90%**	**100**	**Yes**
SI Group ID# 42 Boiler # 4 Ash F002, F003, F003, F004, F005, D036, D007	**Ash: 90 to 100% Water: 0 to 10%**	**10**	**Yes**
Toluene (Spent Solvent) From Vessel Cleaning F005, D001	**Toluene: 0 to 70% Cyclohexane: 0 to 30% Isobutyl Benzene: 0 to 10%**	**100**	**Yes**
Toluene (Reactant) From Plant 5 Light Ends D001	**Toluene: 0 to 70% Cyclohexane: 0 to 30% Isobutyl Benzene: 0 to 10%**	**100**	**Yes**

SUPERFUND RELEASE REPORTING **NRC NO.** _____

NATIONAL RESPONSE CENTER/SCDHEC CONTACT REPORT

Date of report:_____ Date of release:_____

TIME OF: RELEASE: _____ : _____ a.m. / _____ : _____ p.m.

NCR REPORT: _____ : _____ a.m. / _____ : _____ p.m.

* SCDHEC INITIAL REPORT: _____ : _____ a.m. / _____ : _____ p.m.

SCDHEC FINAL REPORT: _____ : _____ a.m. / _____ : _____ p.m.

LEPC REPORT: _____ : _____ a.m. / _____ : _____ p.m.

CHARLESTON PW REPORT _____ : _____ a.m. / _____ : _____ p.m.

* SCDHEC HAS A ANSWERING SERVICE WHO WILL GET SOMEONE TO CALL BACK.

MATERIAL: _____	**QUANTITY:** _____

HAVE THE FOLLOWING INFORMATION AVAILABLE IF POSSIBLE BEFORE CALLING:

- ANYONE INJURED? _____
- VAPOR CLOUD? _____
- OFF-SITE IMPACT? _____
- NOTIFY EMERGENCY AUTHORITIES? _____
- CLEANUP/CONTAINMENT ACTIVITIES? _____
- WEATHER CONDITIONS? _____
- WIND, SPEED & DIRECTION? _____

BRIEF DESCRIPTION OF INCIDENT: _____

COMMENTS/QUESTIONS OF PERSONS CONTACTED

NATIONAL RESPONSE CENTER PHONE NO. 1-800-424-8802 (backup #) 1-202-267-2675 PERSON CONTACTED: _____	SCDHEC PHONE NO. 1-888-481-0125 PERSON(S) CONTACTED: _____ (NOT ANSWERING SERVICE)	LEPC PHONE NO. 531-3020 PERSON CONTACTED: _____	CHARLESTON PUBLIC WORKS PHONE NO. 843-863-4019 BACKUP NO. 843-727-6800 Jane Byrne No. 843-819-8890 PERSON CONTACTED: _____

NOTIFY: ***PLANT MANAGER, OPERATIONS MANAGER, ENVIRONMENTAL MANAGER, AND HSST (SAFETY) MANAGER AFTER CALLING NRC, SCDHEC, AND LEPC.***

SIGNATURE OF SI GROUP PERSON MAKING CONTACT:

NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Abamectin	ABAMECTIN AVERMECTIN B1	71751412			
Acenaphthene	ACENAPHTHENE	83329		100	
Acenaphthylene	ACENAPHTHYLENE	208968		5,000	
Acephate	ACEPHATE	30560191			
Acetaldehyde	ACETALDEHYDE	75070		1,000	U001
Acetaldehyde, trichloro-	ACETALDEHYDE, TRICHLORO-	75876		5,000	U034
Acetamide	ACETAMIDE	60355		100	
Acetic acid	ACETICACID	64197		5,000	
Acetic acid, (2,4-dichlorophenoxy)-	ACETICACIDDICHLOROPHENOXY)-	94757		100	U240
Acetic acid ethenyl ester	ACETICACIDETHENYLESTER	108054	5,000	5,000	
Acetic anhydride	ACETICANHYDRIDE	108247		5,000	
Acetone	ACETONE	67641		5,000	U002
Acetone cyanohydrin	ACETONE CYANOHYDRIN	75865	10	10	P069
Acetone thiosemicarbazide	ACETONE THIOSEMICARBAZIDE	1752303	1,000		
Acetonitrile	ACETONITRILE	75058		5,000	U003
Acetophenone	ACETOPHENONE	98862		5,000	U004
2-Acetylaminofluorene	ACETYLAMINOFLUOREN	53963		1	U005
Acetyl bromide	ACETYLBROMIDE	506967		5,000	
Acetyl chloride	ACETYLCHLORIDE	75365		5,000	U006
Acetylene	ACETYLENE	74862			
Acetylphosphoramidothioic acid O,S-dimethyl ester	ACETYLPHOSPHORAMIDOTHIOICACIDDIMETHYL ESTER	30560191			
1-Acetyl-2-thiourea	ACETYLTHIOUREA	591082		1,000	P002
Acifluorfen, sodium salt	ACIFLUORFEN, SODIUM SALT	62476599			
Acrolein	ACROLEIN	107028	1	1	P003
Acrylamide	ACRYLAMIDE	79061	5,000	5,000	U007
Acrylic acid	ACRYLICACID	79107		5,000	U008
Acrylonitrile	ACRYLONITRILE	107131	100	100	U009
Acrylyl chloride	ACRYLYL CHLORIDE	814686	100		
Adipic acid	ADIPIC ACID	124049		5,000	
Adiponitrile	ADIPONITRILE	111693	1,000		
Alachlor	ALACHLOR	15972608			
Aldicarb	ALDICARB	116063	1	1	P070
Aldicarb sulfone	ALDICARBSULFONE	1646884		100	P203
Aldrin	ALDRIN	309002	1	1	P004
d-trans-Allethrin	ALLETHRIN	28057489			
Allyl alcohol	ALLYLALCOHOL	107186	100	100	P005
Allylamine	ALLYLAMINE	107119	500		
Allyl chloride	ALLYLCHLORIDE	107051		1,000	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Aluminum (fume or dust)	ALUMINUM	7429905			
Aluminum oxide (fibrous forms)	ALUMINUMOXIDE	1344281			
Aluminum phosphide	ALUMINUMPHOSPHIDE	20859738	100	100	P006
Aluminum sulfate	ALUMINUMSULFATE	10043013		5,000	
Ametryn	AMETRYN	834128			
2-Aminoanthraquinone	AMINOANTHRAQUINONE	117793			
4-Aminoazobenzene	AMINOAZOBENZENE	60093			
4-Aminobiphenyl	AMINOBIPHENYL	92671		1	
1-Amino-2-methylanthraquinone	AMINOMETHYLANTH	82280			
5-(Aminomethyl)-3-isoxazolol	AMINOMETHYLISOXAZOLOL	2763964	1,000	1,000	P007
Aminopterin	AMINOPTERIN	54626	500		
4-Aminopyridine	AMINOPYRIDINE	504245	1,000	1,000	P008
Amiton	AMITON	78535	500		
Amiton oxalate	AMITON OXALATE	3734972	100		
Amitraz	AMITRAZ	33089611			
Amitrole	AMITROLE	61825		10	U011
Ammonia	AMMONIA	7664417	100	100	
Ammonia (anhydrous)	AMMONIA	7664417	100	100	
Ammonia (conc 20% or greater)	AMMONIAS	7664417		1,000	
Ammonium acetate	AMMONIUMACETATE	631618		5,000	
Ammonium benzoate	AMMONIUMBENZOATE	1863634		5,000	
Ammonium bicarbonate	AMMONIUMBICARBONATE	1066337		5,000	
Ammonium bichromate	AMMONIUMBICHROMATE	7789095		10	
Ammonium bifluoride	AMMONIUMBIFLUORIDE	1341497		100	
Ammonium bisulfite	AMMONIUMBISULFITE	10192300		5,000	
Ammonium carbamate	AMMONIUMCARBAMATE	1111780		5,000	
Ammonium carbonate	AMMONIUMCARBONATE	506876		5,000	
Ammonium chloride	AMMONIUMCHLORIDE	12125029		5,000	
Ammonium chromate	AMMONIUMCHROMATE	7788989		10	
Ammonium citrate, dibasic	AMMONIUMCITRATE, DIBASIC	3012655		5,000	
Ammonium fluoborate	AMMONIUMFLUOBORATE	13826830		5,000	
Ammonium fluoride	AMMONIUMFLUORIDE	12125018		100	
Ammonium hydroxide	AMMONIUMHYDROXIDE	1336216		1,000	
Ammonium oxalate	AMMONIUMOXALATE	5972736		5,000	
Ammonium oxalate	AMMONIUMOXALATE	6009707		5,000	
Ammonium oxalate	AMMONIUMOXALATE	14258492		5,000	
Ammonium picrate	AMMONIUMPICRATE	131748		10	P009
Ammonium silicofluoride	AMMONIUMSILICOFLUORIDE	16919190		1,000	
Ammonium sulfamate	AMMONIUMSULFAMATE	7773060		5,000	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Ammonium sulfide	AMMONIUMSULFIDE	12135761		100	
Ammonium sulfite	AMMONIUMSULFITE	10196040		5,000	
Ammonium tartrate	AMMONIUMTARTRATE	3164292		5,000	
Ammonium tartrate	AMMONIUMTARTRATE	14307438		5,000	
Ammonium thiocyanate	AMMONIUMTHIOCYANATE	1762954		5,000	
Ammonium vanadate	AMMONIUMVANADATE	7803556		1,000	P119
Amphetamine	AMPHETAMINE	300629	1,000		
Amyl acetate	AMYLACETATE	628637		5,000	
iso-Amyl acetate	AMYLACETATE-I	123922		5,000	
sec-Amyl acetate	AMYLACETATE-S	626380		5,000	
tert-Amyl acetate	AMYLACETATE-T	625161		5,000	
Anilazine	ANILAZINE	101053			
Aniline	ANILINE	62533	5,000	5,000	U012
Aniline, 2,4,6-trimethyl-	ANILINE, 2,4,6-TRIMETHYL-	88051	500		
o-Anisidine	ANISIDINEA	90040		100	
p-Anisidine	ANISIDINEB	104949			
o-Anisidine hydrochloride	ANISIDINEHYDROCHL	134292			
Anthracene	ANTHRACENE	120127		5,000	
Antimony	ANTIMONY	7440360		5,000	
Antimony Compounds	ANTIMONYCOMPOUNDS	N010		***	
Antimony pentachloride	ANTIMONYPENTACHLORIDE	7647189		1,000	
Antimony pentafluoride	ANTIMONYPENTAFLUORIDE	7783702	500		
Antimony potassium tartrate	ANTIMONYPOTASSIUM TARTRATE	28300745		100	
Antimony tribromide	ANTIMONYTRIBROMIDE	7789619		1,000	
Antimony trichloride	ANTIMONYTRICHLORIDE	10025919		1,000	
Antimony trifluoride	ANTIMONYTRIFLUORIDE	7783564		1,000	
Antimony trioxide	ANTIMONYTRIOXIDE	1309644		1,000	
Antimycin A	ANTIMYCIN A	1397940	1,000		
ANTU	ANTU	86884	100	100	P072
Aroclor 1016	AROCLOR 1016	12674112		1	
Aroclor 1221	AROCLOR 1221	11104282		1	
Aroclor 1232	AROCLOR 1232	11141165		1	
Aroclor 1242	AROCLOR 1242	53469219		1	
Aroclor 1248	AROCLOR 1248	12672296		1	
Aroclor 1254	AROCLOR 1254	11097691		1	
Aroclor 1260	AROCLOR 1260	11096825		1	
Arsenic	ARSENIC	7440382		1	
Arsenic acid	ARSENIC ACID	1327522		1	P010
Arsenic acid	ARSENIC ACID	7778394		1	P010

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Arsenic Compounds	ARSENIC COMPOUNDS	N020		***	
Arsenic disulfide	ARSENIC DISULFIDE	1303328		1	
Arsenic pentoxide	ARSENIC PENTOXIDE	1303282	1	1	P011
Arsenic trioxide	ARSENIC TRIOXIDE	1327533	1	1	P012
Arsenic trisulfide	ARSENIC TRISULFIDE	1303339		1	
Arsenous oxide	ARSENOUS OXIDE	1327533	1	1	P012
Arsenous trichloride	ARSENOUS TRICHLORIDE	7784341	1	1	
Arsine	ARSINE	7784421	100		
Asbestos (friable)	ASBESTOS	1332214		1	
Atrazine	ATRAZINE	1912249			
Auramine	AURAMINE	492808		100	U014
Avermectin B1	AVERMECTIN B1	71751412			
Azaserine	AZASERINE	115026		1	U015
1H-Azepine-1 carbothioic acid, hexahydro-S-ethyl ester	AZEPINECARBOTHIOICACIDHEXAHYDRO-S-ETHYL ESTER	2212671			
Azinphos-ethyl	AZINPHOS-ETHYL	2642719	100		
Azinphos-methyl	AZINPHOS-METHYL	86500	1	1	
Aziridine	AZIRIDINE	151564	1	1	P054
Aziridine, 2-methyl	AZIRIDINE, 2-METHYL	75558	1	1	P067
Barban	BARBAN	101279		10	U280
Barium	BARIUM	7440393			
Barium Compounds	BARIUM COMPOUNDS	N040			
–Except Barium Sulfate (under	BARIUM COMPOUNDS EXCEPTION	0			
Barium cyanide	BARIUM CYANIDE	542621		10	P013
Bendiocarb	BENDIOCARB	22781233		100	U278
Bendiocarb phenol	BENDIOCARBPHENOL	22961826		1,000	U364
Benezeneamine, 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)-	BENEZENEAMINEDINITRODIPROPYL-4-(TRIFLUOROMETHYL)-	1582098		10	
Benfluralin	BENFLURALIN	1861401			
Benomyl	BENOMYL	17804352		10	U271
Benz[c]acridine	BENZACRIDINE	225514		100	U016
Benzal chloride	BENZALCHLORIDE	98873	5,000	5,000	U017
Benzamide	BENZAMIDE	55210			
Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl	BENZAMIDE,3,5-DICHLORO-N-(1,1-DIMETHYL-2-PROPYNYL	23950585		5,000	U192
Benz[a]anthracene	BENZANTHRACENE	56553		10	U018
Benzenamine, 3-(trifluoromethyl)-	BENZENAMINE, 3-(TRIFLUOROMETHYL)-	98168	500		
Benzene	BENZENE	71432		10	U019

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Benzeneacetic acid, 4-chloro-.alpha.-(4-chlorophenyl)-.alpha.-hydroxy-, ethyl ester	BENZENEACETICACIDCHLORO-.ALPHA.-(4-CHLOROPHENYL)-.ALPHA	510156		10	U038
Benzeneamine, N-hydroxy-N-nitroso, ammonium salt	BENZENEAMINEHYDROXYNITROSO, AMMONIUM SALT	135206			
Benzenearsonic acid	BENZENEARSONIC ACID	98055	10		
Benzene, 1-(chloromethyl)-4-nitro-	BENZENECHLOROMETHYL)-4-NITRO-	100141	500		
1,3-Benzenedicarbonitrile, 2,4,5,6-tetrachloro-	BENZENEDICARBONITRILETETRACHLORO-	1897456			
Benzene, 2,4-dichloro-1-(4-nitrophenoxy)-	BENZENEDICHLORONITROPHENOXY)-	1836755			
Benzene, 2,4-diisocyanato-1-methyl-	BENZENEDIISOCYANATOMETHYLA	584849	100	100	
Benzene, 1,3-diisocyanato-2-methyl-	BENZENEDIISOCYANATOMETHYLB	91087	100	100	
Benzene, 1,3-diisocyanatomethyl-	BENZENEDIISOCYANATOMETHYLC	26471625		100	U223
Benzene, m-dimethyl-	BENZENEDIMETHYL-M	108383		1,000	U239
Benzene, o-dimethyl-	BENZENEDIMETHYL-O	95476		1,000	U239
Benzene, p-dimethyl-	BENZENEDIMETHYL-P	106423		100	U239
Benzeneethanamine, alpha,alpha-dimethyl-	BENZENEETHANAMINE, ALPAH,ALPHA-DIMETHYL-+	122098		5,000	P046
Benzenemethanol, 4-chloro-.alpha.-4-chlorophenyl)-.alpha.-(trichloromethyl)-	BENZENEMETHANOLCHLORO-.ALPHA.-4-CHLOROPHENYL)-.ALPHA.-(	115322		10	
Benzenesulfonyl chloride	BENZENESULFONYL CHLORIDE	98099		100	U020
Benzenethiol	BENZENETHIOL	108985	100	100	P014
Benzene, 1,1'-(2,2,2-trichloroethylidene)bis [4-methoxy-	BENZENETRICHLOROETHYLIDENE)BIS [4-METHOXY-	72435		1	U247
Benzidine	BENZIDINE	92875		1	U021
Benzimidazole, 4,5-dichloro-2-(trifluoromethyl)-	BENZIMIDAZOLE,4,5-DICHLORO-2-(TRIFLUOROMETHYL)-	3615212	500		
Benzo[b]fluoranthene	BENZOFLUORANTHENE	205992		1	
Benzo(j)fluoranthene	BENZOFLUORANTHENEJ	205823			
Benzo(k)fluoranthene	BENZOFLUORANTHENEK	207089		5,000	
Benzoic acid	BENZOICACID	65850		5,000	
Benzoic acid, 3-amino-2,5-dichloro-	BENZOICACIDAMINODICHLORO-	133904		100	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Benzoic acid, 5-(2-chloro-4-(trifluoromethyl)phenoxy)-2-nitro-, 2-ethoxy-1-methyl-2-oxethyl ester	Benzoicacidchlorotrifluoromethylphenoxynitroethocymethyloxethyl ester	77501634			
Benzoic trichloride	BENZOICTRICHLORIDE	98077	10	10	U023
Benzonitrile	BENZONITRILE	100470		5,000	
Benzo(rst)pentaphene	BENZOPENTAPHENE	189559		10	U064
Benzo[g,h,i]perylene	BENZOPERYLENE	191242		5,000	
Benzo(a)phenanthrene	BENZOPHENANTHRENE	218019		100	U050
Benzo[a]pyrene	BENZOPYRENE	50328		1	U022
p-Benzoquinone	BENZOQUINONE	106514		10	U197
Benzotrichloride	BENZOTRICHLORIDE	98077	10	10	U023
Benzoyl chloride	BENZOYLCHLORIDE	98884		1,000	
Benzoyl peroxide	BENZOYLPEROXIDE	94360			
Benzyl chloride	BENZYLCHLORIDE	100447	100	100	P028
Benzyl cyanide	BENZYLCYANIDE	140294	500		
Beryllium	BERYLLIUM	7440417		10	P015
Beryllium chloride	BERYLLIUM CHLORIDE	7787475		1	
Beryllium Compounds	BERYLLIUM COMPOUNDS	N050		***	
Beryllium fluoride	BERYLLIUM FLUORIDE	7787497		1	
Beryllium nitrate	BERYLLIUM NITRATE	7787555		1	
Beryllium nitrate	BERYLLIUM NITRATE	13597994		1	
alpha-BHC	BHC	319846		10	
beta-BHC	BHC	319857		1	
delta-BHC	BHC	319868		1	
Bicyclo[2.2.1]heptane-2-carbonitrile, 5-chloro-6-((((methylamino)carbonyl)oxy)imino)-,(1-alpha,2-beta,4-alpha,5-alpha,6E))-	BICYCLO[2.2.1]HEPTANE-2-CARBONITRILE, 5-CHLORO-6-(	15271417	500		
Bifenthrin	BIFENTHRIN	82657043			
2,2'-Bioxirane	BIOXIRANE	1464535	10	10	U085
Biphenyl	BIPHENYL	92524		100	
Bis(2-chloroethoxy) methane	BISCHLOROETHOXYMETHANE	111911		1,000	U024
Bis(2-chloroethyl) ether	BISCHLOROETHYLETHER	111444	10	10	U025
Bis(chloromethyl) ether	BISCHLOROMETHYLETHER	542881	10	10	P016
Bis(2-chloro-1-methylethyl)ether	BISCHLOROMETHYLETHYL	108601		1,000	U027
Bis(chloromethyl) ketone	BISCHLOROMETHYLKETONE	534076	10		
Bis(2-ethylhexyl)phthalate	BISETHYLHEXYLPHTHALATE	117817		100	U028

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
N,N'-Bis(1-methylethyl)-6-methylthio-1,3,5-triazine-2,4-diamine	BISMETHYLETHYLMETHYLTHIOTRIAZINEDIA	7287196			
1,3-Bis(methylisocyanate)cyclohexane	BISMETHYLISOCYANATECYCLOHEXANE	38661722			
1,4-Bis(methylisocyanate)cyclohexane	BISMETHYLISOCYANATECYCLOHEXANE	10347543			
Bis(tributyltin) oxide	BISTRIBUTYLTIN) OXIDE	56359			
Bitoscanate	BITOSCANATE	4044659	500		
Borane, trichloro-	BORANETRICHLORO-	10294345	500		
Borane, trifluoro-	BORANETRIFLUORO-	7637072	500		
Boron trichloride	BORON TRICHLORIDE	10294345	500		
Boron trifluoride	BORON TRIFLUORIDE	7637072	500		
Boron trifluoride compound with methyl ether (1:1)	BORON TRIFLUORIDE COMPOUND WITH METHYL ETHER (1:1)	353424	1,000		
Boron, trifluoro[oxybis[methane]]-, (T-4)-	BORONTRIFLUORO[OXYBIS[METHANE]]-, (T-4)-	353424	1,000		
Bromacil	BROMACIL	314409			
Bromacil, lithium salt	BROMACIL, LITHIUM SALT	53404196			
Bromadiolone	BROMADIOLONE	28772567	100		
Bromine	BROMINE	7726956	500		
Bromoacetone	BROMOACETONE	598312		1,000	P017
1-Bromo-1-(bromomethyl)-1,3-propanedicarbonitrile	BROMOBROMOMETHYL)-1,3-PROPANEDICARBONITRILE	35691657			
Bromochlorodifluoromethane	BROMOCHLORODIFLUOROMETHANE	353593			
O-(4-Bromo-2-chlorophenyl)-O-ethyl-S-propylphosphorothioate	BROMOCHLOROPHENYLETHYLPROPYLPHOSPHOROTHIOATE	41198087			
Bromoform	BROMOFORM	75252		100	U225
Bromomethane	BROMOMETHANE	74839	1,000	1,000	U029
5-Bromo-6-methyl-3-(1-methylpropyl)-2,4-(1H,3H)-pyrimidinedione	BROMOMETHYLMETHYLPROPYLPYRIMIDINEDI	314409			
4-Bromophenyl phenyl ether	BROMOPHENYL PHENYL ETHER	101553		100	U030
Bromotrifluoroethylene	BROMOTRIFLUOROETHYLEN	598732			
Bromotrifluoromethane	BROMOTRIFLUOROMETHANE	75638			
Bromoxynil	BROMOXYNIL	1689845			
Bromoxynil octanoate	BROMOXYNIL OCTANOATE	1689992			
Brucine	BRUCINE	357573		100	P018
1,3-Butadiene	BUTADIENE	106990		10	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
1,3-Butadiene, 2-methyl-	BUTADIENEMETHYL	78795		100	
Butane	BUTANE	106978			
Butane, 2-methyl-	BUTANEMETHYL-	78784			
2-Butenal	BUTENAL	4170303	100	100	U053
2-Butenal, (e)-	BUTENAL, (E)-	123739	100	100	U053
Butene	BUTENE	25167673			
1-Butene	BUTENE1	106989			
2-Butene	BUTENE2	107017			
2-Butene-cis	BUTENE-CIS	590181			
2-Butene, 1,4-dichloro-	BUTENEDICHLORO-	764410		1	U074
2-Butene, (E)	BUTENE-E	624646			
2-Butene-trans	BUTENE-TRANS	624646			
1-Buten-3-yne	BUTENYNE	689974			
2,4-D butoxyethyl ester	BUTOXYETHYL ESTER-2,4-D	1929733		100	
Butyl acetate	BUTYLACETATE	123864		5,000	
iso-Butyl acetate	BUTYLACETATE-I	110190		5,000	
sec-Butyl acetate	BUTYLACETATE-S	105464		5,000	
tert-Butyl acetate	BUTYLACETATE-T	540885		5,000	
Butyl acrylate	BUTYLACRYLATE	141322			
n-Butyl alcohol	BUTYLALCOHOLA	71363		5,000	U031
sec-Butyl alcohol	BUTYLALCOHOLB	78922			
tert-Butyl alcohol	BUTYLALCOHOLC	75650			
Butylamine	BUTYLAMINE	109739		1,000	
iso-Butylamine	BUTYLAMINE-I	78819		1,000	
sec-Butylamine	BUTYLAMINE-S	513495		1,000	
sec-Butylamine	BUTYLAMINE-S	13952846		1,000	
tert-Butylamine	BUTYLAMINE-T	75649		1,000	
Butyl benzyl phthalate	BUTYLBENZYLPHTHALA	85687		100	
.alpha.-Butyl-.alpha.-(4-chlorophenyl)-1H-1,2,4-triazole-1-propanenitrile	BUTYLCHLOROPHENYLTRIAZOLE-1-P	88671890			
1,2-Butylene oxide	BUTYLENEOXIDE	106887		100	
Butylethylcarbamothioic acid S-propyl ester	BUTYLETHYLCARBAMOTHIOICACIDPROPYLESTER	1114712			
N-Butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl) benzenamine	BUTYLETHYLDINITROTRIFLUOROMETHYLBENZENAMINE	1861401			
n-Butyl phthalate	BUTYLPHTHALATE	84742		10	U069
1-Butyne	BUTYNE	107006			
Butyraldehyde	BUTYRALDEHYDE	123728			

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Butyric acid	BUTYRIC ACID	107926		5,000	
iso-Butyric acid	BUTYRIC ACIDISO	79312		5,000	
Cacodylic acid	CACODYLIC ACID	75605		1	U136
Cadmium	CADMIUM	7440439		10	
Cadmium acetate	CADMIUM ACETATE	543908		10	
Cadmium bromide	CADMIUM BROMIDE	7789426		10	
Cadmium chloride	CADMIUM CHLORIDE	10108642		10	
Cadmium Compounds	CADMIUM COMPOUNDS	N078		***	
Cadmium oxide	CADMIUM OXIDE	1306190	100		
Cadmium stearate	CADMIUM STEARATE	2223930	1,000		
Calcium arsenate	CALCIUMARSENATE	7778441	1	1	
Calcium arsenite	CALCIUMARSENITE	52740166		1	
Calcium carbide	CALCIUMCARBIDE	75207		10	
Calcium chromate	CALCIUMCHROMATE	13765190		10	U032
Calcium cyanamide	CALCIUMCYANAMIDE	156627		1,000	
Calcium cyanide	CALCIUMCYANIDE	592018		10	P021
Calcium dodecylbenzenesulfonate	CALCIUMDODECYLBENZENESULFONATE	26264062		1,000	
Calcium hypochlorite	CALCIUMHYPOCHLORITE	7778543		10	
Camphechlor	CAMPHECHLOR	8001352	1	1	P123
Camphene, octachloro-	CAMPHENE, OCTACHLORO-	8001352	1	1	P123
Cantharidin	CANTHARIDIN	56257	100		
Captan	CAPTAN	133062		10	
Carbachol chloride	CARBACHOL CHLORIDE	51832	500		
Carbamic acid, diethylthio-, S-(p-chlorobenzyl)	CARBAMIC ACIDDIETHYLTHIOCHLOROBENZYL)	28249776			
Carbamic acid, ethyl ester	CARBAMIC ACIDETHYL ESTER	51796		100	U238
Carbamic acid, methyl-, O-(((2,4-dimethyl-1,3-dithiolan-2-yl)methylene)amino)-	CARBAMIC ACIDMETHYL-, O-(((2,4-DIMETHYL-1, 3-DIT	26419738	100	100	P185
Carbamodithioic acid, 1,2-ethanediylbis-, manganese complex	CARBAMODITHIOICACIDETHANEDIYLBIS-, MANGANESE COMPLEX	12427382			
Carbamodithioic acid, 1,2-ethanediylbis-, zinc complex	CARBAMODITHIOICACIDETHANEDIYLBIS-, ZINC COMPLEX	12122677			
Carbamothioic acid, bis(1-methylethyl)-S-(2,3-dichloro-2-propenyl)ester	CARBAMOTHIOIC ACID, BIS(1-METHYLETHYL)-S-(2,3-DICHLORO-	2303164		100	U062
Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester	CARBAMOTHIOICACIDDIPROPYL-, S-(PHENYLMETHYL) ES	52888809		5,000	U387

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Carbaryl	CARBARYL	63252		100	U279
Carbendazim	CARBENDAZIM	10605217		10	U372
Carbofuran	CARBOFURAN	1563662	10	10	P127
Carbofuran phenol	CARBOFURANPHENOL	1563388		10	U367
Carbon disulfide	CARBONDISULFIDE	75150	100	100	P022
Carbonic difluoride	CARBONIC DIFLUORIDE	353504		1,000	U033
Carbonic dichloride	CARBONICDICHLORIDE	75445	10	10	P095
Carbonochloridic acid, methylester	CARBONOCHLORIDICACIDMETHYLESTER	79221	1,000	1,000	U156
Carbonochloridic acid, 1-methylethyl ester	CARBONOCHLORIDICACIDMETHYLETHYL ESTER	108236	1,000		
Carbonochloridic acid, propylester	CARBONOCHLORIDICACIDPROPYLESTER	109615	500		
Carbon oxide sulfide (COS)	CARBONOXIDESULFIDE	463581		100	
Carbon tetrachloride	CARBONTETRACHLORIDE	56235		10	U211
Carbonyl sulfide	CARBONYLSULFIDE	463581		100	
Carbophenothion	CARBOPHENOTHION	786196	500		
Carbosulfan	CARBOSULFAN	55285148		1,000	P189
Carboxin	CARBOXIN	5234684			
Catechol	CATECHOL	120809		100	
CFC-11	CFC-11	75694		5,000	U121
CFC-12	CFC-112	75718		5,000	U075
CFC-114	CFC-114	76142			
CFC-115	CFC-115	76153			
CFC-13	CFC-13	75729			
Chinomethionat	CHINOMETHIONAT	2439012			
Chloramben	CHLORAMBEN	133904		100	
Chlorambucil	CHLORAMBUCIL	305033		10	U035
Chlordane	CHLORDANE	57749	1	1	U036
Chlordane (Technical Mixture and Metabolites)	CHLORDANE (TECHNICAL MIXTURE AND METABOLITES)	0		***	
Chlorendic acid	CHLORENDIC ACID	115286			
Chlorfenvinfos	CHLORFENVINFOS	470906	500		
Chlorimuron ethyl	CHLORIMURON ETHYL	90982324			
Chlorinated Benzenes	CHLORINATED BENZENES	0		***	
Chlorinated Ethanes	CHLORINATED ETHANES	0		***	
Chlorinated Naphthalene	CHLORINATED NAPHTHALENE	0		***	
Chlorinated Phenols	CHLORINATED PHENOLS	N084		***	
Chlorine	CHLORINE	7782505	10	10	
Chlorine dioxide	CHLORINEDIOXIDE	10049044			

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Chlorine monoxide	CHLORINEMONOXIDE	7791211			
Chlorine oxide	CHLORINEOXIDE	7791211			
Chlorine oxide (ClO2)	CHLORINEOXIDE (CLO2)	10049044			
Chlormephos	CHLORMEPHOS	24934916	500		
Chlormequat chloride	CHLORMEQUAT CHLORIDE	999815	100		
Chlornaphazine	CHLORNAPHAZINE	494031		100	U026
Chloroacetaldehyde	CHLOROACETALDEHYDE	107200		1,000	P023
Chloroacetic acid	CHLOROACETICACID	79118	100	100	
2-Chloroacetophenone	CHLOROACETOPHENONE	532274		100	
Chloroalkyl Ethers	CHLOROALKYL ETHERS	0		***	
1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride	CHLOROALLYLTRIAZA-1-AZONIAADAMANTANE CHLOR	4080313			
p-Chloroaniline	CHLOROANILINE	106478		1,000	P024
Chlorobenzene	CHLOROBENZENE	108907		100	U037
Chlorobenzilate	CHLOROBENZILATE	510156		10	U038
2-(4-((6-Chloro-2-benzoxazolylen)oxy)phenoxy)propanoic acid, ethyl ester	CHLOROBENZOXAZOLYLENOXYPHENOXYPROPANOICACID,	66441234			
2-Chloro-N-(2-chloroethyl)-N-methylethanamine	CHLOROCHLOROETHYL)-N-METHYLETHANAMINE	51752	10		
p-Chloro-m-cresol	CHLOROCRESOL	59507		5,000	U039
2,4-D chlorocrotyl ester	CHLOROCROTYL ESTER	2971382		100	
Chlorodibromomethane	CHLORODIBROMOMETHANE	124481		100	
1-Chloro-1,1-difluoroethane	CHLORODIFLUOROETHANE	75683			
Chlorodifluoromethane	CHLORODIFLUOROMETHANE	75456			
5-Chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione	CHLORODIMETHYLETHYLMETHYLPYRIMIDIN	5902512			
Chloroethane	CHLOROETHANE	75003		100	
Chloroethanol	CHLOROETHANOL	107073	500		
Chloroethyl chloroformate	CHLOROETHYLCHLOROFORMATE	627112	1,000		
6-Chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine	CHLOROETHYLMETHYLETHYL)-1,3,5-TRIAZINE-2,4-DIAMI	1912249			
2-Chloroethyl vinyl ether	CHLOROETHYLVINYL ETHER	110758		1,000	U042
Chloroform	CHLOROFORM	67663	10	10	U044
Chloromethane	CHLOROMETHANE	74873		100	U045

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
2-Chloro-N-(((4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl)benzenesulfonamide	CHLOROMETHOXYMETHYLTRIAZINYLAMINO]CA	64902723			
4-Chloro-5-(methylamino)-2-[3-(trifluoromethyl)phenyl]-3(2H)-pyridazinone	CHLOROMETHYLAMINOTRIFLUOROMETHYLPHENYL]-3(2H)	27314132			
Chloromethyl ether	CHLOROMETHYLETHER	542881	10	10	P016
4-Chloro-alpha-(1-methylethyl)benzeneacetic acid cyano(3-phenoxyphenyl)methyl ester	CHLOROMETHYLETHYLBENZENEACETICACIDCYANOPHE	51630581			
2-Chloro-N-(1-methylethyl)-N-phenylacetamide	CHLOROMETHYLETHYLPHENYLACETAMIDE	1918167			
Chloromethyl methyl ether	CHLOROMETHYLMETHYLETHER	107302	10	10	U046
(4-Chloro-2-methylphenoxy) acetate sodium salt	CHLOROMETHYLPHENOXYACETATESODIUMSALT	3653483			
(4-Chloro-2-methylphenoxy) acetic acid	CHLOROMETHYLPHENOXYACETICACID	94746			
3-Chloro-2-methyl-1-propene	CHLOROMETHYLPROPENE	563473			
2-Chloronaphthalene	CHLORONAPHTHALENE	91587		5,000	U047
Chlorophacinone	CHLOROPHACINONE	3691358	100		
2-Chlorophenol	CHLOROPHENOL	95578		100	U048
Chlorophenols	CHLOROPHENOLS	N084		***	
1-(4-Chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone	CHLOROPHENOXYDIMETHYLTRIAZOLYL	43121433			
.alpha.-(2-Chlorophenyl)-.alpha.-4-chlorophenyl)-5-pyrimidinemethanol	CHLOROPHENYLCHLOROPHENYLPYRIMIDIN	60168889			
p-Chlorophenyl isocyanate	CHLOROPHENYLISOCYANATE	104121			
4-Chlorophenyl phenyl ether	CHLOROPHENYLPHENYLETHER	7005723		5,000	
Chloropicrin	CHLOROPICRIN	76062			
Chloroprene	CHLOROPRENE	126998		100	
3-Chloropropionitrile	CHLOROPROPIONITRILE	542767	1,000	1,000	P027
1-Chloropropylene	CHLOROPROPYLENE	590216			
2-Chloropropylene	CHLOROPROPYLENE	557982			

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
2-(4-((6-Chloro-2-quinoxalinyl)oxy]phenoxy) propanoic acid ethyl ester	CHLOROQUINOXALINYLOXYPHENOXYPROPANOIC ACID E	76578148			
Chlorosulfonic acid	CHLOROSULFONIC ACID	7790945		1,000	
Chlorotetrafluoroethane	CHLOROTETRAFLUOROETHANE	63938103			
1-Chloro-1,1,2,2-tetrafluoroethane	CHLOROTETRAFLUOROETHANE1	354256			
2-Chloro-1,1,1,2-tetrafluoroethane	CHLOROTETRAFLUOROETHANE2	2837890			
Chlorothalonil	CHLOROTHALONIL	1897456			
p-Chloro-o-toluidine	CHLOROTOLUIDINE	95692			
4-Chloro-o-toluidine, hydrochloride	CHLOROTOLUIDINE, HYDROCHLORIDE	3165933		100	U049
2-Chloro-6-(trichloromethyl)pyridine	CHLOROTRICHLOROMETHYLPYRIDINE	1929824			
2-Chloro-1,1,1-trifluoroethane	CHLOROTRIFLUOROETHANE (HCFC-133A)	75887			
Chlorotrifluoromethane	CHLOROTRIFLUOROMETHANE	75729			
5-(2-Chloro-4-(trifluoromethyl)phenoxy)-2-nitrobenzoic acid, sodium salt	CHLOROTRIFLUOROMETHYLPHENOXY)-2-NITROBENZOIC ACID,	62476599			
5-(2-Chloro-4-(trifluoromethyl)phenoxy)-N-methylsulfonyl)-2-nitrobenzamide	CHLOROTRIFLUOROMETHYLPHENOXYMETHYLSULFONYL)-2-	72178020			
5-(2-Chloro-4-(trifluoromethyl)phenoxy)-2-nitro-2-ethoxy-1-methyl-2-oxoethyl ester	CHLOROTRIFLUOROMETHYLPHENOXYNITROETHOXYM	77501634			
N-(2-Chloro-4-(trifluoromethyl)phenyl)-DL-valine(+)-cyano(3-phenoxyphenyl)methyl ester	CHLOROTRIFLUOROMETHYLPHENYLVALINE(+)-CYANO(3-	69409945			
3-Chloro-1,1,1-trifluoropropane	CHLOROTRIFLUOROPROPANE (HCFC-253FB)	460355			
3-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylic acid cyano(3-phenoxyphenyl) methyl ester	CHLOROTRIFLUOROPROPENYLDIMETHYLCYCLOPRO	68085858			
Chloroxuron	CHLOROXURON	1982474	500		
Chlorpyrifos	CHLORPYRIFOS	2921882		1	
Chlorpyrifos methyl	CHLORPYRIFOSMETHYL	5598130			
Chlorsulfuron	CHLORSULFURON	64902723			
Chlorthiophos	CHLORTHIOPHOS	21923239	500		

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Chromic acetate	CHROMIC ACETATE	1066304		1,000	
Chromic acid	CHROMIC ACID	7738945		10	
Chromic acid	CHROMIC ACID	11115745		10	
Chromic chloride	CHROMIC CHLORIDE	10025737	1		
Chromic sulfate	CHROMIC SULFATE	10101538		1,000	
Chromium	CHROMIUM	7440473		5,000	
Chromium Compounds	CHROMIUM AND COMPOUNDS	N090		***	
Chromous chloride	CHROMOUS CHLORIDE	10049055		1,000	
d-trans-Chrysanthemic acid of d-allethrone	CHRYSANTHEMICACID OF D-ALLETHRONE	28057489			
Chrysene	CHRYSENE	218019		100	U050
C.I. Acid Green 3	CIACIDGREEN3	4680788			
C.I. Acid Red 114	CIACIDRED114	6459945			
C.I. Basic Green 4	CIBASICGREEN4	569642			
C.I. Basic Red 1	CIBASICRED1	989388			
C.I. Direct Black 38	CIDIRECTBLACK38	1937377			
C.I. Direct Blue 218	CIDIRECTBLUE218	28407376			
C.I. Direct Blue 6	CIDIRECTBLUE6	2602462			
C.I. Direct Brown 95	CIDIRECTBROWN95	16071866			
C.I. Disperse Yellow 3	CIDISPERSEYELLOW	2832408			
C.I. Food Red 5	CIFOODRED05	3761533			
C.I. Food Red 15	CIFOODRED15	81889			
C.I. Solvent Orange 7	CISOLVENTORANGE	3118976			
C.I. Solvent Yellow 3	CISOLVENTYELLOWA	97563			
C.I. Solvent Yellow 14	CISOLVENTYELLOWB	842079			
C.I. Solvent Yellow 34	CISOLVENTYELLOWC	492808		100	U014
C.I. Vat Yellow 4	CIVATYELLOW4	128665			
Cobalt	COBALT	7440484			
Cobalt carbonyl	COBALT CARBONYL	10210681	10		
Cobalt Compounds	COBALT COMPOUNDS	N096		***	
Cobalt, ((2,2'-(1,2-ethanediylbis(nitrilomethylidyne))bis(6-fluorophenylato))(2-)-N,N',O,O')-	COBALT, ((2,2'-(1,2-ETHANEDIYLBIS (NITRILOMETHYLID	62207765	100		
Cobaltous bromide	COBALTOUS BROMIDE	7789437		1,000	
Cobaltous formate	COBALTOUS FORMATE	544183		1,000	
Cobaltous sulfamate	COBALTOUS SULFAMATE	14017415		1,000	
Coke Oven Emissions	COKE OVEN EMISSIONS	0		1	
Colchicine	COLCHICINE	64868	10		

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Copper	COPPER	7440508		5,000	
Copper Compounds	COPPER COMPOUNDS	N100		***	
--Except copper phthalocyanine compounds (under 313)	COPPER COMPOUNDS EXCEPTION1	0			
--Except C.I. Pigment Blue 15 (under 313)	COPPER COMPOUNDS EXCEPTION2	0			
--Except C.I. Pigment Green 7 (under 313)	COPPER COMPOUNDS EXCEPTION3	0			
--Except C.I. Pigment Green 36 (under 313)	COPPER COMPOUNDS EXCEPTION4	0			
Copper cyanide	COPPER CYANIDE	544923		10	P029
Coumaphos	COUMAPHOS	56724	10	10	
Coumatetralyl	COUMATETRALYL	5836293	500		
Creosote	CREOSOTE	8001589		1	U051
p-Cresidine	CRESIDINE	120718			
m-Cresol	CRESOLA	108394		100	U052
o-Cresol	CRESOLB	95487	100	100	U052
p-Cresol	CRESOLC	106445		100	U052
Cresol (mixed isomers)	CRESOLMIXEDISOMER	1319773		100	U052
Crimidine	CRIMIDINE	535897	100		
Crotonaldehyde	CROTONALDEHYDE	4170303	100	100	U053
Crotonaldehyde, (E)-	CROTONALDEHYDE, (E)-	123739	100	100	U053
Cumene	CUMENE	98828		5,000	U055
Cumene hydroperoxide	CUMENEHYDROPEROXIDE	80159		10	U096
Cupferron	CUPFERRON	135206			
Cupric acetate	CUPRIC ACETATE	142712		100	
Cupric acetoarsenite	CUPRIC ACETOARSENITE	12002038	1	1	
Cupric chloride	CUPRIC CHLORIDE	7447394		10	
Cupric nitrate	CUPRIC NITRATE	3251238		100	
Cupric oxalate	CUPRIC OXALATE	5893663		100	
Cupric sulfate	CUPRIC SULFATE	7758987		10	
Cupric sulfate, ammoniated	CUPRIC SULFATE, AMMONIATED	10380297		100	
Cupric tartrate	CUPRIC TARTRATE	815827		100	
Cyanazine	CYANAZINE	21725462			
Cyanide Compounds	CYANIDE COMPOUNDS	N106		***	
Cyanides (soluble salts and complexes)	CYANIDES (SOLUBLE SALTS AND COMPLEXES) NOT OTHERWI	57125		10	P030
Cyanogen	CYANOGEN	460195		100	P031
Cyanogen bromide	CYANOGENBROMIDE	506683	1,000	1,000	U246

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Cyanogen chloride	CYANOGENCHLORIDE	506774		10	P033
Cyanogen chloride ((CN)Cl)	CYANOGENCHLORIDE ((CN)CL)	506774		10	P033
Cyanogen iodide	CYANOGENIODIDE	506785	1,000		
Cyanophos	CYANOPHOS	2636262	1,000		
Cyanuric fluoride	CYANURICFLUORIDE	675149	100		
Cycloate	CYCLOATE	1134232			
2,5-Cyclohexadiene-1,4-dione, 2,3,5-tris(1-aziridinyl)-	CYCLOHEXADIENEDIONETRIS(1-AZIRIDINYL)-	68768			
Cyclohexanamine	CYCLOHEXANAMINE	108918	10,000		
Cyclohexane	CYCLOHEXANE	110827		1,000	U056
1,4-Cyclohexane diisocyanate	CYCLOHEXANEDIISOCYANATE	2556367			
Cyclohexane, 1,2,3,4,5,6-hexachloro-,(1.alpha.,2.alpha.,3.beta.,4.alpha.,5.alpha.,6.beta.)-	CYCLOHEXANEHEXACHLORO-,(1.ALPHA.,2.ALPHA.,3.BE	58899	1	1	U129
Cyclohexanol	CYCLOHEXANOL	108930			
Cyclohexanone	CYCLOHEXANONE	108941		5,000	U057
Cycloheximide	CYCLOHEXIMIDE	66819	100		
Cyclohexylamine	CYCLOHEXYLAMINE	108918	10,000		
2-Cyclohexyl-4,6-dinitrophenol	CYCLOHEXYLDINITROPHENOL	131895		100	P034
Cyclophosphamide	CYCLOPHOSPHAMIDE	50180		10	U058
Cyclopropane	CYCLOPROPANE	75194			
Cyfluthrin	CYFLUTHRIN	68359375			
Cyhalothrin	CYHALOTHRIN	68085858			
2,4-D	D	94757		100	U240
2,4-D Acid	D ACID	94757		100	U240
2,4-D butyl ester	D BUTYL ESTER	94804		100	
2,4-D Esters	D ESTERS	94111		100	
2,4-D Esters	D ESTERS	94791		100	
2,4-D Esters	D ESTERS	94804		100	
2,4-D Esters	D ESTERS	1320189		100	
2,4-D Esters	D ESTERS	1928387		100	
2,4-D Esters	D ESTERS	1928616		100	
2,4-D Esters	D ESTERS	1929733		100	
2,4-D Esters	D ESTERS	2971382		100	
2,4-D Esters	D ESTERS	25168267		100	
2,4-D Esters	D ESTERS	53467111		100	
2,4-D isopropyl ester	D ISOPROPYL ESTER	94111		100	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
2,4-D propylene glycol butyl ether ester	D PROPYLENE GLYCOL BUTYL ETHER ESTER	1320189		100	
2,4-D, salts and esters	D SALTS	94757		100	U240
Daunomycin	DAUNOMYCIN	20830813		10	U059
Dazomet	DAZOMET	533744			
Dazomet, sodium salt	DAZOMETSODIUM SALT	53404607			
2,4-DB	DB	94826			
DBCP	DBCP	96128		1	U066
DDD	DDD	72548		1	U060
DDE	DDE	72559		1	
DDE	DDE	3547044		5,000	
DDT	DDT	50293		1	U061
DDT and Metabolites	DDT AND METABOLITES	0		***	
Decaborane(14)	DECABORANE(14)	17702419	500		
Decabromodiphenyl oxide	DECABROMODIPHENYLOX	1163195			
DEF	DEF	78488			
DEHP	DEHP	117817		100	U028
Demeton	DEMETON	8065483	500		
Demeton-S-methyl	DEMETON-S-METHYL	919868	500		
Desmedipham	DESMEDIPHAM	13684565			
2,4-D 2-ethylhexyl ester	DETHYLHEXYL ESTER	1928434			
2,4-D 2-ethyl-4-methylpentyl ester	DETHYLMETHYLPENTYL ESTER	53404378			
Dialifor	DIALIFOR	10311849	100		
Diallate	DIALLATE	2303164		100	U062
2,4-Diaminoanisole	DIAMINOANISOLE	615054			
2,4-Diaminoanisole sulfate	DIAMINOANISOLESULF	39156417			
4,4'-Diaminodiphenyl ether	DIAMINODIPHENYL	101804			
Diaminotoluene	DIAMINOTOLUENE	496720		10	U221
Diaminotoluene	DIAMINOTOLUENE	823405		10	U221
2,4-Diaminotoluene	DIAMINOTOLUENEA	95807		10	
Diaminotoluene (mixed isomers)	DIAMINOTOLUENEMIXE	25376458		10	U221
o-Dianisidine dihydrochloride	DIANISIDINEDIHYDROCHLORIDE	20325400			
o-Dianisidine hydrochloride	DIANISIDINEHYDROCHLORIDE	111984099			
Diazinon	DIAZINON	333415		1	
Diazomethane	DIAZOMETHANE	334883		100	
Dibenz(a,h)acridine	DIBENZACRIDINEAH	226368			
Dibenz(a,j)acridine	DIBENZACRIDINEAJ	224420			
Dibenz[a,h]anthracene	DIBENZANTHRACENE	53703		1	U063
7H-Dibenzo(c,g)carbazole	DIBENZOCARBAZOLECG	194592			

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Dibenzo(a,e)fluoranthene	DIBENZOFLUORANTHENEAE	5385751			
Dibenzofuran	DIBENZOFURAN	132649		100	
Dibenzo(a,e)pyrene	DIBENZOPYRENEAE	192654			
Dibenzo(a,h)pyrene	DIBENZOPYRENEAH	189640			
Dibenzo(a,l)pyrene	DIBENZOPYRENEAL	191300			
Dibenz[a,i]pyrene	DIBENZPYRENEAI	189559		10	U064
Diborane	DIBORANE	19287457	100		
Diborane(6)	DIBORANE(6)	19287457	100		
1,2-Dibromo-3-chloropropane	DIBROMOCHLORO	96128		1	U066
1,2-Dibromoethane	DIBROMOETHANEE	106934		1	U067
3,5-Dibromo-4-hydroxybenzonitrile	DIBROMOHYDROXYBENZONITRILE	1689845			
2,2-Dibromo-3-nitrilopropionamide	DIBROMONITRILOPROPIONAMIDE	10222012			
Dibromotetrafluoroethane	DIBROMOTETRAFLUOROETHANE	124732			
Dibutyl phthalate	DIBUTYLPHTHALATE	84742		10	U069
Dicamba	DICAMBA	1918009		1,000	
Dichlobenil	DICHLOBENIL	1194656		100	
Dichlone	DICHLONE	117806		1	
Dichloran	DICHLORAN	99309			
Dichlorobenzene	DICHLOROBENZENE	25321226		100	
o-Dichlorobenzene	DICHLOROBENZENE	95501		100	U070
1,2-Dichlorobenzene	DICHLOROBENZENEA	95501		100	U070
1,3-Dichlorobenzene	DICHLOROBENZENEB	541731		100	U071
1,4-Dichlorobenzene	DICHLOROBENZENEC	106467		100	U072
Dichlorobenzene (mixed isomers)	DICHLOROBENZENEMIX	25321226		100	
3,3'-Dichlorobenzidine	DICHLOROBENZIDINE	91941		1	U073
Dichlorobenzidine	DICHLOROBENZIDINE	0		***	
3,3'-Dichlorobenzidine dihydrochloride	DICHLOROBENZIDINEDIHYDROCHLORIDE	612839			
3,3'-Dichlorobenzidine sulfate	DICHLOROBENZIDINESULFATE	64969342			
Dichlorobromomethane	DICHLOROBROMOMETHANE	75274		5,000	
trans-1,4-Dichloro-2-butene	DICHLOROBUTENE	110576	500		
trans-1,4-Dichlorobutene	DICHLOROBUTENE	110576	500		
1,4-Dichloro-2-butene	DICHLOROBUTENE2	764410		1	U074
4,6-Dichloro-N-(2-chlorophenyl)-1,3,5-triazin-2-amine	DICHLOROCHLOROPHENYLTRIAZIN-2-AMINE	101053			
1,2-Dichloro-1,1-difluoroethane	DICHLORODIFLUOROETHANE (HCFC-132B)	1649087			
Dichlorodifluoromethane	DICHLORODIFLUOROMETHANE	75718		5,000	U075
1,1-Dichloroethane	DICHLOROETHANE	75343		1,000	U076
1,2-Dichloroethane	DICHLOROETHANE	107062		100	U077

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3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropane carboxylic acid, (3-phenoxy-phenyl)methyl ester	DICHLOROETHENYLDIMETHYLCYCLOPROPANECARBOXYLI	52645531			
3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropanecarboxylic acid, cyano(4-fluoro-3-phenoxyphenyl)methyl ester	DICHLOROETHENYLDIMETHYLCYCLOPROPANECARBOXYLIC A	68359375			
1,1-Dichloroethylene	DICHLOROETHYLENE	75354		100	U078
1,2-Dichloroethylene	DICHLOROETHYLENE	156605		1,000	U079
1,2-Dichloroethylene	DICHLOROETHYLENE	540590			
Dichloroethyl ether	DICHLOROETHYLETHER	111444	10	10	U025
1,1-Dichloro-1-fluoroethane	DICHLOROFLUOROETHANE	1717006			
Dichlorofluoromethane	DICHLOROFLUOROMETHANE	75434			
Dichloroisopropyl ether	DICHLOROISOPROPYL ETHER	108601		1,000	U027
Dichloromethane	DICHLOROMETHANE	75092		1,000	U080
3,6-Dichloro-2-methoxybenzoic acid	DICHLOROMETHOXYBENZOICACID	1918009		1,000	
3,6-Dichloro-2-methoxybenzoic acid, sodium salt	DICHLOROMETHOXYBENZOICACIDSODIUM SALT	1982690			
Dichloromethyl ether	DICHLOROMETHYLETHER	542881	10	10	P016
3-(2,4-Dichloro-5-(1-methylethoxy)phenyl)-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one	DICHLOROMETHYLETHOXYPHENYLDIMETHYLETH	19666309			
Dichloromethylphenylsilane	DICHLOROMETHYLPHENYLSILANE	149746	1,000		
2,6-Dichloro-4-nitroaniline	DICHLORONITROANILINE	99309			
Dichloropentafluoropropane	DICHLOROPENTAFLUOROPROPANE	127564925			
2,2-Dichloro-1,1,1,3,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225AA)	128903219			
2,3-Dichloro-1,1,1,2,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225BA)	422480			
1,2-Dichloro-1,1,2,3,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225BB)	422446			
3,3-Dichloro-1,1,1,2,2-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225CA)	422560			
1,3-Dichloro-1,1,2,2,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225CB)	507551			

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1,1-Dichloro-1,2,2,3,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225CC)	13474889			
1,2-Dichloro-1,1,3,3,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225DA)	431867			
1,3-Dichloro-1,1,2,3,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225EA)	136013791			
1,1-Dichloro-1,2,3,3,3-pentafluoropropane	DICHLOROPENTAFLUOROPROPANE (HCFC-225EB)	111512562			
Dichlorophene	DICHLOROPHENE	97234			
2,4-Dichlorophenol	DICHLOROPHENOL	120832		100	U081
2,6-Dichlorophenol	DICHLOROPHENOL	87650		100	U082
2-(4-(2,4-Dichlorophenoxy)phenoxy)propanoic acid, methyl ester	DICHLOROPHENOXYPHENOXYPROPANOICACID METHYL EST	51338273			
Dichlorophenylarsine	DICHLOROPHENYLARSINE	696286	1	1	P036
3-(3,5-Dichlorophenyl)-5-ethenyl-5-methyl-2,4-oxazolidinedione	DICHLOROPHENYLETHENYLMETHYLOXAZOLIDINEDIO	50471448			
2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione	DICHLOROPHENYLMETHYLOXADIAZOLIDINEDIO	20354261			
N-(3,4-Dichlorophenyl)propanamide	DICHLOROPHENYLPROPANAMIDE	709988			
1-(2-(2,4-Dichlorophenyl)-2-(2-propenyloxy)ethyl)-1H-imidazole	DICHLOROPHENYLPROPENYLOXYETHYLIMIDAZO	35554440			
1-(2-(2,4-Dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl)-methyl-1H-1,2,4,-triazole	DICHLOROPHENYLPROPYLDIOXOLANYLMETHYL	60207901			
Dichloropropane	DICHLOROPROPANE	26638197		1,000	
Dichloropropane - Dichloropropene (mixture)	DICHLOROPROPANE - DICHLOROPROPENE (MIXTURE)	8003198		100	
1,1-Dichloropropane	DICHLOROPROPANE11	78999		1,000	
1,2-Dichloropropane	DICHLOROPROPANE12	78875		1,000	U083
1,3-Dichloropropane	DICHLOROPROPANE13	142289		5,000	
Dichloropropene	DICHLOROPROPENE	26952238		100	
1,3-Dichloropropene	DICHLOROPROPENE13	542756		100	U084
trans-1,3-Dichloropropene	DICHLOROPROPENE13T	10061026			
2,3-Dichloropropene	DICHLOROPROPENE23	78886		100	
2,2-Dichloropropionic acid	DICHLOROPROPIONIC ACID	75990		5,000	
1,3-Dichloropropylene	DICHLOROPROPYLEN	542756		100	U084
Dichlorosilane	DICHLOROSILANE	4109960			

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Dichlorotetrafluoroethane	DICHLOROTETRAFLUOROETHANE	76142			
Dichloro-1,1,2-trifluoroethane	DICHLOROTRIFLUOROETHANE	90454185			
Dichlorotrifluoroethane	DICHLOROTRIFLUOROETHANE	34077877			
1,1-Dichloro-1,2,2-trifluoroethane	DICHLOROTRIFLUOROETHANE11	812044			
1,2-Dichloro-1,1,2-trifluoroethane	DICHLOROTRIFLUOROETHANE12	354234			
2,2-Dichloro-1,1,1-trifluoroethane	DICHLOROTRIFLUOROETHANE22	306832			
Dichlorvos	DICHLORVOS	62737	10	10	
Diclofop methyl	DICLOFOPMETHYL	51338273			
Dicofol	DICOFOL	115322		10	
Dicrotophos	DICROTOPHOS	141662	100		
Dicyclopentadiene	DICYCLOPENTADIENE	77736			
Dieldrin	DIELDRIN	60571		1	P037
Diepoxybutane	DIEPOXYBUTANE	1464535	10	10	U085
Diethanolamine	DIETHANOLAMINE	111422		100	
Diethatyl ethyl	DIETHATYLETHYL	38727558			
Diethylamine	DIETHYLAMINE	109897		100	
O-(2-(Diethylamino)-6-methyl-4-pyrimidinyl)-O,O-dimethyl phosphorothioate	DIETHYLAMINOMETHYLPYRIMIDINYLDIMETHYLPHO	29232937			
N,N-Diethylaniline	DIETHYLANILINE	91667		1,000	
Diethylarsine	DIETHYLARSINE	692422		1	P038
Diethyl chlorophosphate	DIETHYLCHLOROPHOSPHATE	814493	500		
Diethyldiisocyanatobenzene	DIETHYLDIISOCYANATOBENZENE	134190377			
Di(2-ethylhexyl) phthalate	DIETHYLHEXYLPHT	117817		100	U028
O,O-Diethyl S-methyl dithiophosphate	DIETHYLMETHYLDITHIOPHOSPHATE	3288582		5,000	U087
Diethyl-p-nitrophenyl phosphate	DIETHYLNITROPHENYL PHOSPHATE	311455		100	P041
Diethyl phthalate	DIETHYLPHTHALATE	84662		1,000	U088
O,O-Diethyl O-pyrazinyl phosphorothioate	DIETHYLPYRAZINYL PHOSPHOROTHIOATE	297972	100	100	P040
Diethylstilbestrol	DIETHYLSTILBESTROL	56531		1	U089
Diethyl sulfate	DIETHYLSULFATE	64675		10	
Diflubenzuron	DIFLUBENZURON	35367385			
Difluoroethane	DIFLUOROETHANE	75376			
Digitoxin	DIGITOXIN	71636	100		
Diglycidyl ether	DIGLYCIDYL ETHER	2238075	1,000		
Diglycidyl resorcinol ether	DIGLYCIDYLRESORCINOL ETHER	101906			
Digoxin	DIGOXIN	20830755	10		

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2,3,-Dihydro-5,6-dimethyl-1,4-dithiin 1,1,4,4-tetraoxide	DIHYDRODIMETHYLDITHIINTETRAOXIDE	55290647			
5,6-Dihydro-2-methyl-N-phenyl-1,4-oxathiin-3-carboxamide	DIHYDROMETHYLPHENYLOXATHIINCARBOXAMIDE	5234684			
Dihydrosafrole	DIHYDROSAFROLE	94586		10	U090
Diisocyanates (includes only 20 chemicals)	DIISOCYANATES	N120			
4,4'-Diisocyanatodiphenyl ether	DIISOCYANATODIPHENYLETHER	4128738			
2,4'-Diisocyanatodiphenyl sulfide	DIISOCYANATODIPHENYLSULFIDE	75790873			
Diisopropylfluorophosphate	DIISOPROPYLFLUOROPHOSPHATE	55914	100	100	P043
Dimefox	DIMEFOX	115264	500		
1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-(1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-	DIMETHANONAPHTHALENEHEXACHLORO-1,4,4	309002	1	1	P004
Dimethipin	DIMETHIPIN	55290647			
Dimethoate	DIMETHOATE	60515	10	10	P044
3,3'-Dimethoxybenzidine	DIMETHOXYBENZID	119904		100	U091
3,3'-Dimethoxybenzidine dihydrochloride	DIMETHOXYBENZIDINEDIHYDROCHLORIDE	20325400			
3,3'-Dimethoxybenzidine-4,4'-diisocyanate	DIMETHOXYBENZIDINEDIISOCYANATE	91930			
3,3'-Dimethoxybenzidine hydrochloride	DIMETHOXYBENZIDINEHYDROCHLORIDE	111984099			
Dimethylamine	DIMETHYLAMINE	124403		1,000	U092
Dimethylamine dicamba	DIMETHYLAMINEDICAMBA	2300665			
4-Dimethylaminoazobenzene	DIMETHYLAMINOAZO	60117		10	U093
Dimethylaminoazobenzene	DIMETHYLAMINOAZOBENZENE	60117		10	U093
N,N-Dimethylaniline	DIMETHYLANILINE	121697		100	
7,12-Dimethylbenz[a]anthracene	DIMETHYLBENZAANTHRACENE	57976		1	U094
3,3'-Dimethylbenzidine	DIMETHYLBENZIDI	119937		10	U095
3,3'-Dimethylbenzidine dihydrochloride	DIMETHYLBENZIDINEDIHYDROCHLORIDE	612828			
3,3'-Dimethylbenzidine dihydrofluoride	DIMETHYLBENZIDINEDIHYDROFLUORIDE	41766750			
2,2-Dimethyl-1,3-benzodioxol-4-ol methylcarbamate	DIMETHYLBENZODIOXOLOL METHYLCARBAMATE	22781233		100	U278
Dimethylcarbamyl chloride	DIMETHYLCARBAMYL	79447		1	U097

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Dimethyl chlorothiophosphate	DIMETHYLCHLOROTHIOPHOSPHATE	2524030	500		
Dimethyldichlorosilane	DIMETHYLDICHLOROSILANE	75785	500		
3,3'-Dimethyl-4,4'-diphenylene diisocyanate	DIMETHYLDIPHENYLENEDIISOCYANATE	91974			
3,3'-Dimethyldiphenylmethane-4,4'-diisocyanate	DIMETHYLDIPHENYLMETHANEDIISOCYANATE	139253			
N-(5-(1,1-Dimethylethyl)-1,3,4-thiadiazol-2-yl)-N,N'-dimethylurea	DIMETHYLETHYLTHIADIAZOLYLDIMETHY	34014181			
Dimethylformamide	DIMETHYLFORMAMIDE	68122		100	
N,N-Dimethylformamide	DIMETHYLFORMAMIDE,N,N-	68122		100	
1,1-Dimethyl hydrazine	DIMETHYLHYDRAZI	57147	10	10	U098
Dimethylhydrazine	DIMETHYLHYDRAZINE	57147	10	10	U098
O,O-Dimethyl O-(3-methyl-4-(methylthio) phenyl) ester, phosphorothioic acid	DIMETHYLMETHYLMETHYLTHIOPHENYLESTERPHOSP	55389			
2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid (1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl ester	DIMETHYLMETHYLPROPENYLCYCLOPROPANECARBOXYLIC A	7696120			
2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid (3-phenoxyphenyl)methyl ester	DIMETHYLMETHYLPROPENYLCYCLOPROPANECARBOXYLIC A	26002802			
2,4-Dimethylphenol	DIMETHYLPHENOL	105679		100	U101
Dimethyl-p-phenylenediamine	DIMETHYLPHENYLENEDIAMINE	99989	10		
Dimethyl phosphorochloridothioate	DIMETHYLPHOSPHOROCHLORIDOTHIOATE	2524030	500		
Dimethyl phthalate	DIMETHYLPHTALATE	131113		5,000	U102
2,2-Dimethylpropane	DIMETHYLPROPANE	463821			
Dimethyl sulfate	DIMETHYLSULFATE	77781	100	100	U103
O,O-Dimethyl-O-(3,5,6-trichloro-2-pyridyl)phosphorothioate	DIMETHYLTRICHLOROPYRIDYLPHOSPHOROTHIOATE	5598130			
Dimetilan	DIMETILAN	644644	1	1	P191
Dinitrobenzene (mixed isomers)	DINITROBENZENE (MIXED)	25154545		100	
m-Dinitrobenzene	DINITROBENZENEM	99650		100	
o-Dinitrobenzene	DINITROBENZENEO	528290		100	
p-Dinitrobenzene	DINITROBENZENEP	100254		100	
Dinitrobutyl phenol	DINITROBUTYL PHENOL	88857	1,000	1,000	P020
4,6-Dinitro-o-cresol	DINITROCRESOL	534521	10	10	P047
Dinitrocresol	DINITROCRESOL	534521	10	10	P047

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4,6-Dinitro-o-cresol and salts	DINITROOCRESOL AND SALTS	534521		10	P047
Dinitrophenol	DINITROPHENOLA	25550587		10	
2,4-Dinitrophenol	DINITROPHENOLB	51285		10	P048
2,5-Dinitrophenol	DINITROPHENOLC	329715		10	
2,6-Dinitrophenol	DINITROPHENOLD	573568		10	
Dinitrotoluene (mixed isomers)	DINITROTOLUENEA	25321146		10	
2,4-Dinitrotoluene	DINITROTOLUENEB	121142		10	U105
2,6-Dinitrotoluene	DINITROTOLUENEC	606202		100	U106
3,4-Dinitrotoluene	DINITROTOLUENED	610399		10	
Dinocap	DINOCAP	39300453			
Dinoseb	DINOSEB	88857	1,000	1,000	P020
Dinoterb	DINOTERB	1420071	500		
Di-n-octyl phthalate	DIOCTYLPHTHALATE	117840		5,000	U107
n-Dioctylphthalate	DIOCTYLPHTHALATE	117840		5,000	U107
1,4-Dioxane	DIOXANE	123911		100	U108
Dioxathion	DIOXATHION	78342	500		
Dioxin and dioxin-like compounds (includes only 17 chemicals)	DIOXIN AND DIOXIN-LIKE COMPOUNDS	N150			
Diphacinone	DIPHACINONE	82666	10		
Diphenamid	DIPHENAMID	957517			
Diphenylamine	DIPHENYLAMINE	122394			
1,2-Diphenylhydrazine	DIPHENYLHYDRAZI	122667		10	U109
Diphenylhydrazine	DIPHENYLHYDRAZINE	0		***	
Diphosphoramide, octamethyl-	DIPHOSPHORAMIDE, OCTAMETHYL-	152169	100	100	P085
Dipotassium endothall	DIPOTASSIUMENDOTHALL	2164070			
Dipropylamine	DIPROPYLAMINE	142847		5,000	U110
4-(Dipropylamino)-3,5-dinitrobenzenesulfonamide	DIPROPYLAMINODINITROBENZENESULFONAMIDE	19044883			
Dipropyl isocinchomeronate	DIPROPYLISOCINCHOMERONATE	136458			
Di-n-propylnitrosamine	DIPROPYLNITROSAMINE	621647		10	U111
Diquat	DIQUAT	85007		1,000	
Diquat	DIQUAT	2764729		1,000	
Disodium cyanodithioimidocarbonate	DISODIUMCYANODITHIOIMIDOCARBONATE	138932			
Disulfoton	DISULFOTON	298044	1	1	P039
Dithiazanine iodide	DITHIAZANINE IODIDE	514738	500		
Dithiobiuret	DITHIOBIURET	541537	100	100	P049
2,4-Dithiobiuret	DITHIOBIURET-2,4	541537	100	100	P049
Diuron	DIURON	330541		100	

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Dodecylbenzenesulfonic acid	DODECYLBENZENESULFONIC ACID	27176870		1,000	
Dodecylguanidine monoacetate	DODECYLGUANIDINEMONOACETATE	2439103			
Dodine	DODINE	2439103			
2,4-DP	DP	120365			
2,4-D sodium salt	DSODIUM SALT	2702729			
Emetine, dihydrochloride	EMETINE, DIHYDROCHLORIDE	316427	1		
alpha - Endosulfan	ENDOSULFAN	959988		1	
beta - Endosulfan	ENDOSULFAN	33213659		1	
Endosulfan	ENDOSULFAN	115297	1	1	P050
Endosulfan and Metabolites	ENDOSULFAN AND METABOLITES	0		***	
Endosulfan sulfate	ENDOSULFAN SULFATE	1031078		1	
Endothall	ENDOTHALL	145733		1,000	P088
Endothion	ENDOTHION	2778043	500		
Endrin	ENDRIN	72208	1	1	P051
Endrin aldehyde	ENDRIN ALDEHYDE	7421934		1	
Endrin and Metabolites	ENDRIN AND METABOLITES	0		***	
Epichlorohydrin	EPICHLOROHYDRIN	106898	100	100	U041
Epinephrine	EPINEPHRINE	51434		1,000	P042
EPN	EPN	2104645	100		
EPTC	EPTC	759944			
Ergocalciferol	ERGOCALCIFEROL	50146	1,000		
Ergotamine tartrate	ERGOTAMINE TARTRATE	379793	500		
Ethanamine	ETHANAMINE	75047		100	
Ethane	ETHANE	74840			
Ethane, chloro-	ETHANECHLORO-	75003		100	
1,2-Ethanediamine	ETHANEDIAMINE	107153	5,000	5,000	
Ethane, 1,1-difluoro-	ETHANEDIFLUORO	75376			
Ethanedinitrile	ETHANEDINITRILE	460195		100	P031
Ethane, 1,1'-oxybis-	ETHANEOXYBIS-	60297		100	U117
Ethaneperoxoic acid	ETHANEPEROXOICACID	79210	500		
Ethanesulfonyl chloride, 2-chloro-	ETHANESULFONYL CHLORIDE, 2-CHLORO-	1622328	500		
Ethane, 1,1,1,2-tetrachloro-	ETHANETETRACHLORO-	630206		100	U208
Ethane, 1,1'-thiobis[2-chloro-	ETHANETHIOBISCHLORO-	505602	500		
Ethanethiol	ETHANETHIOL	75081			
Ethane, 1,1,2-trichloro-1,2,2,-trifluoro-	ETHANETRICHLOROTRIFLUORO-	76131			
Ethanimidothioic acid, 2-(dimethylamino)-N-hydroxy-2-oxo-, methyl ester	ETHANIMIDOTHIOICACIDDIMETHYLAMINO)-N-HYDROXY	30558431		5,000	U394

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Ethanimidothioic acid, N-[[methylamino)carbonyl]	ETHANIMIDOTHIOICACIDMETHYLAMINO)CARBONYL]	16752775	100	100	P066
Ethanol, 1,2-dichloro-, acetate	ETHANOLDICHLOROACETATE	10140871	1,000		
Ethanol, 2-ethoxy-	ETHANOLETHOXY	110805		1,000	U359
Ethanol, 2,2'-oxybis-, dicarbamate	ETHANOLOXYBISDICARBAMATE	5952261		5,000	U395
Ethene	ETHENE	74851			
Ethene, bromotrifluoro-	ETHENEBROMOTRIFLUORO	598732			
Ethene, chloro-	ETHENECHLORO-	75014		1	U043
Ethene, chlorotrifluoro-	ETHENECHLOROTRIFLU	79389			
Ethene, 1,1-dichloro-	ETHENEDICHLORO	75354		100	U078
Ethene, 1,1-difluoro-	ETHENEDIFLUORO	75387			
Ethene, ethoxy-	ETHENEETHOXY-	109922			
Ethene, fluoro-	ETHENEFLUORO-	75025			
Ethene, methoxy-	ETHENEMETHOXY-	107255			
Ethene, tetrafluoro-	ETHENETETRAFLUORO-	116143			
Ethion	ETHION	563122	10	10	
Ethoprop	ETHOPROP	13194484	1,000		
Ethoprophos	ETHOPROPHOS	13194484	1,000		
2-Ethoxyethanol	ETHOXYETHANOL	110805		1,000	U359
2-(1-(Ethoxyimino) butyl)-5-(2-(ethylthio)propyl)-3-hydroxyl-2-cyclohexen-1-one	ETHOXYIMINOBUTYLETHYLTHIOPROPYLHYDROXYL	74051802			
2-((Ethoxyl((1-methylethyl)amino]phosphinothioyl] oxy) benzoic acid 1-methylethyl ester	ETHOXYLMETHYLETHYLAMINOPHOSPHINOTHIOYLOXYBENZOI	25311711			
Ethyl acetate	ETHYLACETATE	141786		5,000	U112
Ethyl acetylene	ETHYLACETYLENE	107006			
Ethyl acrylate	ETHYLACRYLATE	140885		1,000	U113
3-((Ethylamino)methoxyphosphinothioyl)oxy)-2-butenoic acid, 1-methylethyl ester	ETHYLAMINOMETHOXYPHOSPHINOTHIOYLOXYBUTENOIC ACID,	31218834			
Ethylbenzene	ETHYLBENZENE	100414		1,000	
Ethylbis(2-chloroethyl)amine	ETHYLBISCHLOROETHYL)AMINE	538078	500		
Ethyl carbamate	ETHYLCARBAMATE	51796		100	U238
Ethyl chloride	ETHYLCHLORIDE	75003		100	
Ethyl chloroformate	ETHYLCHLOROFORMATE	541413			

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Ethyl-2-(((((4-chloro-6-methoxyprimidin-2-yl)amino)carbonyl)amino)sulfonyl)benzoate	ETHYLCHLOROMETHOXYPRIMIDINYLCARBONYLAMINO	90982324			
Ethyl cyanide	ETHYLCYANIDE	107120	10	10	P101
Ethyl dipropylthiocarbamate	ETHYLDIPROPYLTHIOCARBAMATE EPTC	759944			
Ethylene	ETHYLENE	74851			
Ethylenebisdithiocarbamic acid, salts and esters	ETHYLENEBISDITHIOCARBAMIC ACID SALTS AND ESTERS	N171			
Ethylenebisdithiocarbamic acid, salts & esters	ETHYLENEBISDITHIOCARBAMIC ACID, SALTS & ESTERS	111546		5,000	U114
Ethylenediamine	ETHYLENEDIAMINE	107153	5,000	5,000	
Ethylenediamine-tetraacetic acid (EDTA)	ETHYLENEDIAMINE-TETRAACETIC ACID (EDTA)	60004		5,000	
Ethylene dibromide	ETHYLENEDIBROMIDE	106934		1	U067
Ethylene dichloride	ETHYLENEDICHLORIDE	107062		100	U077
Ethylene fluorohydrin	ETHYLENEFLUOROHYDRIN	371620	10		
Ethylene glycol	ETHYLENEGLYCOL	107211		5,000	
Ethyleneimine	ETHYLENEIMINE	151564	1	1	P054
Ethylene oxide	ETHYLENEOXIDE	75218	10	10	U115
Ethylene thiourea	ETHYLENETHIOUREA	96457		10	U116
Ethyl ether	ETHYLETHER	60297		100	U117
Ethylidene Dichloride	ETHYLIDENEDICHLLORIDE	75343		1,000	U076
Ethyl mercaptan	ETHYLMERCAPTAN	75081			
Ethyl methacrylate	ETHYLMETHACRYLATE	97632		1,000	U118
Ethyl methanesulfonate	ETHYLMETHANESULFONATE	62500		1	U119
N-Ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5,-triazine-2,4-diamine	ETHYLMETHYLETHYLMETHYLTHIO)-1,3,5,-TRIAZINE-2,	834128			
O-Ethyl O-(4-(methylthio)phenyl)phosphorodithioic acid S-propyl ester	ETHYLMETHYLTHIOPHENYLPHOSPHORODITHIOIC ACID S-PRO	35400432			
Ethyl nitrite	ETHYLNITRITE	109955			
N-(1-Ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	ETHYLPROPYLDIMETHYLDINITROBENZENAMINE	40487421			
S-(2-(Ethylsulfinyl)ethyl) O,O-dimethyl ester phosphorothioic acid	ETHYLSULFINYLETHYLDIMETHYLESTERPHOSPHOROTHIOI	301122			
Ethylthiocyanate	ETHYLTHIOCYANATE	542905	10,000		

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Ethyne	ETHYNE	74862			
Famphur	FAMPHUR	52857		1,000	P097
Fenamiphos	FENAMIPHOS	22224926	10		
Fenarimol	FENARIMOL	60168889			
Fenbutatin oxide	FENBUTATINOXIDE	13356086			
Fenoxaprop ethyl	FENOXAPROPETHYL	66441234			
Fenoxycarb	FENOXYCARB	72490018			
Fenpropathrin	FENPROPATHRIN	39515418			
Fensulfothion	FENSULFOTHION	115902	500		
Fenthion	FENTHION	55389			
Fenvalerate	FENVALERATE	51630581			
Ferbam	FERBAM	14484641			
Ferric ammonium citrate	FERRICAMMONIUMCITRATE	1185575		1,000	
Ferric ammonium oxalate	FERRICAMMONIUMOXALATE	2944674		1,000	
Ferric ammonium oxalate	FERRICAMMONIUMOXALATE	55488874		1,000	
Ferric chloride	FERRICCHLORIDE	7705080		1,000	
Ferric fluoride	FERRICFLUORIDE	7783508		100	
Ferric nitrate	FERRICNITRATE	10421484		1,000	
Ferric sulfate	FERRICSULFATE	10028225		1,000	
Ferrous ammonium sulfate	FERROUSAMMONIUM SULFATE	10045893		1,000	
Ferrous chloride	FERROUSCHLORIDE	7758943		100	
Ferrous sulfate	FERROUSSULFATE	7720787		1,000	
Ferrous sulfate	FERROUSSULFATE	7782630		1,000	
Fine mineral fibers	FINEMINERALFIBERS	0		***	
Fluazifop butyl	FLUAZIFOPBUTYL	69806504			
Fluenetil	FLUENETIL	4301502	100		
Fluometuron	FLUOMETURON	2164172			
Fluoranthene	FLUORANTHENE	206440		100	U120
Fluorene	FLUORENE	86737		5,000	
Fluorine	FLUORINE	7782414	10	10	P056
Fluoroacetamide	FLUOROACETAMIDE	640197	100	100	P057
Fluoroacetic acid	FLUOROACETIC ACID	144490	10		
Fluoroacetic acid, sodium salt	FLUOROACETIC ACID, SODIUM SALT	62748	10	10	P058
Fluoroacetyl chloride	FLUOROACETYL CHLORIDE	359068	10		
Fluorouracil	FLUOROURACIL	51218	500		
5-Fluorouracil	FLUOROURACIL,5-	51218	500		
Fluvalinate	FLUVALINATE	69409945			
Folpet	FOLPET	133073			
Fomesafen	FOMESAFEN	72178020			

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Fonofos	FONOFOS	944229	500		
Formaldehyde	FORMALDEHYDE	50000	100	100	U122
Formaldehyde cyanohydrin	FORMALDEHYDECYANOHYDRIN	107164	1,000		
Formaldehyde (solution)	FORMALDEHYDESOLUTION)	50000	100	100	U122
Formetanate hydrochloride	FORMETANATEHYDROCHLORIDE	23422539	100	100	P198
Formic acid	FORMICACID	64186		5,000	U123
Formic acid, methyl ester	FORMICACIDMETHYL	107313			
Formothion	FORMOTHION	2540821	100		
Formparanate	FORMPARANATE	17702577	100	100	P197
Fosthietan	FOSTHIETAN	21548323	500		
Freon 113	FREON113	76131			
Fuberidazole	FUBERIDAZOLE	3878191	100		
Fumaric acid	FUMARIC ACID	110178		5,000	
Furan	FURAN	110009	100	100	U124
Furan, tetrahydro-	FURAN, TETRAHYDRO-	109999		1,000	U213
Furfural	FURFURAL	98011		5,000	U125
Gallium trichloride	GALLIUM TRICHLORIDE	13450903	500		
Glycidylaldehyde	GLYCIDYLALDEHYDE	765344		10	U126
Glycol Ethers	GLYCOL ETHERS	N230		***	
Guanidine, N-methyl-N'-nitro-N-nitroso-	GUANIDINE, N-METHYL-N'-NITRO-N-NITROSO-	70257		10	U163
Guthion	GUTHION	86500	1	1	
Haloethers	HALOETHERS	0		***	
Halomethanes	HALOMETHANES	0		***	
Halon 1211	HALON1211	353593			
Halon 1301	HALON1301	75638			
Halon 2402	HALON2402	124732			
HCFC-121	HCFC-121	354143			
HCFC-121a	HCFC-121A	354110			
HCFC-123	HCFC-123	306832			
HCFC-123a	HCFC-123A	354234			
HCFC-123b	HCFC-123B	812044			
HCFC-124	HCFC-124	2837890			
HCFC-124a	HCFC-124A	354256			
HCFC-132b	HCFC-132B	1649087			
HCFC-133a	HCFC-133A	75887			
HCFC-141b	HCFC-141B	1717006			
HCFC-142b	HCFC-142B	75683			
HCFC-21	HCFC-21	75434			

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HCFC-22	HCFC-22	75456			
HCFC-225aa	HCFC-225AA	128903219			
HCFC-225ba	HCFC-225BA	422480			
HCFC-225bb	HCFC-225BB	422446			
HCFC-225ca	HCFC-225CA	422560			
HCFC-225cb	HCFC-225CB	507551			
HCFC-225cc	HCFC-225CC	13474889			
HCFC-225da	HCFC-225DA	431867			
HCFC-225ea	HCFC-225EA	136013791			
HCFC-225eb	HCFC-225EB	111512562			
HCFC-253fb	HCFC-253FB	460355			
Heptachlor	HEPTACHLOR	76448		1	P059
Heptachlor and Metabolites	HEPTACHLOR AND METABOLITES	0		***	
Heptachlor epoxide	HEPTACHLOR EPOXIDE	1024573		1	
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	HEPTACHLORODIBENZODIOXIN	35822469			
1,2,3,4,6,7,8-heptachlorodibenzofuran	HEPTACHLORODIBENZOFURAN	67562394			
1,2,3,4,7,8,9-heptachlorodibenzofuran	HEPTACHLORODIBENZOFURAN	55673897			
1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene	HEPTACHLOROTETRAHYDRO-4,7-METHANO-1	76448		1	P059
Hexachlorobenzene	HEXACHLOROBENZENE	118741		10	U127
Hexachloro-1,3-butadiene	HEXACHLOROBUTAD	87683		1	U128
Hexachlorobutadiene	HEXACHLOROBUTADIENE	87683		1	U128
Hexachlorocyclohexane (all isomers)	HEXACHLOROCYCLOHEXANEALL	608731		***	
alpha-Hexachlorocyclohexane	HEXACHLOROCYCLOHEXANEALPHA	319846		10	
Hexachlorocyclohexane (gamma isomer)	HEXACHLOROCYCLOHEXANEGAMMA ISOMER)	58899	1	1	U129
Hexachlorocyclopentadiene	HEXACHLOROCYCLOPENTADIENE	77474	10	10	U130
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	HEXACHLORODIBENZODIOXIN	39227286			
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	HEXACHLORODIBENZODIOXIN	57653857			
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	HEXACHLORODIBENZODIOXIN	19408743			

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1,2,3,4,7,8-hexachlorodibenzofuran	HEXACHLORODIBENZOFURAN	70648269			
1,2,3,6,7,8-hexachlorodibenzofuran	HEXACHLORODIBENZOFURAN	57117449			
1,2,3,7,8,9-hexachlorodibenzofuran	HEXACHLORODIBENZOFURAN	72918219			
2,3,4,6,7,8-hexachlorodibenzofuran	HEXACHLORODIBENZOFURAN	60851345			
Hexachloroethane	HEXACHLOROETHANE	67721		100	U131
Hexachloronaphthalene	HEXACHLORONAPHTHA	1335871			
Hexachlorophene	HEXACHLOROPHENE	70304		100	U132
Hexachloropropene	HEXACHLOROPROPENE	1888717		1,000	U243
Hexaethyl tetraphosphate	HEXAETHYL TETRAPHOSPHATE	757584		100	P062
Hexakis(2-methyl-2-phenylpropyl)distannoxane	HEXAKISMETHYLPHENYLPROPYLDISTANNOXANE	13356086			
Hexamethylenediamine, N,N'-dibutyl-	HEXAMETHYLENEDIAMINE, N,N'-DIBUTYL-	4835114	500		
Hexamethylene-1,6-diisocyanate	HEXAMETHYLENEDIISOCYANATE	822060		100	
Hexamethylphosphoramide	HEXAMETHYLPHOSPHO	680319		1	
Hexane	HEXANE	110543		5,000	
n-Hexane	HEXANE-N	110543		5,000	
Hexazinone	HEXAZINONE	51235042			
Hydramethylnon	HYDRAMETHYLNON	67485294			
Hydrazine	HYDRAZINE	302012	1	1	U133
Hydrazine, 1,2-diethyl-	HYDRAZINEDIETHYL-	1615801		10	U086
Hydrazine, 1,1-dimethyl-	HYDRAZINEDIMETHYL-	57147	10	10	U098
Hydrazine, 1,2-dimethyl-	HYDRAZINEDIMETHYL-	540738		1	U099
Hydrazine, 1,2-diphenyl-	HYDRAZINEDIPHENYL-	122667		10	U109
Hydrazine, methyl-	HYDRAZINEMETHYL-	60344	10	10	P068
Hydrazine sulfate	HYDRAZINESULFATE	10034932			
Hydrazobenzene	HYDRAZOBENZENE	122667		10	U109
Hydrochloric acid	HYDROCHLORICACID	7647010		5,000	
Hydrochloric acid (conc 37% or greater)	HYDROCHLORICACID	7647010		5,000	
Hydrochloric acid (aerosol forms only)	HYDROCHLORICACIDAEROSOL	7647010		5,000	
Hydrocyanic acid	HYDROCYANICACID	74908	10	10	P063
Hydrofluoric acid	HYDROFLUORICACID	7664393	100	100	U134

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Hydrofluoric acid (conc. 50% or greater)	HYDROFLUORICACID (CONC>)	7664393	100	100	U134
Hydrogen	HYDROGEN	1333740			
Hydrogen chloride (anhydrous)	HYDROGENCHLORIDE	7647010	5,000	5,000	
Hydrogen chloride (gas only)	HYDROGENCHLORIDE (Gas Only)	7647010	5,000	5,000	
Hydrogen cyanide	HYDROGENCYANIDE	74908	10	10	P063
Hydrogen fluoride	HYDROGENFLUORIDE	7664393	100	100	U134
Hydrogen fluoride (anhydrous)	HYDROGENFLUORIDE(ANHYDROUS)	7664393	100	100	U134
Hydrogen peroxide (Conc.> 52%)	HYDROGENPEROXIDE (Conc.> 52%)	7722841	1,000		
Hydrogen selenide	HYDROGENSELENIDE	7783075	10		
Hydrogen sulfide	HYDROGENSULFIDE	7783064	100	100	U135
Hydroperoxide, 1-methyl-1-phenylethyl-	HYDROPEROXIDE, 1-METHYL-1-PHENYLETHYL-	80159		10	U096
Hydroquinone	HYDROQUINONE	123319	100	100	
Imazalil	IMAZALIL	35554440			
Indeno(1,2,3-cd)pyrene	INDENO(1,2,3-CD)PYRENE	193395		100	U137
3-Iodo-2-propynyl butylcarbamate	IODOPROPYNYL BUTYLCARBAMATE	55406536			
Iron carbonyl (Fe(CO)5), (TB-5-11)-	IRONCARBONYL (FE(CO)5), (TB-5-11)-	13463406	100		
Iron, pentacarbonyl-	IRONPENTACARBONYL-	13463406	100		
Isobenzan	ISOBENZAN	297789	100		
Isobutane	ISOBUTANE	75285			
Isobutyl alcohol	ISOBUTYL ALCOHOL	78831		5,000	U140
Isobutyraldehyde	ISOBUTYRALDEHYDE	78842			
Isobutyronitrile	ISOBUTYRONITRILE	78820	1,000		
Isocyanic acid, 3,4-dichlorophenyl ester	ISOCYANIC ACID, 3,4-DICHLOROPHENYL ESTER	102363	500		
Isodrin	ISODRIN	465736	1	1	P060
Isofenphos	ISOFENPHOS	25311711			
Isofluorphate	ISOFLUORPHATE	55914	100	100	P043
1H-Isoindole-1,3(2H)-dione, 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]-	ISOINDOLEDIONETETRAHYDROTRICHLO	133062		10	
Isopentane	ISOPENTANE	78784			
Isophorone	ISOPHORONE	78591		5,000	
Isophorone diisocyanate	ISOPHORONE DIISOCYANATE	4098719	500		
Isoprene	ISOPRENE	78795		100	
Isopropanolamine dodecylbenzene sulfonate	ISOPROPANOLAMINE DODECYLBENZENE SULFONATE	42504461		1,000	

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Isopropyl alcohol (mfg-strong acid process)	ISOPROPYLALCOHOL	67630			
Isopropylamine	ISOPROPYLAMINE	75310			
Isopropyl chloride	ISOPROPYLCHLORIDE	75296			
Isopropyl chloroformate	ISOPROPYLCHLOROFORMATE	108236	1,000		
4,4'-Isopropylidenediphenol	ISOPROPYLIDENED	80057			
Isopropylmethylpyrazolyl dimethylcarbamate	ISOPROPYLMETHYLPYRAZOLYL DIMETHYLCARBAMATE	119380	100	100	P192
Isosafrole	ISOSAFROLE	120581		100	U141
Isothiocyanatomethane	ISOTHIOCYANATOMETHANE	556616	500		
Kepone	KEPONE	143500		1	U142
Lactofen	LACTOFEN	77501634			
Lactonitrile	LACTONITRILE	78977	1,000		
Lasiocarpine	LASIOCARPINE	303344		10	U143
Lead	LEAD	7439921		10	
Lead acetate	LEADACETATE	301042		10	U144
Lead arsenate	LEADARSENATE	7645252		1	
Lead arsenate	LEADARSENATE	7784409		1	
Lead arsenate	LEADARSENATE	10102484		1	
Lead chloride	LEADCHLORIDE	7758954		10	
Lead Compounds	LEADCOMPOUNDS	N420		***	
Lead fluoborate	LEADFLUOBORATE	13814965		10	
Lead fluoride	LEADFLUORIDE	7783462		10	
Lead iodide	LEADIODIDE	10101630		10	
Lead nitrate	LEADNITRATE	10099748		10	
Lead phosphate	LEADPHOSPHATE	7446277		10	U145
Lead stearate	LEADSTEARATE	1072351		10	
Lead stearate	LEADSTEARATE	7428480		10	
Lead stearate	LEADSTEARATE	52652592		10	
Lead stearate	LEADSTEARATE	56189094		10	
Lead subacetate	LEADSUBACETATE	1335326		10	U146
Lead sulfate	LEADSULFATE	7446142		10	
Lead sulfate	LEADSULFATE	15739807		10	
Lead sulfide	LEADSULFIDE	1314870		10	
Lead thiocyanate	LEADTHIOCYANATE	592870		10	
Leptophos	LEPTOPHOS	21609905	500		
Lewisite	LEWISITE	541253	10		
Lindane	LINDANE	58899	1	1	U129
Linuron	LINURON	330552			

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Lithium carbonate	LITHIUMCARBONATE	554132			
Lithium chromate	LITHIUMCHROMATE	14307358		10	
Lithium hydride	LITHIUMHYDRIDE	7580678	100		
Malathion	MALATHION	121755		100	
Maleic acid	MALEICACID	110167		5,000	
Maleic anhydride	MALEICANHYDRIDE	108316		5,000	U147
Maleic hydrazide	MALEICHYDRAZIDE	123331		5,000	U148
Malononitrile	MALONONITRILE	109773	1,000	1,000	U149
Maneb	MANEB	12427382			
Manganese	MANGANESE	7439965			
Manganese, bis(dimethylcarbamodithioato-S,S')-	MANGANESEBISDIMETHYLCARBAMODITHIOATO-S,S')-	15339363		10	P196
Manganese Compounds	MANGANESECOMPOUNDS	N450		***	
Manganese, tricarbonyl methylcyclopentadienyl	MANGANESETRICARBONYL METHYLCYCLOPENTADIENYL	12108133	100		
MBOCA	MBOCA	101144		10	U158
MBT	MBT	149304			
MCPA	MCPA	94746			
MDI	MDI	101688		5,000	
Mechlorethamine	MECHLORETHAMINE	51752	10		
Mecoprop	MECOPROP	93652			
Melphalan	MELPHALAN	148823		1	U150
Mephosfolan	MEPHOSFOLAN	950107	500		
2-Mercaptobenzothiazole	MERCAPTOBENZOTHIAZOLE (MBT)	149304			
Mercaptodimethur	MERCAPTODIMETHUR	2032657	10	10	P199
Mercuric acetate	MERCURICACETATE	1600277	500		
Mercuric chloride	MERCURICCHLORIDE	7487947	500		
Mercuric cyanide	MERCURICCYANIDE	592041		1	
Mercuric nitrate	MERCURICNITRATE	10045940		10	
Mercuric oxide	MERCURICOXIDE	21908532	500		
Mercuric sulfate	MERCURICSULFATE	7783359		10	
Mercuric thiocyanate	MERCURICTHIOCYANATE	592858		10	
Mercurous nitrate	MERCUROUSNITRATE	7782867		10	
Mercurous nitrate	MERCUROUSNITRATE	10415755		10	
Mercury	MERCURY	7439976		1	U151
Mercury Compounds	MERCURY COMPOUNDS	N458		***	
Mercury fulminate	MERCURY FULMINATE	628864		10	P065
Merphos	MERPHOS	150505			

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Methacrolein diacetate	METHACROLEIN DIACETATE	10476956	1,000		
Methacrylic anhydride	METHACRYLIC ANHYDRIDE	760930	500		
Methacrylonitrile	METHACRYLONITRILE	126987	1,000	1,000	U152
Methacryloyl chloride	METHACRYLOYL CHLORIDE	920467	100		
Methacryloyloxyethyl isocyanate	METHACRYLOYLOXYETHYL ISOCYANATE	30674807	100		
Methamidophos	METHAMIDOPHOS	10265926	100		
Metham sodium	METHAMSODIUM	137428			
Methanamine	METHANAMINE	74895		100	
Methanamine, N,N-dimethyl-	METHANAMINEDIMETHYL	75503		100	
Methanamine, N-methyl-	METHANAMINEMETHYL	124403		1,000	U092
Methanamine, N-methyl-N-nitroso-	METHANAMINEMETHYLNITROSO-	62759	10	10	P082
Methane	METHANE	74828			
Methane, chloro-	METHANECHLORO-	74873		100	U045
Methane, chloromethoxy-	METHANECHLOROMETHOXY-	107302	10	10	U046
Methane, isocyanato-	METHANEISOCYANATO-	624839	10	10	P064
Methane, oxybis-	METHANEOXYBIS-	115106			
Methane, oxybis[chloro-	METHANEOXYBIS[CHLORO-	542881	10	10	P016
Methanesulfenyl chloride, trichloro-	METHANESULFENYLCHLORIDETRICHLORO-	594423	100	100	
Methanesulfonyl fluoride	METHANESULFONYL FLUORIDE	558258	1,000		
Methane, tetranitro-	METHANETETRANITRO-	509148	10	10	P112
Methanethiol	METHANETHIOL	74931	100	100	U153
Methane, trichloro-	METHANETRICHLORO-	67663	10	10	U044
4,7-Methanoindan, 1,2,3,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-	METHANOINDANOCTACHLORO-2,3,3A,4,7,7A	57749	1	1	U036
Methanol	METHANOL	67561		5,000	U154
Methapyrilene	METHAPYRILENE	91805		5,000	U155
Methazole	METHAZOLE	20354261			
Methidathion	METHIDATHION	950378	500		
Methiocarb	METHIOCARB	2032657	10	10	P199
Methomyl	METHOMYL	16752775	100	100	P066
Methoxone	METHOXONE	94746			
Methoxone sodium salt	METHOXONESODIUM SALT	3653483			
Methoxychlor	METHOXYCHLOR	72435		1	U247
2-Methoxyethanol	METHOXYETHANOL	109864			
Methoxyethylmercuric acetate	METHOXYETHYLMERCURIC ACETATE	151382	500		

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2-(4-Methoxy-6-methyl-1,3,5-triazin-2-yl)-methylamino)carbonyl)amino)sulfonyl)benzoic acid, methyl ester	METHOXYMETHYLTRIAZINYLMETHYLAMINOCARBON	101200480			
Methyl acrylate	METHYLACRYLATE	96333			
Methyl bromide	METHYLBROMIDE	74839	1,000	1,000	U029
2-Methyl-1-butene	METHYLBUTENE2	563462			
3-Methyl-1-butene	METHYLBUTENE3	563451			
Methyl chloride	METHYLCHLORIDE	74873		100	U045
Methyl 2-chloroacrylate	METHYLCHLOROACRYLATE	80637	500		
Methyl chlorocarbonate	METHYLCHLOROCARBONATE	79221	1,000	1,000	U156
Methyl chloroform	METHYLCHLOROFORM	71556		1,000	U226
Methyl chloroformate	METHYLCHLOROFORMATE	79221	1,000	1,000	U156
3-Methylcholanthrene	METHYLCHOLANTHRENE	56495		10	U157
5-Methylchrysene	METHYLCHRYSENE5	3697243			
4-Methyldiphenylmethane-3,4-diisocyanate	METHYLDIPHENYLMETHANEDIISOCYANATE	75790840			
6-Methyl-1,3-dithiolo[4,5-b]quinoxalin-2-one	METHYLDITHIOLOQUINOXALIN-2-ONE	2439012			
4,4'-Methylenebis(2-chloroaniline)	METHYLENEBISCHLORO	101144		10	U158
2,2'-Methylenebis(4-chlorophenol	METHYLENEBISCHLOROPHENOL	97234			
4,4'-Methylenebis(N,N-dimethyl)benzenamine	METHYLENEBISDIMETH	101611			
1,1'-Methylene bis(4-isocyanatocyclohexane)	METHYLENEBISISOCYANATOCYCLOHEXANE)	5124301			
Methylenebis(phenylisocyanate)	METHYLENEBISPHENYL	101688		5,000	
Methylene bromide	METHYLENEBROMIDE	74953		1,000	U068
Methylene chloride	METHYLENECHLORIDE	75092		1,000	U080
4,4'-Methylenedianiline	METHYLENEDIANI	101779		10	
Methyl ether	METHYLETHER	115106			
Methyl ethyl ketone	METHYLETHYLKETONE	78933		5,000	U159
Methyl ethyl ketone (MEK)	METHYLETHYLKETONE (MEK)	78933		5,000	U159
Methyl ethyl ketone peroxide	METHYLETHYLKETONEPEROXIDE	1338234		10	U160
Methyl formate	METHYLFORMATE	107313			
Methyl hydrazine	METHYLHYDRAZINE	60344	10	10	P068
Methyl iodide	METHYLIODIDE	74884		100	U138
Methyl isobutyl ketone	METHYLISOBUTYLKETO	108101		5,000	U161
Methyl isocyanate	METHYLISOCYANATE	624839	10	10	P064
Methyl isothiocyanate	METHYLISOTHIOCYANATE	556616	500		

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2-Methyllactonitrile	METHYLLACTONITRILE	75865	10	10	P069
Methyl mercaptan	METHYLMERCAPTAN	74931	100	100	U153
Methylmercuric dicyanamide	METHYLMERCURIC DICYANAMIDE	502396	500		
Methyl methacrylate	METHYLMETHACRYLATE	80626		1,000	U162
N-Methylolacrylamide	METHYLOLACRYLAMIDE	924425			
Methyl parathion	METHYLPARATHION	298000	100	100	P071
Methyl phenkapton	METHYLPHENKAPTON	3735237	500		
Methyl phosphonic dichloride	METHYLPHOSPHONIC DICHLORIDE	676971	100		
2-Methylpropene	METHYLPROPENE	115117			
2-Methylpyridine	METHYLPYRIDINE	109068		5,000	U191
N-Methyl-2-pyrrolidone	METHYLPYRROLIDONE	872504			
Methyl tert-butyl ether	METHYLTBUTYLET	1634044		1,000	
Methyl thiocyanate	METHYLTHIOCYANATE	556649	10,000		
Methylthiouracil	METHYLTHIOURACIL	56042		10	U164
Methyltrichlorosilane	METHYLTRICHLOROSILANE	75796	500		
Methyl vinyl ketone	METHYLVINYL KETONE	78944	10		
Metiram	METIRAM	9006422			
Metolcarb	METOLCARB	1129415	1,000	1,000	P190
Metribuzin	METRIBUZIN	21087649			
Mevinphos	MEVINPHOS	7786347	10	10	
Mexacarbate	MEXACARBATE	315184	1,000	1,000	P128
Michler's ketone	MICHLERSKETONE	90948			
Mitomycin C	MITOMYCIN C	50077	10	10	U010
Molinate	MOLINATE	2212671			
Molybdenum trioxide	MOLYBDENUMTRIOXIDE	1313275			
Monochloropentafluoroethane	MONOCHLOROPENTAFLUOROETHANE	76153			
Monocrotophos	MONOCROTOPHOS	6923224	10		
Monoethylamine	MONOETHYLAMINE	75047		100	
Monomethylamine	MONOMETHYLAMINE	74895		100	
Monuron	MONURON	150685			
Muscimol	MUSCIMOL	2763964	1,000	1,000	P007
Mustard gas	MUSTARDGAS	505602	500		
Myclobutanil	MYCLOBUTANIL	88671890			
Nabam	NABAM	142596			
Naled	NALED	300765		10	
Naphthalene	NAPHTHALENE	91203		100	U165
1,5-Naphthalene diisocyanate	NAPHTHALENEDIISOCYANATE	3173726			
1-Naphthalenol, methylcarbamate	NAPHTHALENOLMETHYLCARBAMATE	63252		100	U279
Naphthenic acid	NAPHTHENIC ACID	1338245		100	

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1,4-Naphthoquinone	NAPHTHOQUINONE	130154		5,000	U166
alpha-Naphthylamine	NAPHTHYLAMINEA	134327		100	U167
beta-Naphthylamine	NAPHTHYLAMINEB	91598		10	U168
Nickel	NICKEL	7440020		100	
Nickel ammonium sulfate	NICKELAMMONIUM SULFATE	15699180		100	
Nickel carbonyl	NICKELCARBONYL	13463393	10	10	P073
Nickel chloride	NICKELCHLORIDE	7718549		100	
Nickel chloride	NICKELCHLORIDE	37211055		100	
Nickel Compounds	NICKELCOMPOUNDS	N495		***	
Nickel cyanide	NICKELCYANIDE	557197		10	P074
Nickel hydroxide	NICKELHYDROXIDE	12054487		10	
Nickel nitrate	NICKELNITRATE	14216752		100	
Nickel sulfate	NICKELSULFATE	7786814		100	
Nicotine	NICOTINE	54115	100	100	P075
Nicotine and salts	NICOTINE AND SALTS	54115		100	P075
Nicotine and salts	NICOTINE AND SALTS	N503			
Nicotine sulfate	NICOTINE SULFATE	65305	100	100	
Nitrapyrin	NITRAPYRIN	1929824			
Nitrate compounds (water dissociable)	NITRATECOMPOUNDS	N511			
Nitric acid	NITRICACID	7697372	1,000	1,000	
Nitric acid (conc 80% or greater)	NITRICACID	7697372	1,000	1,000	
Nitric oxide	NITRICOXIDE	10102439	10	10	P076
Nitrilotriacetic acid	NITRILOTRIACETICACI	139139			
p-Nitroaniline	NITROANILINE	100016		5,000	P077
5-Nitro-o-anisidine	NITROANISIDINE	99592			
Nitrobenzene	NITROBENZENE	98953	1,000	1,000	U169
4-Nitrobiphenyl	NITROBIPHENYL	92933		10	
Nitrocyclohexane	NITROCYCLOHEXANE	1122607	500		
Nitrofen	NITROFEN	1836755			
Nitrogen dioxide	NITROGEN DIOXIDE	10102440	10	10	P078
Nitrogen dioxide	NITROGEN DIOXIDE	10544726		10	
Nitrogen mustard	NITROGENMUSTARD	51752	10		
Nitrogen oxide (NO)	NITROGENOXIDE (NO)	10102439	10	10	P076
Nitroglycerin	NITROGLYCERINE	55630		10	P081
Nitrophenol (mixed isomers)	NITROPHENOL (MIXED)	25154556		100	
2-Nitrophenol	NITROPHENOLA	88755		100	
4-Nitrophenol	NITROPHENOLB	100027		100	U170
m-Nitrophenol	NITROPHENOL-M	554847		100	

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p-Nitrophenol	NITROPHENOL-P	100027		100	U170
Nitrophenols	NITROPHENOLS	0		***	
2-Nitropropane	NITROPROPANE	79469		10	U171
1-Nitropyrene	NITROPYRENE	5522430			
Nitrosamines	NITROSAMINES	0		***	
N-Nitrosodi-n-butylamine	NITROSODIBUTYLA	924163		10	U172
N-Nitrosodiethanolamine	NITROSODIETHANOLAMINE	1116547		1	U173
N-Nitrosodiethylamine	NITROSODIETHYLAMIN	55185		1	U174
N-Nitrosodimethylamine	NITROSODIMETHYLAMI	62759	10	10	P082
Nitrosodimethylamine	NITROSODIMETHYLAMINE	62759	10	10	P082
N-Nitrosodiphenylamine	NITROSODIPHENYLA	86306		100	
p-Nitrosodiphenylamine	NITROSODIPHENYLB	156105			
N-Nitrosodi-n-propylamine	NITROSODIPROPYL	621647		10	U111
N-Nitroso-N-ethylurea	NITROSOETHYLURE	759739		1	U176
N-Nitroso-N-methylurea	NITROSOMETHYLUR	684935		1	U177
N-Nitroso-N-methylurethane	NITROSOMETHYLURETHANE	615532		1	U178
N-Nitrosomethylvinylamine	NITROSOMETHYLVINYL	4549400		10	P084
N-Nitrosomorpholine	NITROSOMORPHOLINE	59892		1	
N-Nitrosonornicotine	NITROSONORNICOTINE	16543558			
N-Nitrosopiperidine	NITROSOPIPERIDINE	100754		10	U179
N-Nitrosopyrrolidine	NITROSOPYRROLIDINE	930552		1	U180
Nitrotoluene	NITROTOLUENE	1321126		1,000	
m-Nitrotoluene	NITROTOLUENE-M	99081		1,000	
o-Nitrotoluene	NITROTOLUENE-O	88722		1,000	
p-Nitrotoluene	NITROTOLUENE-P	99990		1,000	
5-Nitro-o-toluidine	NITROTOLUIDINE	99558		100	U181
Nitrous acid, ethyl ester	NITROUSACIDETHYL	109955			
Norbormide	NORBORMIDE	991424	100		
Norflurazon	NORFLURAZON	27314132			
1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin	OCTACHLORODIBENZODIOXIN	3268879			
1,2,3,4,6,7,8,9-octachlorodibenzofuran	OCTACHLORODIBENZOFURAN	39001020			
Octachloronaphthalene	OCTACHLORONAPHTHALEN	2234131			
Octachlorostyrene	OCTACHLOROSTYRENE	29082744			
Octanoic acid, 2,6-dibromo-4-cyanophenyl ester	OCTANOIC ACIDDIBROMOCYANOPHENYL ESTER	1689992			
Oleum (fuming sulfuric acid)	OLEUM	8014957		1,000	

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Organorhodium Complex (PMN-82-147)	ORGANORHODIUM COMPLEX (PMN-82-147)	0	10	**	
Oryzalin	ORYZALIN	19044883			
Osmium oxide OsO4 (T-4)-	OSMIUM OXIDE OSO4 (T-4)-	20816120		1,000	P087
Osmium tetroxide	OSMIUMTETROXIDE	20816120		1,000	P087
Ouabain	OUABAIN	630604	100		
7-Oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid, dipotassium salt	OXABICYCLOHEPTANEDICARBOXYLICACIDDIPOTASSIU	2164070			
Oxamyl	OXAMYL	23135220	100	100	P194
Oxetane, 3,3-bis(chloromethyl)-	OXETANE, 3,3-BIS(CHLOROMETHYL)-	78717	500		
Oxirane	OXIRANE	75218	10	10	U115
Oxirane, (chloromethyl)-	OXIRANECHLOROMETHYL)-	106898	100	100	U041
Oxirane, methyl-	OXIRANEMETHYL-	75569	100	100	
Oxydemeton methyl	OXYDEMETONMETHYL	301122			
Oxydiazon	OXYDIAZON	19666309			
Oxydisulfoton	OXYDISULFOTON	2497076	500		
Oxyfluorfen	OXYFLUORFEN	42874033			
Ozone	OZONE	10028156	100		
Paraformaldehyde	PARAFORMALDEHYDE	30525894		1,000	
Paraldehyde	PARALDEHYDE	123637		1,000	U182
Paraquat dichloride	PARAQUATDICHLORIDE	1910425	10		
Paraquat methosulfate	PARAQUATMETHOSULFATE	2074502	10		
Parathion	PARATHION	56382	10	10	P089
Parathion-methyl	PARATHION-METHYL	298000	100	100	P071
Paris green	PARIS GREEN	12002038	1	1	
PCBs	PCBS	1336363		1	
PCNB	PCNB	82688		100	U185
PCP	PCP	87865		10	
Pebulate	PEBULATE	1114712			
Pendimethalin	PENDIMETHALIN	40487421			
Pentaborane	PENTABORANE	19624227	500		
Pentachlorobenzene	PENTACHLOROBENZENE	608935		10	U183
1,2,3,7,8-pentachlorodibenzo-p-dioxin	PENTACHLORODIBENZODIOXIN	40321764			
1,2,3,7,8-pentachlorodibenzofuran	PENTACHLORODIBENZOFURAN	57117416			
2,3,4,7,8-pentachlorodibenzofuran	PENTACHLORODIBENZOFURAN	57117314			
Pentachloroethane	PENTACHLOROETHANE	76017		10	U184
Pentachloronitrobenzene	PENTACHLORONITROBENZENE (PCNB)	82688		100	U185
Pentachlorophenol	PENTACHLOROPHENOLP	87865		10	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Pentadecylamine	PENTADECYLAMINE	2570265	100		
1,3-Pentadiene	PENTADIENE	504609		100	U186
Pentane	PENTANE	109660			
1-Pentene	PENTENE	109671			
2-Pentene, (E)-	PENTENEE	646048			
2-Pentene, (Z)-	PENTENEZ	627203			
Pentobarbital sodium	PENTOBARBITALSODIUM	57330			
Peracetic acid	PERACETICACID	79210	500		
Perchloroethylene	PERCHLOROETHYLENE	127184		100	U210
Perchloromethyl mercaptan	PERCHLOROMETHYLMERCAPTAN	594423	100	100	
Permethrin	PERMETHRIN	52645531			
Phenacetin	PHENACETIN	62442		100	U187
Phenanthrene	PHENANTHRENE	85018		5,000	
Phenol	PHENOL	108952	1,000	1,000	U188
Phenol, 2-(1-methylethoxy)-, methylcarbamate	PHENOLMETHYLETHOXYMETHYLCARBAMATE	114261		100	U411
Phenol, 3-(1-methylethyl)-, methylcarbamate	PHENOLMETHYLETHYL)-, METHYLCARBAMATE	64006	10	10	P202
Phenol, 2,2'-thiobis[4-chloro-6-methyl-	PHENOLTHIOBIS[4-CHLORO-6-METHYL-	4418660	100		
Phenothrin	PHENOTHRIN	26002802			
Phenoxarsine, 10,10'-oxydi-	PHENOXARSINE, 10,10'-OXYDI-	58366	500		
(2-(4-Phenoxyphenoxy)ethyl carbamic acid ethyl ester	PHENOXYPHENOXYETHYLCARBAMICACIDETHYL ESTER	72490018			
Phenyl dichloroarsine	PHENYLDICHLOROARSINE	696286	1	1	P036
(1,2-Phenylenebis(iminocarbonothioyl)) biscarbamic acid diethyl ester	PHENYLENEBISIMINOCARBONOTHIOYLBISCARB AMIC ACID DIET	23564069			
1,2-Phenylenediamine	PHENYLENEDIAMINE	95545			
1,3-Phenylenediamine	PHENYLENEDIAMINE	108452			
p-Phenylenediamine	PHENYLENEDIAMINE	106503		5,000	
1,2-Phenylenediamine dihydrochloride	PHENYLENEDIAMINEDIHYDROCHLORIDE	615281			
1,4-Phenylenediamine dihydrochloride	PHENYLENEDIAMINEDIHYDROCHLORIDE	624180			
1,3-Phenylene diisocyanate	PHENYLENEDIISOCYANATE	123615			
1,4-Phenylene diisocyanate	PHENYLENEDIISOCYANATE	104494			
Phenylhydrazine hydrochloride	PHENYLHYDRAZINE HYDROCHLORIDE	59881	1,000		
Phenylmercuric acetate	PHENYLMERCURIC ACETATE	62384	100	100	P092

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Phenylmercury acetate	PHENYLMERCURY ACETATE	62384	100	100	P092
5-(Phenylmethyl)-3-furanyl)methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate	PHENYLMETHYLFURANYLMETHYLDIMETHYLMETHYL	10453868			
2-Phenylphenol	PHENYLPHENOL	90437			
Phenylsilatrane	PHENYLSILATRANE	2097190	100		
Phenylthiourea	PHENYLTHIOUREA	103855	100	100	P093
Phenytoin	PHENYTOIN	57410			
Phorate	PHORATE	298022	10	10	P094
Phosacetim	PHOSACETIM	4104147	100		
Phosfolan	PHOSFOLAN	947024	100		
Phosgene	PHOSGENE	75445	10	10	P095
Phosphamidon	PHOSPHAMIDON	13171216	100		
Phosphine	PHOSPHINE	7803512	100	100	P096
Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl)-,dimethyl ester	PHOSPHONICACIDTRICHLORO-1-HYDROXYETHYL)-,DIMETHYL	52686		100	
Phosphonothioic acid, methyl-, O-ethyl O-(4-(methylthio)phenyl) ester	PHOSPHONOTHIOIC ACID, METHYL-, O-ETHYL O-(4-(METHY	2703131	500		
Phosphonothioic acid, methyl-, S-(2-(bis(1-methylethyl)amino)ethyl) O-ethyl ester	PHOSPHONOTHIOIC ACID, METHYL-, S-(2-(BIS(1-METHYLE	50782699	100		
Phosphonothioic acid, methyl-, O-(4-nitrophenyl) O-phenyl ester	PHOSPHONOTHIOIC ACID, METHYL-,O-(4-NITROPHENYL) O-	2665307	500		
Phosphoric acid	PHOSPHORICACID	7664382		5,000	
Phosphoric acid, 2-chloro-1-(2,3,5-trichlorophenyl) ethenyl dimethyl ester	PHOSPHORICACIDCHLOROTRICHLOROPHENYL) ETHENYL	961115			
Phosphoric acid, 2-dichloroethenyl dimethyl ester	PHOSPHORICACIDDICHLOROETHENYL DIMETHYL ESTER	62737	10	10	
Phosphoric acid, dimethyl 4-(methylthio) phenyl ester	PHOSPHORICACIDDIMETHYL 4-(METHYLTHIO) PHENYL ES	3254635	500		
Phosphorodithioic acid O-ethyl S,S-dipropyl ester	PHOSPHORODITHIOICACIDETHYLDIPROPYL ESTER	13194484	1,000		
Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester	PHOSPHOROTHIOICACIDDIETHYLNITROPHENYL) ESTER	56382	10	10	P089
Phosphorothioic acid, O,O-dimethyl-5-(2-(methylthio)ethyl)ester	PHOSPHOROTHIOICACIDDIMETHYLMETHYLTHIO	2587908	500		

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Phosphorous trichloride	PHOSPHOROUSTRICHLORIDE	7719122	1,000	1,000	
Phosphorus	PHOSPHORUS	7723140	1	1	
Phosphorus (yellow or white)	PHOSPHORUS	7723140	1	1	
Phosphorus oxychloride	PHOSPHORUS OXYCHLORIDE	10025873	1,000	1,000	
Phosphorus pentachloride	PHOSPHORUS PENTACHLORIDE	10026138	500		
Phosphorus trichloride	PHOSPHORUS TRICHLORIDE	7719122	1,000	1,000	
Phosphoryl chloride	PHOSPHORYLCHLORIDE	10025873	1,000	1,000	
Phthalate Esters	PHTHALATE ESTERS	0		***	
Phthalic anhydride	PHTHALICANHYDRIDE	85449		5,000	U190
Physostigmine	PHYSOSTIGMINE	57476	100	100	P204
Physostigmine, salicylate (1:1)	PHYSOSTIGMINE, SALICYLATE (1:1)	57647	100	100	P188
Picloram	PICLORAM	1918021			
2-Picoline	PICOLINE	109068		5,000	U191
Picric acid	PICRICACID	88891			
Picrotoxin	PICROTOXIN	124878	500		
N,N'-(1,4-Piperazinediylbis(2,2,2-trichloroethylidene)) bisformamide	PIPERAZINEDIYLBISTRICHLOROETHYLIDENEBISF	26644462			
Piperidine	PIPERIDINE	110894	1,000		
Piperonyl butoxide	PIPERONYLBUTOXIDE	51036			
Pirimifos-ethyl	PIRIMIFOS-ETHYL	23505411	1,000		
Pirimiphos methyl	PIRIMIPHOSMETHYL	29232937			
Plumbane, tetramethyl-	PLUMBANETETRAMETHYL-	75741	100		
Polybrominated Biphenyls (PBBs)	POLYBROMINATED BIPHENYLS (PBBS)	N575			
Polychlorinated alkanes (C10 to C13)	POLYCHLORINATED ALKANES	N583			
Polychlorinated biphenyls	POLYCHLORINATEDBIPH	1336363		1	
Polycyclic aromatic compounds (includes only 19 chemicals)	POLYCYCLIC AROMATIC COMPOUNDS	N590			
Polycyclic organic matter	POLYCYCLICORGANICMATTER	0		***	
Polymeric diphenylmethane diisocyanate	POLYMERICDIPHENYLMETHANEDIISOCYANATE	9016879			
Polynuclear Aromatic Hydrocarbons	POLYNUCLEAR AROMATIC HYDROCARBONS	0		***	
Potassium arsenate	POTASSIUMARSENATE	7784410		1	
Potassium arsenite	POTASSIUMARSENITE	10124502	1	1	
Potassium bichromate	POTASSIUMBICHROMATE	7778509		10	
Potassium bromate	POTASSIUMBROMATE	7758012			
Potassium chromate	POTASSIUMCHROMATE	7789006		10	
Potassium cyanide	POTASSIUMCYANIDE	151508	10	10	P098

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Potassium dimethyldithiocarbamate	POTASSIUMDIMETHYLDITHIOCARBAMATE	128030			
Potassium hydroxide	POTASSIUMHYDROXIDE	1310583		1,000	
Potassium N-methyldithiocarbamate	POTASSIUMMETHYLDITHIOCARBAMATE	137417			
Potassium permanganate	POTASSIUMPERMANGANATE	7722647		100	
Potassium silver cyanide	POTASSIUMSILVERCYANIDE	506616	1	1	P099
Profenofos	PROFENOFOS	41198087			
Promecarb	PROMECARB	2631370	1,000	1,000	P201
Prometryn	PROMETRYN	7287196			
Pronamide	PRONAMIDE	23950585		5,000	U192
Propachlor	PROPACHLOR	1918167			
1,2-Propadiene	PROPADIENE	463490			
Propadiene	PROPADIENE	463490			
2-Propanamine	PROPANAMINE	75310			
Propane	PROPANE	74986			
Propane, 2-chloro-	PROPANECHLORO-	75296			
Propane 1,2-dichloro-	PROPANEDICHLORO-	78875		1,000	U083
Propane, 2,2-dimethyl-	PROPANEDIMETHYL	463821			
Propane, 2-methyl	PROPANEMETHYL	75285			
Propanenitrile	PROPANENITRILE	107120	10	10	P101
Propanenitrile, 2-methyl-	PROPANENITRILEMETHYL-	78820	1,000		
1,3-Propane sultone	PROPANESULTONE	1120714		10	U193
Propane sultone	PROPANESULTONE	1120714		10	U193
Propanil	PROPANIL	709988			
Propargite	PROPARGITE	2312358		10	
Propargyl alcohol	PROPARGYL ALCOHOL	107197		1,000	P102
Propargyl bromide	PROPARGYL BROMIDE	106967	10		
2-Propenal	PROPENAL	107028	1	1	P003
2-Propen-1-amine	PROPENAMINE	107119	500		
Propene	PROPENE	115071			
1-Propene	PROPENE1	115071			
1-Propene, 1-chloro-	PROPENECHLORO-1	590216			
1-Propene, 2-chloro-	PROPENECHLORO-2	557982			
1-Propene, 2-methyl-	PROPENEMETHYL-	115117			
2-Propenenitrile	PROPENENITRILE	107131	100	100	U009
2-Propenenitrile, 2-methyl-	PROPENENITRILEMETHYL-	126987	1,000	1,000	U152
2-Propen-1-ol	PROPENOL	107186	100	100	P005
2-Propenoyl chloride	PROPENOYLCHLORIDE	814686	100		

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Propetamphos	PROPETAMPHOS	31218834			
Propham	PROPHAM	122429		1,000	U373
Propiconazole	PROPICONAZOLE	60207901			
beta-Propiolactone	PROPIOLACTONE	57578	10	10	
Propionaldehyde	PROPIONALDEHYDE	123386		1,000	
Propionic acid	PROPIONICACID	79094		5,000	
Propionic anhydride	PROPIONICANHYDRIDE	123626		5,000	
Propionitrile	PROPIONITRILE	107120	10	10	P101
Propionitrile, 3-chloro-	PROPIONITRILE, 3-CHLORO-	542767	1,000	1,000	P027
Propiophenone, 4'-amino	PROPIOPHENONE,4-AMINO	70699	100		
Propoxur	PROPOXUR	114261		100	U411
n-Propylamine	PROPYLAMINE	107108		5,000	U194
Propyl chloroformate	PROPYLCHLOROFORMATE	109615	500		
Propylene	PROPYLENE	115071			
Propyleneimine	PROPYLENEIMINE	75558	1	1	P067
Propylene oxide	PROPYLENEOXIDE	75569	100	100	
1-Propyne	PROPYNE	74997			
Propyne	PROPYNE	74997			
Prothoate	PROTHOATE	2275185	100		
Pyrene	PYRENE	129000	5,000	5,000	
Pyrethrins	PYRETHRINS	121211		1	
Pyrethrins	PYRETHRINS	121299		1	
Pyrethrins	PYRETHRINS	8003347		1	
Pyridine	PYRIDINE	110861		1,000	U196
Pyridine, 4-amino-	PYRIDINEAMINO-	504245	1,000	1,000	P008
Pyridine, 3-(1-methyl-2-pyrrolidinyl)-,(S)-	PYRIDINEMETHYLPYRROLIDINYL(S)-	54115	100	100	P075
Pyridine, 2-methyl-5-vinyl-	PYRIDINEMETHYLVINYL-	140761	500		
Pyridine, 4-nitro-, 1-oxide	PYRIDINENITROOXIDE	1124330	500		
2,4-(1H,3H)-Pyrimidinedione, 5-bromo-6-methyl-3-(1-methylpropyl), lithium salt	PYRIMIDINEDIONEBROMOMETHYLMETHYLPRO	53404196			
Pyriminil	PYRIMINIL	53558251	100		
Quinoline	QUINOLINE	91225		5,000	
Quinone	QUINONE	106514		10	U197
Quintozene	QUINTOZENE	82688		100	U185
Quizalofop-ethyl	QUIZALOFOPETHYL	76578148			
Reserpine	RESERPINE	50555		5,000	U200
Resmethrin	RESMETHRIN	10453868			

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Resorcinol	RESORCINOL	108463		5,000	U201
Saccharin (manufacturing)	SACCHARIN	81072		100	U202
Saccharin and salts	SACCHARIN AND SALTS	81072		100	U202
Safrole	SAFROLE	94597		100	U203
Salcomine	SALCOMINE	14167181	500		
Sarin	SARIN	107448	10		
Selenious acid	SELENIOUS ACID	7783008	10	10	U204
Selenious acid, dithallium(1+) salt	SELENIOUS ACID, DITHALLIUM(1+) SALT	12039520		1,000	P114
Selenium	SELENIUM	7782492		100	
Selenium Compounds	SELENIUMCOMPOUNDS	N725		***	
Selenium dioxide	SELENIUMDIOXIDE	7446084		10	
Selenium oxychloride	SELENIUMOXYCHLORIDE	7791233	500		
Selenium sulfide	SELENIUMSULFIDE	7488564		10	U205
Selenourea	SELENOUREA	630104		1,000	P103
Semicarbazide hydrochloride	SEMICARBAZIDE HYDROCHLORIDE	563417	1,000		
Sethoxydim	SETHOXYDIM	74051802			
Silane	SILANE	7803625			
Silane, (4-aminobutyl)diethoxymethyl-	SILANE, (4-AMINOBUTYL)DIETHOXYMETHYL-	3037727	1,000		
Silane, chlorotrimethyl-	SILANECHLOROTRIMETHYL-	75774	1,000		
Silane, dichloro-	SILANEDICHLORO-	4109960			
Silane, dichlorodimethyl-	SILANEDICHLORODIMETHYL-	75785	500		
Silane, tetramethyl-	SILANETETRAMETHYL-	75763			
Silane, trichloro-	SILANETRICHLORO-	10025782			
Silane, trichloromethyl-	SILANETRICHLOROMETHYL-	75796	500		
Silver	SILVER	7440224		1,000	
Silver Compounds	SILVER AND COMPOUNDS	N740		***	
Silver cyanide	SILVERCYANIDE	506649		1	P104
Silver nitrate	SILVERNITRATE	7761888		1	
Silvex (2,4,5-TP)	SILVEX (2,4,5-TP)	93721		100	
Simazine	SIMAZINE	122349			
Sodium	SODIUM	7440235		10	
Sodium arsenate	SODIUM ARSENATE	7631892	1	1	
Sodium arsenite	SODIUM ARSENITE	7784465	1	1	
Sodium azide (Na(N3))	SODIUM AZIDE (Na(N3))	26628228	1,000	1,000	P105
Sodium bichromate	SODIUM BICHROMATE	10588019		10	
Sodium bifluoride	SODIUM BIFLUORIDE	1333831		100	
Sodium bisulfite	SODIUM BISULFITE	7631905		5,000	
Sodium cacodylate	SODIUM CACODYLATE	124652	100		

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Sodium chromate	SODIUM CHROMATE	7775113		10	
Sodium cyanide (Na(CN))	SODIUM CYANIDE (Na(CN))	143339	10	10	P106
Sodium dicamba	SODIUM DICAMBA	1982690			
Sodium dimethyldithiocarbamate	SODIUM DIMETHYLDITHIOCARBAMATE	128041			
Sodium dodecylbenzenesulfonate	SODIUM DODECYLBENZENESULFONATE	25155300		1,000	
Sodium fluoride	SODIUM FLUORIDE	7681494		1,000	
Sodium fluoroacetate	SODIUM FLUOROACETATE	62748	10	10	P058
Sodium hydrosulfide	SODIUM HYDROSULFIDE	16721805		5,000	
Sodium hydroxide	SODIUM HYDROXIDE	1310732		1,000	
Sodium hypochlorite	SODIUM HYPOCHLORITE	7681529		100	
Sodium hypochlorite	SODIUM HYPOCHLORITE	10022705		100	
Sodium methylate	SODIUM METHYLATE	124414		1,000	
Sodium methyldithiocarbamate	SODIUM METHYLDITHIOCARBAMATE	137428			
Sodium nitrite	SODIUM NITRITE	7632000		100	
Sodium pentachlorophenate	SODIUM PENTACHLOROPHENATE	131522			
Sodium o-phenylphenoxide	SODIUM PHENYLPHENOXIDE	132274			
Sodium phosphate, dibasic	SODIUM PHOSPHATE, DIBASIC	7558794		5,000	
Sodium phosphate, dibasic	SODIUM PHOSPHATE, DIBASIC	10039324		5,000	
Sodium phosphate, dibasic	SODIUM PHOSPHATE, DIBASIC	10140655		5,000	
Sodium phosphate, tribasic	SODIUM PHOSPHATE, TRIBASIC	7601549		5,000	
Sodium phosphate, tribasic	SODIUM PHOSPHATE, TRIBASIC	7758294		5,000	
Sodium phosphate, tribasic	SODIUM PHOSPHATE, TRIBASIC	7785844		5,000	
Sodium phosphate, tribasic	SODIUM PHOSPHATE, TRIBASIC	10101890		5,000	
Sodium phosphate, tribasic	SODIUM PHOSPHATE, TRIBASIC	10124568		5,000	
Sodium phosphate, tribasic	SODIUM PHOSPHATE, TRIBASIC	10361894		5,000	
Sodium selenate	SODIUM SELENATE	13410010	100		
Sodium selenite	SODIUM SELENITE	7782823		100	
Sodium selenite	SODIUM SELENITE	10102188	100	100	
Sodium tellurite	SODIUM TELLURITE	10102202	500		
Stannane, acetoxytriphenyl-	STANNANE,ACETOXYTRIPHENYL-	900958	500		
Streptozotocin	STREPTOZOTOCIN	18883664		1	U206
Strontium chromate	STRONTIUM CHROMATE	7789062		10	
Strychnine	STRYCHNINE	57249	10	10	P108
Strychnine and salts	STRYCHNINE	N746			
Strychnine, and salts	STRYCHNINE, AND SALTS	57249		10	P108
Strychnine, sulfate	STRYCHNINE, SULFATE	60413	10	10	
Styrene	STYRENEMONOMER	100425		1,000	
Styrene oxide	STYRENEOXIDE	96093		100	
Sulfotep	SULFOTEP	3689245	100	100	P109

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Sulfoxide, 3-chloropropyl octyl	SULFOXIDE, 3-CHLOROPROPYL OCTYL	3569571	500		
Sulfur dioxide	SULFURDIOXIDE	7446095	500		
Sulfur dioxide (anhydrous)	SULFURDIOXIDE	7446095	500		
Sulfur fluoride (SF4), (T-4)-	SULFURFLUORIDE (SF4), (T-4)-	7783600	100		
Sulfuric acid	SULFURICACID	7664939	1,000	1,000	
Sulfuric acid (aerosol forms only)	SULFURICACID	7664939	1,000	1,000	
Sulfuric acid (fuming)	SULFURICACID (FUMING)	8014957		1,000	
Sulfuric acid, mixture with sulfur trioxide	SULFURICACIDMIXTURE WITH SULFUR TRIOXIDE	8014957		1,000	
Sulfur monochloride	SULFURMONOCHLORIDE	12771083		1,000	
Sulfur phosphide	SULFURPHOSPHIDE	1314803		100	U189
Sulfur tetrafluoride	SULFURTETRAFLUORIDE	7783600	100		
Sulfur trioxide	SULFURTRIOXIDE	7446119	100		
Sulfuryl fluoride	SULFURYLFLUORIDE	2699798			
Sulprofos	SULPROFOS	35400432			
2,4,5-T acid	T ACID	93765		1,000	
2,4,5-T amines	T AMINES	1319728		5,000	
2,4,5-T amines	T AMINES	2008460		5,000	
2,4,5-T amines	T AMINES	3813147		5,000	
2,4,5-T amines	T AMINES	6369966		5,000	
2,4,5-T amines	T AMINES	6369977		5,000	
2,4,5-T esters	T ESTERS	93798		1,000	
2,4,5-T esters	T ESTERS	1928478		1,000	
2,4,5-T esters	T ESTERS	2545597		1,000	
2,4,5-T esters	T ESTERS	25168154		1,000	
2,4,5-T esters	T ESTERS	61792072		1,000	
2,4,5-T salts	T SALTS	13560991		1,000	
Tabun	TABUN	77816	10		
Tebuthiuron	TEBUTHIURON	34014181			
Tellurium hexafluoride	TELLURIUM HEXAFLUORIDE	7783804	100		
Temephos	TEMEPHOS	3383968			
TEPP	TEPP	107493	10	10	P111
Terbacil	TERBACIL	5902512			
Terbufos	TERBUFOS	13071799	100		
Tetrabromobisphenol A	TETRABROMOBISPHENOLA	79947			
1,2,4,5-Tetrachlorobenzene	TETRACHLOROBENZENE	95943		5,000	U207
2,3,7,8-tetrachlorodibenzofuran	TETRACHLORODIBENZOFURAN	51207319			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	TETRACHLORODIBENZO-P-DIOXIN (TCDD)	1746016		1	

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1,1,1,2-Tetrachloroethane	TETRACHLOROETHANE	630206		100	U208
1,1,2,2-Tetrachloroethane	TETRACHLOROETHANE	79345		100	U209
Tetrachloroethylene	TETRACHLOROETHYLENE	127184		100	U210
1,1,2,2-Tetrachloro-1-fluoroethane	TETRACHLOROFLUOROETHANE (HCFC-121)	354143			
1,1,1,2-Tetrachloro-2-fluoroethane	TETRACHLOROFLUOROETHANE (HCFC-121A)	354110			
2,3,4,6-Tetrachlorophenol	TETRACHLOROPHENOL	58902		10	
Tetrachlorvinphos	TETRACHLORVINPHOS	961115			
Tetracycline hydrochloride	TETRACYCLINEHYDROCHLORIDE	64755			
Tetraethyldithiopyrophosphate	TETRAETHYLDITHIOPYROPHOSPHATE	3689245	100	100	P109
Tetraethyl lead	TETRAETHYLLEAD	78002	10	10	P110
Tetraethyl pyrophosphate	TETRAETHYLPYROPHOSPHATE	107493	10	10	P111
Tetraethyltin	TETRAETHYLTIN	597648	100		
Tetrafluoroethylene	TETRAFLUOROETHYLENE	116143			
Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone(3-(4-(trifluoromethyl)phenyl)-1-(2-(4-(trifluoromethyl)phenyl)ethenyl)-2-propenylidene)hydrazone	TETRAHYDRODIMETHYLPYRIMIDINONETRIFLUOROME	67485294			
Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione	TETRAHYDRODIMETHYLTHIADIAZINETHIONE	533744			
Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione, ion(1-), sodium	TETRAHYDRODIMETHYLTHIADIAZINETHIONEION(1	53404607			
Tetramethrin	TETRAMETHRIN	7696120			
2,2,3,3-Tetramethylcyclopropane carboxylic acid cyano(3-phenoxyphenyl)methyl ester	TETRAMETHYLCYCLOPROPANECARBOXYLICACIDCYANOPHEN	39515418			
Tetramethyllead	TETRAMETHYLLEAD	75741	100		
Tetramethylsilane	TETRAMETHYLSILANE	75763			
Tetranitromethane	TETRANITROMETHANE	509148	10	10	P112
Thallic oxide	THALLIC OXIDE	1314325		100	P113
Thallium	THALLIUM	7440280		1,000	
Thallium(I) acetate	THALLIUMACETATE	563688		100	U214
Thallium(I) carbonate	THALLIUMCARBONATE	6533739	100	100	U215
Thallium chloride TICl	THALLIUMCHLORIDE TICl	7791120	100	100	U216
Thallium Compounds	THALLIUMCOMPOUNDS	N760		***	
Thallium(I) nitrate	THALLIUMNITRATE	10102451		100	U217
Thallium sulfate	THALLIUMSULFATE	10031591	100	100	
Thallium(I) sulfate	THALLIUMSULFATE	7446186	100	100	P115

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Thallous carbonate	THALLOUS CARBONATE	6533739	100	100	U215
Thallous chloride	THALLOUS CHLORIDE	7791120	100	100	U216
Thallous malonate	THALLOUS MALONATE	2757188	100		
Thallous sulfate	THALLOUS SULFATE	7446186	100	100	P115
Thiabendazole	THIABENDAZOLE	148798			
2-(4-Thiazolyl)-1H-benzimidazole	THIAZOLYLBENZIMIDAZOLE	148798			
Thioacetamide	THIOACETAMIDE	62555		10	U218
Thiobencarb	THIOBENCARB	28249776			
Thiocarbazide	THIOCARBAZIDE	2231574	1,000		
Thiocyanic acid, methyl ester	THIOCYANICACIDMETHYLESTER	556649	10,000		
4,4'-Thiodianiline	THIODIANILINE	139651			
Thiodicarb	THIODICARB	59669260		100	U410
Thiofanox	THIOFANOX	39196184	100	100	P045
Thiomethanol	THIOMETHANOL	74931	100	100	U153
Thionazin	THIONAZIN	297972	100	100	P040
Thiophanate ethyl	THIOPHANATEETHYL	23564069			
Thiophanate-methyl	THIOPHANATEMETHYL	23564058		10	U409
Thiophenol	THIOPHENOL	108985	100	100	P014
Thiosemicarbazide	THIOSEMICARBAZIDE	79196	100	100	P116
Thiourea	THIOUREA	62566		10	U219
Thiourea, (2-chlorophenyl)-	THIOUREA, (2-CHLOROPHENYL)-	5344821	100	100	P026
Thiourea, (2-methylphenyl)-	THIOUREA, (2-METHYLPHENYL)-	614788	500		
Thiourea, 1-naphthalenyl-	THIOUREANAPHTHALENYL-	86884	100	100	P072
Thiram	THIRAM	137268		10	U244
Thorium dioxide	THORIUMDIOXIDE	1314201			
Titanium chloride (TiCl4) (T-4)-	TITANIUMCHLORIDE (TICL4) (T-4)-	7550450	1,000	1,000	
Titanium tetrachloride	TITANIUMTETRACHLOR	7550450	1,000	1,000	
o-Tolidine	TOLIDINE	119937		10	U095
o-Tolidine dihydrochloride	TOLIDINEDIHYDROCHLORIDE	612828			
o-Tolidine dihydrofluoride	TOLIDINEDIHYDROFLUORIDE	41766750			
Toluene	TOLUENE	108883		1,000	U220
Toluenediamine	TOLUENEDIAMINE	25376458		10	U221
Toluene-2,4-diisocyanate	TOLUENEDIISOCYANATEA	584849	100	100	
Toluene-2,6-diisocyanate	TOLUENEDIISOCYANATEB	91087	100	100	
Toluenediisocyanate (mixed isomers)	TOLUENEDIISOCYANATEM	26471625		100	U223
Toluene diisocyanate (unspecified isomer)	TOLUENEDIISOCYANATEU	26471625		100	U223
o-Toluidine	TOLUIDINE	95534		100	U328

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
p-Toluidine	TOLUIDINE	106490		100	U353
o-Toluidine hydrochloride	TOLUIDINEHYDROCHL	636215		100	U222
Toxaphene	TOXAPHENE	8001352	1	1	P123
2,4,5-TP esters	TP ESTERS	32534955		100	
Triadimefon	TRIADIMEFON	43121433			
Triallate	TRIALLATE	2303175		100	U389
Triamiphos	TRIAMIPHOS	1031476	500		
Triaziquone	TRIAZIQUONE	68768			
Triazofos	TRIAZOFOS	24017478	500		
Tribenuron methyl	TRIBENURONMETHYL	101200480			
Tribromomethane	TRIBROMOMETHANE	75252		100	U225
Tributyltin fluoride	TRIBUTYLTINFLUORIDE	1983104			
Tributyltin methacrylate	TRIBUTYLTINMETHACRYLATE	2155706			
S,S,S-Tributyltrithiophosphate	TRIBUTYLTRITHIOPHOSPHATE (DEF)	78488			
Trichlorfon	TRICHLORFON	52686		100	
Trichloroacetyl chloride	TRICHLOROACETYL CHLORIDE	76028	500		
1,2,4-Trichlorobenzene	TRICHLOROBENZE	120821		100	
Trichloro(chloromethyl)silane	TRICHLOROCHLOROMETHYL)SILANE	1558254	100		
Trichloro(dichlorophenyl)silane	TRICHLORODICHLOROPHENYL)SILANE	27137855	500		
1,1,1-Trichloroethane	TRICHLOROETHANEA	71556		1,000	U226
1,1,2-Trichloroethane	TRICHLOROETHANEB	79005		100	U227
Trichloroethylene	TRICHLOROETHYLENE	79016		100	U228
Trichloroethylsilane	TRICHLOROETHYLSILANE	115219	500		
Trichlorofluoromethane	TRICHLOROFLUOROMETHANE	75694		5,000	U121
Trichloromethanesulfenyl chloride	TRICHLOROMETHANESULFENYL CHLORIDE	594423	100	100	
Trichloromonofluoromethane	TRICHLOROMONOFLUOROMETHANE	75694		5,000	U121
Trichloronate	TRICHLORONATE	327980	500		
Trichlorophenol	TRICHLOROPHENOL	25167822		10	
2,3,4-Trichlorophenol	TRICHLOROPHENOL-A	15950660		10	
2,3,5-Trichlorophenol	TRICHLOROPHENOL-B	933788		10	
2,3,6-Trichlorophenol	TRICHLOROPHENOL-C	933755		10	
2,4,5-Trichlorophenol	TRICHLOROPHENOL-D	95954		10	
2,4,6-Trichlorophenol	TRICHLOROPHENOL-E	88062		10	
3,4,5-Trichlorophenol	TRICHLOROPHENOL-F	609198		10	
Trichlorophenylsilane	TRICHLOROPHENYLSILANE	98135	500		
1,2,3-Trichloropropane	TRICHLOROPROPANE	96184			
Trichlorosilane	TRICHLOROSILANE	10025782			
Triclopyr triethylammonium salt	TRICLOPYRTRIETHYLAMMONIUM SALT	57213691			

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Triethanolamine dodecylbenzene sulfonate	TRIETHANOLAMINE DODECYLBENZENE SULFONATE	27323417		1,000	
Triethoxysilane	TRIETHOXYSILANE	998301	500		
Triethylamine	TRIETHYLAMINE	121448		5,000	U404
Trifluorochloroethylene	TRIFLUOROCHLOROETHYL	79389			
2-(4-((5-(Trifluoromethyl)-2-pyridinyl)oxy)-phenoxy)propanoic acid, butyl ester	TRIFLUOROMETHYLPYRIDINYLOXYPHENOXYPROPANOIC	69806504			
Trifluralin	TRIFLURALIN	1582098		10	
Triforine	TRIFORINE	26644462			
Trimethylamine	TRIMETHYLAMINE	75503		100	
1,2,4-Trimethylbenzene	TRIMETHYLBENZ	95636			
Trimethylchlorosilane	TRIMETHYLCHLOROSILANE	75774	1,000		
2,2,4-Trimethylhexamethylene diisocyanate	TRIMETHYLHEXAMETHYLENEDIISOCYANATE	16938220			
2,4,4-Trimethylhexamethylene diisocyanate	TRIMETHYLHEXAMETHYLENEDIISOCYANATE	15646965			
Trimethylolpropane phosphite	TRIMETHYLOLPROPANE PHOSPHITE	824113	100		
2,2,4-Trimethylpentane	TRIMETHYLPENTANE	540841		1,000	
2,3,5-Trimethylphenyl methylcarbamate	TRIMETHYLPHENYLMETHYLCARBAMATE	2655154			
Trimethyltin chloride	TRIMETHYLTIN CHLORIDE	1066451	500		
1,3,5-Trinitrobenzene	TRINITROBENZENE	99354		10	U234
Triphenyltin chloride	TRIPHENYLTIN CHLORIDE	639587	500		
Triphenyltin hydroxide	TRIPHENYLTINHYDROXIDE	76879			
Tris(2-chloroethyl)amine	TRIS(2-CHLOROETHYL)AMINE	555771	100		
Tris(2,3-dibromopropyl) phosphate	TRISDIBROMOPROP	126727		10	U235
Tris(dimethylcarbamodithioato-S,S')iron	TRISDIMETHYLCARBAMODITHIOATO-S,S')IRON	14484641			
Trypan blue	TRYPAN BLUE	72571		10	U236
Uracil mustard	URACIL MUSTARD	66751		10	U237
Uranyl acetate	URANYL ACETATE	541093		100	
Uranyl nitrate	URANYL NITRATE	10102064		100	
Uranyl nitrate	URANYL NITRATE	36478769		100	
Urea, N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]-	UREADIMETHYLTRIFLUOROMETHYL)PHENYL]-	2164172			
Urethane	URETHANE	51796		100	U238
Valinomycin	VALINOMYCIN	2001958	1,000		

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NAME	NAME INDEX	CAS - 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Vandium (except when contained in an alloy)	VANADIUM	7440622			
Vanadium pentoxide	VANADIUM PENTOXIDE	1314621	1,000	1,000	P120
Vanadyl sulfate	VANADYL SULFATE	27774136		1,000	
Vandium Compounds	VANDIUM COMPOUNDS	N770			
Vikane	VIKANE	2699798			
Vinclozolin	VINCLOZOLIN	50471448			
Vinyl acetate	VINYLACETATE	108054	5,000	5,000	
Vinyl acetate monomer	VINYLACETATEMONOMER	108054	5,000	5,000	
Vinyl acetylene	VINYLACETYLENE	689974			
Vinyl bromide	VINYLBROMIDE	593602		100	
Vinyl chloride	VINYLCHLORIDE	75014		1	U043
Vinyl ethyl ether	VINYLETHYLETHER	109922			
Vinyl fluoride	VINYLFLUORIDE	75025			
Vinylidene chloride	VINYLIDENECHLORIDE	75354		100	U078
Vinylidene fluoride	VINYLIDENEFLUORIDE	75387			
Vinyl methyl ether	VINYLMETHYLETHER	107255			
Warfarin	WARFARIN	81812	100	100	P001
Warfarin and salts	WARFARIN AND SALTS	N874			
Warfarin, & salts, conc.>0.3%	WARFARIN SALTS, WHEN PRESENT AT CONCENTRATIONS	81812		100	P001
Warfarin sodium	WARFARIN SODIUM	129066	100	100	
m-Xylene	XYLENEA	108383		1,000	U239

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
o-Xylene	XYLENEB	95476		1,000	U239
p-Xylene	XYLENEC	106423		100	U239
Xylene (mixed isomers)	XYLENEMIXEDISOMER	1330207		100	U239
Xylenol	XYLENOL	1300716		1,000	
2,6-Xylidine	XYLIDINE	87627			
Xylylene dichloride	XYLYLENE DICHLORIDE	28347139	100		
Zinc	ZINC	7440666		1,000	
Zinc (fume or dust)	ZINC	7440666		1,000	
Zinc acetate	ZINCACETATE	557346		1,000	
Zinc ammonium chloride	ZINCAMMONIUM CHLORIDE	14639975		1,000	
Zinc ammonium chloride	ZINCAMMONIUM CHLORIDE	14639986		1,000	
Zinc ammonium chloride	ZINCAMMONIUM CHLORIDE	52628258		1,000	
Zinc borate	ZINCBORATE	1332076		1,000	
Zinc bromide	ZINCBROMIDE	7699458		1,000	
Zinc carbonate	ZINCCARBONATE	3486359		1,000	
Zinc chloride	ZINCCHLORIDE	7646857		1,000	
Zinc Compounds	ZINCCOMPOUNDS	N982		***	
Zinc cyanide	ZINCCYANIDE	557211		10	P121
Zinc, dichloro(4,4-dimethyl-5((((methylamino)carbonyl)oxy)imino)pentanenitrile)-, (T-4)-	ZINCDICHLORO(4,4-DIMETHYL-5((((METHYLAMINO) CARB	58270089	100		
Zinc fluoride	ZINCFLUORIDE	7783495		1,000	
Zinc formate	ZINCFORMATE	557415		1,000	
Zinc hydrosulfite	ZINCHYDROSULFITE	7779864		1,000	
Zinc nitrate	ZINCNITRATE	7779886		1,000	
Zinc phenolsulfonate	ZINCPHENOLSULFONATE	127822		5,000	
Zinc phosphide	ZINCPHOSPHIDE	1314847	100	100	P122
Zinc phosphide (conc. <= 10%)	ZINCPHOSPHIDE	1314847	100	100	U249
Zinc phosphide (conc. > 10%)	ZINCPHOSPHIDE	1314847	100	100	P122
Zinc silicofluoride	ZINCSILICOFLUORIDE	16871719		5,000	
Zinc sulfate	ZINCSULFATE	7733020		1,000	
Zineb	ZINEB	12122677			
Ziram	ZIRAM	137304		10	P205
Zirconium nitrate	ZIRCONIUMNITRATE	13746899		5,000	
Zirconium potassium fluoride	ZIRCONIUMPOTASSIUM FLUORIDE	16923958		1,000	
Zirconium sulfate	ZIRCONIUMSULFATE	14644612		5,000	
Zirconium tetrachloride	ZIRCONIUMTETRACHLORIDE	10026116		5,000	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
THE LIST BELOW CONTAINS RCRA WASTE STREAMS AND UNLISTED HAZARDOUS WASTES. THE DESCRIPTIONS OF THE WASTE STREAMS HAVE BEEN TRUNCATED.					
THE FOLLOWING LIST SHOULD BE USED FOR REFERENCE ONLY. COMPLIANCE INFORMATION CAN BE FOUND IN 40 CFR PART 302 AND TABLE 302.4					
The following spent halogenated solvents used in degreasing; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10 percent or more (by volume) of one or more of the halogenated solvents listed below or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.				10	F001
(a) Tetrachloroethylene (CAS No. 127-18-4, RCRA Waste No. U210)				100	
(b) Trichloroethylene (CAS No. 79-01-6, RCRA Waste No. U228)				100	
(c) Methylene chloride (CAS No. 75-09-2, RCRA Waste No. U080)				1,000	
(d) 1,1,1-Trichloroethane (CAS No. 71-55-6, RCRA Waste No. U226)				1,000	
(e) Carbon tetrachloride (CAS No. 56-23-5, RCRA Waste No. U211)				10	
(f) Chlorinated fluorocarbons				5,000	
The following spent halogenated solvents; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10 percent or more (by volume) of one or more of the halogenated solvents listed below or those solvents listed in F001, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.				10	F002
(a) Tetrachloroethylene (CAS No. 127-18-4, RCRA Waste No. U210)				100	
(b) Methylene chloride (CAS No. 75-09-2, RCRA Waste No. U080)				1,000	
(c) Trichloroethylene (CAS No. 79-01-6, RCRA Waste No. U228)				100	
(d) 1,1,1-Trichloroethane (CAS No. 71-55-6, RCRA Waste No. U226)				1,000	
(e) Chlorobenzene (CAS No. 108-90-7, RCRA Waste No. U037)				100	
(f) 1,1,2-Trichloro-1,2,2-trifluoroethane (CAS No. 76-13-1)				5,000	
(g) o-Dichlorobenzene (CAS No. 95-50-1, RCRA Waste No. U070)				100	
(h) Trichlorofluoromethane (CAS No. 75-69-4, RCRA Waste No. U121)				5,000	
(i) 1,1,2-Trichloroethane (CAS No. 79-00-5, RCRA Waste No. U227)				100	

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The following spent non-halogenated solvents and still bottoms from recovery of these solvents:				100	F003
(a) Xylene (CAS No. 1330-20-7, RCRA Waste No. U239)				1,000	
(b) Acetone (CAS No. 67-64-1, RCRA Waste No. U002)				5,000	
(c) Ethyl acetate (CAS No. 141-78-6, RCRA Waste No. U112)				5,000	
(d) Ethylbenzene (CAS No. 100-41-4)				1,000	
(e) Ethyl ether (CAS No. 60-29-7, RCRA Waste No. U117)				100	
(f) Methyl isobutyl ketone (CAS No. 108-10-1, RCRA Waste No. U161)				5,000	
(g) n-Butyl alcohol (CAS No. 71-36-3, RCRA Waste No. U031)				5,000	
(h) Cyclohexanone (CAS No. 108-94-1, RCRA Waste No. U057)				5,000	
(i) Methanol (CAS No. 67-56-1, RCRA Waste No. U154)				5,000	
The following spent non-halogenated solvents and still bottoms from recovery of these solvents:				100	F004
(a) Cresols/cresylic acid (CAS No. 1319-77-3, RCRA Waste No. U052)				100	
(b) Nitrobenzene (CAS No. 98-95-3, RCRA Waste No. U169)				1,000	
The following spent non-halogenated solvents and still bottoms from recovery of these solvents:				100	F005
(a) Toluene (CAS No. 108-88-3, RCRA Waste No. U220)				1,000	
(b) Methyl ethyl ketone (CAS No. 78-93-3, RCRA Waste No. U159)				5,000	
(c) Carbon disulfide (CAS No. 75-15-0, RCRA Waste No. P022)				100	
(d) Isobutanol (CAS No. 78-83-1, RCRA Waste No. U140)				5,000	
(e) Pyridine (CAS No. 110-86-1, RCRA Waste No. U196)				1,000	

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Wastewater treatment sludges from electroplating operations (w/some exceptions)				10	F006
Spent cyanide plating bath solns. from electroplating				10	F007
Plating bath residues from electroplating where cyanides are used				10	F008
Spent stripping/cleaning bath solns. from electroplating where cyanides are used				10	F009
Quenching bath residues from metal heat treating where cyanides are used				10	F010
Spent cyanide soln. from salt bath pot cleaning from metal heat treating				10	F011
Quenching wastewater sludges from metal heat treating where cyanides are used				10	F012
Wastewater treatment sludges from chemical conversion aluminum coating				10	F019
Wastes from prod. or use of tri/tetrachlorophenol or derivative intermediates				1	F020
Wastes from prod. or use of pentachlorophenol or intermediates for derivatives				1	F021
Wastes from use of tetra/penta/hexachlorobenzenes under alkaline conditions				1	F022
Wastes from mat. prod. on equip. previously used for tri\tetrachlorophenol				1	F023
Wastes from production of chlorinated aliphatic hydrocarbons (C1-C5)				1	F024
Lights ends, filters from prod. of chlorinated aliphatic hydrocarbons (C1-C5)				1	F025
Waste from equipment previously used to prod: tetra/penta/hexachlorobenzenes				1	F026
Discarded formulations containing tri/tetra/pentachlorophenols or derivatives				1	F027
Residues from incineration of soil contaminated w/ F020,F021,F022,F023,F026,F027				1	F028
Wastewaters, process residuals from wood preserving using chlorophenolic solns.				1	F032
Wastewaters, process residuals from wood preserving using creosote formulations				1	F034
Wastewaters, process residuals from wood preserving using arsenic or chromium				1	F035
Petroleum refinery primary oil/water/solids separation sludge				1	F037
Petroleum refinery secondary (emulsified) oil/water/solids separation sludge				1	F038
Multisource leachate				1	F039

NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Wastewater treatment sludge from creosote/pentachlorophenol wood preserving				1	K001
Wastewater treatment sludge from prod. of chrome yellow and orange pigments				10	K002
Wastewater treatment sludge from prod. of molybdate orange pigments				10	K003
Wastewater treatment sludge from prod. of zinc yellow pigments				10	K004
Wastewater treatment sludge from prod. of chrome green pigments				10	K005
Wastewater treatment sludge from prod. of chrome oxide green pigments				10	K006
Wastewater treatment sludge from prod. of iron blue pigments				10	K007
Oven residue from prod. of chrome oxide green pigments				10	K008
Dist. bottoms from prod. of acetaldehyde from ethylene				10	K009
Dist. side cuts from prod. of acetaldehyde from ethylene				10	K010
Bottom stream from wastewater stripper in acrylonitrile prod.				10	K011
Bottom stream from acetonitrile column in acrylonitrile prod.				10	K013
Bottoms from acetonitrile purification column in acrylonitrile prod.				5,000	K014
Still bottoms from the dist. of benzyl chloride				10	K015
Heavy ends or dist. residues from prod. of carbon tetrachloride				1	K016
Heavy ends from the purification column in epichlorohydrin prod.				10	K017
Heavy ends from the fractionation column in ethyl chloride prod.				1	K018
Heavy ends from the dist. of ethylene dichloride during its prod.				1	K019
Heavy ends from the dist. of vinyl chloride during prod. of the monomer				1	K020
Aqueous spent antimony catalyst waste from fluoromethanes prod.				10	K021
Dist. bottom tars from prod. of phenol/acetone from cumene				1	K022
Dist. light ends from prod. of phthalic anhydride from naphthalene				5,000	K023
Dist. bottoms from prod. of phthalic anhydride from naphthalene				5,000	K024
Dist. bottoms from prod. of nitrobenzene by nitration of benzene				10	K025
Stripping still tails from the prod. of methyl ethyl pyridines				1,000	K026
Centrifuge/dist. residues from toluene diisocyanate prod.				10	K027
Spent catalyst from hydrochlorinator reactor in prod. of 1,1,1-trichloroethane				1	K028
Waste from product steam stripper in prod. of 1,1,1-trichloroethane				1	K029
Column bottoms/heavy ends from prod. of trichloroethylene and perchloroethylene				1	K030
By-product salts generated in the prod. of MSMA and cacodylic acid				1	K031
Wastewater treatment sludge from the prod. of chlordane				10	K032
Wastewaster/scrubwater from chlorination of cyclopentadiene in chlordane prod.				10	K033
Filter solids from filtration of hexachlorocyclopentadiene in chlordane prod.				10	K034
Wastewater treatment sludges from the prod. of creosote				1	K035
Still bottoms from toluene reclamation distillation in disulfoton prod.				1	K036
Wastewater treatment sludges from the prod. of disulfoton				1	K037
Wastewater from the washing and stripping of phorate production				10	K038
Filter cake from filtration of diethylphosphorodithioic adid in phorate prod.				10	K039

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Wastewater treatment sludge from the prod. of phorate				10	K040
Wastewater treatment sludge from the prod. of toxaphene				1	K041
Heavy ends/residues from dist. of tetrachlorobenzene in 2,4,5-T prod.				10	K042
2,6-Dichlorophenol waste from the prod. of 2,4-D				10	K043
Wastewater treatment sludge from manuf. and processing of explosives				10	K044
Spent carbon from treatment of wastewater containing explosives				10	K045
Wastewater sludge from manuf.,formulating,loading of lead-based initiating compd				10	K046
Pink/red water from TNT operations				10	K047
Dissolved air flotation (DAF) float from the petroleum refining industry				10	K048
Slop oil emulsion solids from the petroleum refining industry				10	K049
Heat exchanger bundle cleaning sludge from petroleum refining industry				10	K050
API separator sludge from the petroleum refining industry				10	K051
Tank bottoms (leaded) from the petroleum refining industry				10	K052
Ammonia still lime sludge from coking operations				1	K060
Emission control dust/sludge from primary prod. of steel in electric furnaces				10	K061
Spent pickle liquor generated by steel finishing (SIC codes 331 and 332)				10	K062
Acid plant blowdown slurry/sludge from blowdown slurry from primary copper prod.				10	K064
Surface impoundment solids at primary lead smelting facilities				10	K065
Sludge from treatment of wastewater/acid plant blowdown from primary zinc prod.				10	K066
Emission control dust/sludge from secondary lead smelting				10	K069
Brine purification muds from mercury cell process in chlorine production				1	K071
Chlorinated hydrocarbon waste from diaphragm cell process in chlorine production				10	K073
Distillation bottoms from aniline extraction				100	K083
Wastewater sludges from prod. of veterinary pharm. from arsenic compds.				1	K084
Distillation or fractionation column bottoms in prod. of chlorobenzenes				10	K085
Wastes/sludges from prod. of inks from chromium and lead-containing substances				10	K086
Decanter tank tar sludge from coking operations				100	K087
Spent potliners from primary aluminum reduction				10	K088
Emission control dust/sludge from ferrochromiumsilicon prod.				10	K090
Emission control dust/sludge from ferrochromium prod.				10	K091
Dist. light ends from prod. of phthalic anhydride by ortho-xylene				5,000	K093
Dist. bottoms in prod. of phthalic anhydride by ortho-xylene				5,000	K094
Distillation bottoms in prod. of 1,1,1-trichloroethane				100	K095
Heavy ends from dist. column in prod. of 1,1,1-trichloroethane				100	K096
Vacuum stripper discharge from the chlordane chlorinator in prod. of chlordane				1	K097
Untreated process wastewater from the prod. of toxaphene				1	K098
Untreated wastewater from the prod. of 2,4-D				10	K099
Waste leaching soln from emission control dust/sludge in secondary lead smelting				10	K100
Dist. tar residue from aniline in prod. of veterinary pharm. from arsenic compd.				1	K101

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Residue from activated carbon in prod. of veterinary pharm. from arsenic compds.				1	K102
Process residues from aniline extraction from the prod. of aniline				100	K103
Combined wastewater streams generated from prod. of nitrobenzene/aniline				10	K104
Aqueous stream from washing in prod. of chlorobenzenes				10	K105
Wastewater treatment sludge from mercury cell process in chlorine prod.				1	K106
Column bottoms from separation in prod. of UDMH from carboxylic acid hydrazides				10	K107
Condensed column overheads and vent gas from prod. of UDMH from -COOH hydrazides				10	K108
Spent filter catridges from purif. of UDMH prod. from carboxylic acid hydrazides				10	K109
Condensed column overheads from separation in UDMH prod. from -COOH hydrazides				10	K110
Product washwaters from prod. of dinitrotoluene via nitration of toluene				10	K111
Reaction by-product water from drying in toluenediamine prod from dinitrotoluene				10	K112
Condensed liquid light ends from purification of toluenediamine during its prod.				10	K113
Vicinals from purification of toluenediamine during its prod from dinitrotoluene				10	K114
Heavy ends from toluenediamine purification during prod. from dinitrotoluene				10	K115
Organic condensate from solvent recovery system in prod. of toluene diisocyanate				10	K116
Wastewater from vent gas scrubber in ethylene bromide prod by ethene bromination				1	K117
Spent absorbent solids in purification of ethylene dibromide in its prod.				1	K118
Process waterwater from the prod. of ethylenebisdithiocarbamic acid and salts				10	K123
Reactor vent scubber water from prod of ethylenebisdithiocarbamic acid and salts				10	K124
Filtration/other solids from prod. of ethylenebisdithiocarbamic acid and salts				10	K125
Dust/sweepings from the prod. of ethylenebisdithiocarbamic acid and salts				10	K126
Wastewater and spent sulfuric acid from the prod. of methyl bromide				100	K131
Spent absorbent and wastewater solids from the prod. of methyl bromide				1,000	K132

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Still bottoms from ethylene dibromide purif. in prod. by ethene bromination				1	K136
Process residues from coal tar recovery in coking				1	K141
Tar storage tank residues from coke prod. from coal or recovery of coke by-prods				1	K142
Process residues from recovery of light oil in coking				1	K143
Wastewater residues from light oil refining in coking				1	K144
Residues from naphthalene collection and recovery from coke by-products				1	K145
Tar storage tank residues from coal tar refining in coking				1	K147
Residues from coal tar distillation, including still bottoms, in coking				1	K148
Distillation bottoms from the prod. of chlorinated toluenes/benzoyl chlorides				10	K149
Organic residuals from Cl gas and HCl recovery from chlorinated toluene prod.				10	K150
Wastewater treatment sludge from production of chlorotoluenes/benzoyl chlorides				10	K151
Organic waste from production of carbamates and carbamoyl oximes				10	K156
Wastewaters from production of carbamates and carbamoyl oximes (not sludges)				10	K157
Bag house dusts & filter/separation solids from prod of carbamates, carb oximes				10	K158
Organics from treatment of thiocarbamate waste				10	K159
Purif. solids/bag house dust/sweepings from prod of dithiocarbamate acids/salts				1	K161
Crude oil storage tank sediment from refining operations				10	K169
Clarified slurry oil tank sediment of in-line filter/separation solids				1	K170
Spent hydrotreating catalyst				1	K171
Spent hydrorefining catalyst				1	K172
Wastewater treatment sludges from the production of ethylene dichloride or vinyl chloride monomer (EDC/VCM)				1	K174
Wastewater treatment sludges from the production vinyl chloride monomer using mercuric chloride catalyst in an acetlyene-based process				1	K175
Residues from manufacturing and manufacturing-site storage of ferric chloride from acids formed during the production of titanium dioxide using the chloride-ilmenite process					K178
Nonwastewaters generated from the production of certain dyes, pigments, and FD&C colorants				1	K181

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Unlisted hazardous wastes characteristic of ignitability				100	D001
Unlisted hazardous wastes characteristic of corrosivity				100	D002
Unlisted hazardous wastes characteristic of reactivity				100	D003
Unlisted hazardous wastes characteristic of toxicity:					
Arsenic				1	D004
Barium				1,000	D005
Cadmium				10	D006
Chromium				10	D007
Lead				10	D008
Mercury				1	D009
Selenium				10	D010
Silver				1	D011
Endrin				1	D012
Lindane				1	D013
Methoxychlor				1	D014
Toxaphene				1	D015
2,4-D				100	D016
2,4,5-TP				100	D017
Benzene				10	D018
Carbon tetrachloride				10	D019
Chlordane				1	D020
Chlorobenzene				100	D021
Chloroform				10	D022
o-Cresol				100	D023
m-Cresol				100	D024
p-Cresol				100	D025
Cresol				100	D026
1,4-Dichlorobenzene				100	D027
1,2-Dichloroethane				100	D028
1,1-Dichloroethylene				100	D029
2,4-Dinitrotoluene				10	D030
Heptachlor (and epoxide)				1	D031
Hexachlorobenzene				10	D032
Hexachlorobutadiene				1	D033
Hexachloroethane				100	D034
Methyl ethyl ketone				5,000	D035
Nitrobenzene				1,000	D036
Pentachlorophenol				10	D037

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NAME	NAME INDEX	CAS 313 Category Codes	EPCRA Section 304 EHS RQ	CERCLA Section 355 RQ	RCRA CODE
Pyridine				1,000	D038
Tetrachloroethylene				100	D039
Trichloroethylene				100	D040
2,4,5-Trichlorophenol				10	D041
2,4,6-Trichlorophenol				10	D042
Vinyl chloride		EN-PP-100		1	D043

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Spilled Liquid Evaporation Rates

$E = (0.284U^{0.78} * MW^{2/3} * A * VP)/(82.05 * T)$

E = Evaporation rate in lb/min
U = Wind speed above spilled liquid surface (m/s)
MW = molecular weight of spilled liquid
A = Spilled liquid surface area
VP = Spilled liquid vapor pressure at liquid temperature (mm Hg)
T = Spilled liquid temperature (K)

To simplify the above:

Assume U = 1 m/s
Assume A = 1 ft^2
Assume T = 25 C = 298.15 K 25 8.559058

Therefore, the above equation becomes

$E = (0.284 * MW^{2/3} * VP)/24463$ or $E = (MW^{2/3} * VP)/86137$

Where E = evaporation rate in $lb/min/ft^2$

For example, for MeOH
MW = 32.04
VP = 125 mm Hg

E =	$32.04^{.667}$	times	125	divided by	86137
E =	10.09943		125		86137
E =	0.014656 $lb/min/ft^2$				

EN-PP-100

Chemical	Mol Wt	Vap. Press mmHg *	Evap Rate Factor lb/min/ft2
Acetic Acid	60	15	0.002672566
Acetic Anhydride	102.1	5.2	0.00132079
Acetone	58.08	236.5	0.04123321
Acetonitrile	41	92	0.01271525
Acetyl Chloride	78.5	280	0.05968241
Ammonia	17	7335	0.563533589
Ammonium Chloride		Negl (< 1mm)	
Ammonium Hydroxide		Negl	
Aniline		Negl	
Boron Trifluoride	67.8	129168	24.96866939
Bromine	159.8	200	0.06848981
Butanol	74.1	6	0.001230638
Butylacetate	116.16	13	0.003598706
Chlorine	70.9	5750	1.145141468
Cyclohexane	84.16	102	0.022774872
Cyclohexanone	98.14	5	0.00123692
Diethanolamine		Negl	
Diethylamine	73.13	220	0.044728536
Diethyl ether	74.12	535	0.109751625
Dimethylamine	45.08	1526	0.224683954
Ethyl Acetate	88.1	90	0.020718185
Ethylene Glycol		Negl	
Formaldehyde	30	3783	0.424508584
Hexane	86.18	150	0.034026529
Hydrogen Chloride	36.46	35000	4.473114524

Hydrogen Cyanide	27	721	0.075416288
MMT	Negl		
Mercury	Negl		
Methanol	32.04	125	0.014656058
Methyl Chloride	50.5	4340	0.68927946
MEK	72.1	90	0.018125733
Methylene Chloride	84.93	438	0.098393892
MIBK	100.16	20	0.005015374
Nitric acid	Negl		
nitrous acid sodium salt	Negl		
Paraformaldehyde	30	3783	0.424508584
Phenol	Negl		
Phosphoric Acid	Negl		
Potassium Bichromate	Negl		
Potassium Hydroxide	Negl		
Potassium Permanganate	Negl		
Propylene Oxide	58	490	0.085351825
Sodium	Negl		
Sodium Bichromate	Negl		
Sodium Bisulfite	Negl		
Sodium Cyanide	Negl		
Sodium Hydroxide	Negl		
Sodium Hypochlorite	Negl		
Sulfuric Acid	Negl		
Sulfur Dioxide	64	3001	0.558210879
Tetrahydrofuran	72	161	0.03239492

Titanium Tetrachloride	189.7	12	0.004607469
Toluene	92.14	28	0.006641333
Triethylamine	101.2	68	0.017170169
Xylene	106.17	8.4	0.002189943

* Vapor pressures < 1 mm Hg are considered negligible

EN-PP-100

Appendix B – List and Location of Emergency Equipment

EQUIPMENT TYPE	EQUIPMENT CAPABILITIES
A10-00- type of fire extinguisher	10# Ansul fire extinguisher used for class B & C fires
A150-00-type of fire extinguisher	150 # Wheeled Ansul fire extinguisher for large class B&C fires
A20-00-type of extinguisher	20# Ansul fire extinguisher for class B & C fires
A30-00-type of fire extinguisher	30# Ansul fire extinguisher for class B & C fires
A350-00-tye of fire extinguisher	350# Wheeled Ansul fire extinguisher for large class B & C fires
A5-00-type of fire extinguisher	5# Ansul fire extinguisher for class B & C fires
AS-air station	Used to supply class D breathing air throughout the plant
CO2-type of fire extinguisher	Used for class B & C fires
Drager-SCBA	Self contained breathing apparatus used for fire fighting and hazardous atmosphere
ED-escape device	10 minute escape pack to use for egress in the event of an emergency
EW-eye wash	Eye wash used for decontamination of the eyes in the event of chemical exposure
FB-fire blanket	For medical use in the event that someone is burned
FE-type of fire extinguisher	Clean agent fire extinguisher used around electronics can be used on class B fires
FH-fire hydrant	Used to supply water to portable monitors and to fire truck
Halon-type of fire extinguisher	Clean agent fire extinguisher used around electronics
HB-hose box	Contains 150ft of 1 1/2” fire hose for the incipient fire fighter
HR-hose reel	Portable wheeled units that deliver fire hose to the scene of an incident allows for rapid deployment
HRack-hose rack	Used to store fire hose
M30-00-type of fire extinguisher	Used to fight metal fires magnesium, sodium
P30-00 Type of fire extinguisher	Purple potassium fire extinguisher for class B& C fires
PD-pass device	(Personal alert safety device) used for fire fighter doing interior fire fighting for finding a downed fire fighter
PIV-post indicator valve	Used to manipulate underground fire main valves

PTN-portable turret	A portable Master stream 350 gpm for firefighting
PW-type of fire extinguisher	Pressurized water extinguisher used for Class A fires
RD-retrieval device	Used for confined space operations and for confined space rescue for retrieving entrants
RES-resuscitator	Medical oxygen for medical emergencies
SH-sprinkler valve house	Contains the control valve for sprinklers for dry pipe, wet pipe and deluge systems
SK-spill kits	Used for small haz-mat spill containment and cleanup
SS-safety shower	Used for decontamination in the plant in the event of a chemical exposure
TN-turret nozzle	Fixed master streams 350 gpm used for exposure control and large fire fighting operations and for mass decontamination
ERT-VAN	Carries all response equipment SCBA's, haz-mat, high angle rescue and confined space rescue
Ambulance	Basic life support unit used to transport patients to the local hospital
Fire Truck	1500 gpm mid-ship pump with ability to discharge water or foam from any connection on the truck with Williams hot shot system automatic or manual control, carries 1000ft of 5" large diameter hose carries 500gal of water and 800 gals of fire aide 2000 foam

For complete listing of equipment, please see Emergency Response Specialist.

REVISION RECORD

04/14/11	Revised legend. Deleted items, EL, ES & EX. Added attachment for equipment list.
04/15/11	Revised legend to add SK-spill kits. Also added revised attachment with spill kits.
10/30/13	Revised equipment list attachment.
05/21/15	Removed legend and created table with equipment type and equipment capabilities.
12/17/15	Updated Spreadsheet to include procedure reference.
09/27/16	See wording in red for changes.
02/13/17	Revised to capture correct number sequence.
02/04/20	Biennial review. No changes

	#REF!							Frequency	Inspections	
5	374-5847	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-05638	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-0609	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-0616	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-0670	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-2827	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-5597	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	6115-5649	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
3*	A05-257	FIRE	EXTINGUISHER	ANSUL	5 LB	AMBULANCE BUILDING	AMBULANCE - PATIENT COMPARTMENT	144	SPECIAL	HYDROTEST
3*	A05-257	FIRE	EXTINGUISHER	ANSUL	5 LB	AMBULANCE BUILDING	AMBULANCE - PATIENT COMPARTMENT	1	INT/EXT	VIS
3*	A05-257	FIRE	EXTINGUISHER	ANSUL	5 LB	AMBULANCE BUILDING	AMBULANCE - PATIENT COMPARTMENT	12	SPECIAL	FULL
3*	A05-313	FIRE	EXTINGUISHER	ANSUL	5 LB	WILDLIFE HABITAT	COOK SHED	1	INT/EXT	VIS
3*	A05-313	FIRE	EXTINGUISHER	ANSUL	5 LB	WILDLIFE HABITAT	COOK SHED	144	SPECIAL	HYDROTEST
3*	A05-313	FIRE	EXTINGUISHER	ANSUL	5 LB	WILDLIFE HABITAT	COOK SHED	12	SPECIAL	FULL
2*	A150-004	FIRE	EXTINGUISHER	ANSUL	150LB	EMT SHED	EMT SHED	1	INT/EXT	VIS
2*	A150-004	FIRE	EXTINGUISHER	ANSUL	150LB	EMT SHED	EMT SHED	144	SPECIAL	HYDROTEST
4	A150-005	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	1ST FLOOR - HCN PLANT	1	INT/EXT	VIS
4	A150-005	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	1ST FLOOR - HCN PLANT	144	SPECIAL	HYDROTEST
4	A150-006	FIRE	EXTINGUISHER	ANSUL WU	150 LB	EMT SHED	EMT SHED	144	SPECIAL	HYDROTEST
4	A150-006	FIRE	EXTINGUISHER	ANSUL WU	150 LB	EMT SHED	EMT SHED	1	INT/EXT	VIS
2*	A150-007	FIRE	EXTINGUISHER	ANSUL WU	150 LB	EMT SHED	EMT SHED	1	INT/EXT	VIS
2*	A150-007	FIRE	EXTINGUISHER	ANSUL WU	150 LB	EMT SHED	EMT SHED	144	SPECIAL	HYDROTEST
3	A150-8	FIRE	EXTINGUISHER	ANSUL WU	150 LB	Plant 14		144	SPECIAL	HYDROTEST
3	A150-8	FIRE	EXTINGUISHER	ANSUL WU	150 LB	Plant 14		1	INT/EXT	VIS
5	A150-C01	FIRE	EXTINGUISHER	ANSUL WU	150 LB	MAINTENANCE COMPLEX	STORES	144	SPECIAL	HYDROTEST
5	A150-C01	FIRE	EXTINGUISHER	ANSUL WU	150 LB	MAINTENANCE COMPLEX	STORES	1	INT/EXT	VIS
4	A150-C01	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	3RD FLOOR - WEST SIDE	1	INT/EXT	VIS
4	A150-C01	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	3RD FLOOR - WEST SIDE	144	SPECIAL	HYDROTEST
4	A150-C02	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	3TH FLOOR - WEST SIDE	1	INT/EXT	VIS
4	A150-C02	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	3TH FLOOR - WEST SIDE	144	SPECIAL	HYROTEST
4	A150-C03	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	4TH FLOOR - WEST SIDE - PORCH	144	SPECIAL	HYDROTEST
4	A150-C03	FIRE	EXTINGUISHER	ANSUL WU	150 LB	PLANT 9	4TH FLOOR - WEST SIDE - PORCH	1	INT/EXT	VIS
2*	A15-314	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3	SUBOFFICE - HALLWAY	144	SPECIAL	HYDROTEST
2*	A15-314	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3	SUBOFFICE - HALLWAY	1	INT/EXT	VIS
2*	A15-315	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3	SUBOFFICE - HALLWAY	144	SPECIAL	HYDROTEST
2*	A15-315	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3	SUBOFFICE - HALLWAY	1	INT/EXT	VIS
1	A15-316	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3/4	SATELLITE SHOP	144	SPECIAL	HYDROTEST
1	A15-316	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3/4	SATELLITE SHOP	1	INT/EXT	VIS
2*	A15-317	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3	SATELLITE SHOP	1	INT/EXT	VIS
2*	A15-317	FIRE	EXTINGUISHER	ANSUL	15 LB	AREA 3	SATELLITE SHOP	144	SPECIAL	HYDROTEST
1*	A15-318	FIRE	EXTINGUISHER	ANSUL	15 LB	ADMIN SERVICES BUILDING	1ST FLOOR - ELEVATOR ROOM	1	INT/EXT	VIS
1*	A15-318	FIRE	EXTINGUISHER	ANSUL	15 LB	ADMIN SERVICES BUILDING	1ST FLOOR - ELEVATOR ROOM	144	SPECIAL	HYDROTEST
1*	A15-318	FIRE	EXTINGUISHER	ANSUL	15 LB	ADMIN SERVICES BUILDING	1ST FLOOR - ELEVATOR ROOM	12	SPECIAL	FULL
3	A20-001	FIRE	EXTINGUISHER	ANSUL	20 LB	RIVER ROAD	SOUTHEAST OF CLARIFIER 1	12	SPECIAL	FULL

3	A20-001	FIRE	EXTINGUISHER	ANSUL	20 LB	RIVER ROAD	SOUTHEAST OF CLARIFIER 1	1	INT/EXT	VIS
3	A20-001	FIRE	EXTINGUISHER	ANSUL	20 LB	RIVER ROAD	SOUTHEAST OF CLARIFIER 1	144	SPECIAL	HYDROTEST
4*	A20-002	FIRE	EXTINGUISHER	ANSUL	20 LB	RIVER ROAD	CLARIFIER #2	12	SPECIAL	FULL
4*	A20-002	FIRE	EXTINGUISHER	ANSUL	20 LB	RIVER ROAD	CLARIFIER #2	144	SPECIAL	HYDROTEST
4*	A20-002	FIRE	EXTINGUISHER	ANSUL	20 LB	RIVER ROAD	CLARIFIER #2	1	INT/EXT	VIS
2*	A20-003	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR - NAPROXEN CRUDE STACKUI	144	SPECIAL	HYDROTEST
2*	A20-003	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR - NAPROXEN CRUDE STACKUI	1	INT/EXT	VIS
2*	A20-003	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR - NAPROXEN CRUDE STACKUI	12	SPECIAL	FULL
2*	A20-004	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	3RD FLOOR - NAPROXEN CRUDE STACKUI	144	SPECIAL	HYDROTEST
2*	A20-004	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	3RD FLOOR - NAPROXEN CRUDE STACKUI	1	INT/EXT	VIS
2*	A20-004	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	3RD FLOOR - NAPROXEN CRUDE STACKUI	12	SPECIAL	FULL
2*	A20-005	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR - NAPROXEN CRUDE STACKUI	12	SPECIAL	FULL
2*	A20-005	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR - NAPROXEN CRUDE STACKUI	144	SPECIAL	HYDROTEST
2*	A20-005	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR - NAPROXEN CRUDE STACKUI	1	INT/EXT	VIS
3*	A20-006	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	AREA 3 CONFINED SPACE ENTRY CART	144	SPECIAL	HYDROTEST
3*	A20-006	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	AREA 3 CONFINED SPACE ENTRY CART	1	INT/EXT	VIS
3*	A20-006	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	AREA 3 CONFINED SPACE ENTRY CART	12	SPECIAL	FULL
2*	A20-008	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	2ND FLOOR - NAPROXEN CRUDE STACKUI	12	SPECIAL	FULL
2*	A20-008	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	2ND FLOOR - NAPROXEN CRUDE STACKUI	144	SPECIAL	HYDROTEST
2*	A20-008	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	2ND FLOOR - NAPROXEN CRUDE STACKUI	1	INT/EXT	VIS
4	A20-009	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	SOUTHEAST CORNER @ LIME SLAKER	144	SPECIAL	HYDROTEST
4	A20-009	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	SOUTHEAST CORNER @ LIME SLAKER	1	INT/EXT	VIS
4	A20-009	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	SOUTHEAST CORNER @ LIME SLAKER	12	SPECIAL	FULL
1*	A20-010	FIRE	EXTINGUISHER	ANSUL	20 LB	ANALYTICAL SERVICES	STOCK ROOM	1	INT/EXT	VIS
1*	A20-010	FIRE	EXTINGUISHER	ANSUL	20 LB	ANALYTICAL SERVICES	STOCK ROOM	12	SPECIAL	FULL
1*	A20-010	FIRE	EXTINGUISHER	ANSUL	20 LB	ANALYTICAL SERVICES	STOCK ROOM	144	SPECIAL	HYDROTEST
1*	A20-011	FIRE	EXTINGUISHER	ANSUL	20 LB	ANALYTICAL SERVICES	RETAIN STORAGE	1	INT/EXT	VIS
1*	A20-011	FIRE	EXTINGUISHER	ANSUL	20 LB	ANALYTICAL SERVICES	RETAIN STORAGE	144	SPECIAL	HYDROTEST
1*	A20-011	FIRE	EXTINGUISHER	ANSUL	20 LB	ANALYTICAL SERVICES	RETAIN STORAGE	12	SPECIAL	FULL
2*	A20-012	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	SOUTH SIDE	144	SPECIAL	HYDROTEST
2*	A20-012	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	SOUTH SIDE	12	SPECIAL	FULL
2*	A20-012	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	SOUTH SIDE	1	INT/EXT	VIS
1	A20-013	FIRE	EXTINGUISHER	ANSUL	20 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1	A20-013	FIRE	EXTINGUISHER	ANSUL	20 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
1	A20-013	FIRE	EXTINGUISHER	ANSUL	20 LB	3RD & "A" STREET	STORAGE SHED	12	SPECIAL	FULL
S*	A20-014	FIRE	EXTINGUISHER	ANSUL	20 LB	3RD & "A" STREET	STORAGE SHED	12	SPECIAL	FULL
S*	A20-014	FIRE	EXTINGUISHER	ANSUL	20 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
S*	A20-014	FIRE	EXTINGUISHER	ANSUL	20 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
2*	A20-015	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR - YARDMAN'S DESK	144	SPECIAL	HYDROTEST
2*	A20-015	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR - YARDMAN'S DESK	12	SPECIAL	FULL
2*	A20-015	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	1ST FLOOR - YARDMAN'S DESK	1	INT/EXT	VIS
2*	A20-016	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	2ND FLOOR NEAR R-103	144	SPECIAL	HYDROTEST
2*	A20-016	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	2ND FLOOR NEAR R-103	1	INT/EXT	VIS
2*	A20-016	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	2ND FLOOR NEAR R-103	12	SPECIAL	FULL
2	A20-017	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	FORK TRUCK 43305	144	SPECIAL	HYDROTEST
2	A20-017	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	FORK TRUCK 43305	12	SPECIAL	FULL
2	A20-017	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	FORK TRUCK 43305	1	INT/EXT	VIS

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2	A20-018	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	FORK TRUCK 43307	144	SPECIAL	HYDROTEST
2	A20-018	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	FORK TRUCK 43307	12	SPECIAL	FULL
2	A20-018	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	FORK TRUCK 43307	1	INT/EXT	VIS
2	A20-018	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	SHIPPING TRUCK	144	SPECIAL	HYDROTEST
2	A20-018	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	SHIPPING TRUCK	12	SPECIAL	FULL
2	A20-018	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	SHIPPING TRUCK	1	INT/EXT	VIS
2*	A20-019	FIRE	EXTINGUISHER	ANSUL	20 LB	AREA 1 MAINTENANCE SHED	OUTSIDE WALL - TOLUENE R/C UNLOAD	1	INT/EXT	VIS
2*	A20-019	FIRE	EXTINGUISHER	ANSUL	20 LB	AREA 1 MAINTENANCE SHED	OUTSIDE WALL - TOLUENE R/C UNLOAD	144	SPECIAL	HYDROTEST
2*	A20-019	FIRE	EXTINGUISHER	ANSUL	20 LB	AREA 1 MAINTENANCE SHED	OUTSIDE WALL - TOLUENE R/C UNLOAD	12	SPECIAL	FULL
1*	A20-021	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 5 MMT TANKFARM	MMT COLUMN CONNTROL ROOM	1	INT/EXT	VIS
1*	A20-021	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 5 MMT TANKFARM	MMT COLUMN CONNTROL ROOM	144	SPECIAL	HYDROTEST
1*	A20-021	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 5 MMT TANKFARM	MMT COLUMN CONNTROL ROOM	12	SPECIAL	FULL
4	A20-020	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HYSTER - NSU - # 24145	12	SPECIAL	FULL
4	A20-020	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HYSTER - NSU - # 24145	144	SPECIAL	HYDROTEST
4	A20-020	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HYSTER - NSU - # 24145	1	INT/EXT	VIS
4	A20-022	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	2ND FLR WEST R142	1	INT/EXT	VIS
4	A20-022	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	2ND FLR WEST R142	144	SPECIAL	HYDROTEST
4	A20-022	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	2ND FLR WEST R142	12	SPECIAL	FULL
4*	A20-023	FIRE	EXTINGUISHER	ANSUL	20 LB	CONTRACTOR COMPOUND	CANTEEN - RESTROOM	60	SPECIAL	HYDROTEST
3*	A20-023	FIRE	EXTINGUISHER	ANSUL	20 LB	CONTRACTOR COMPOUND	CANTEEN - RESTROOM	1	INT/EXT	VIS
3*	A20-023	FIRE	EXTINGUISHER	ANSUL	20 LB	CONTRACTOR COMPOUND	CANTEEN - RESTROOM			FULL
2*	A20-024	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR OLD PLANT 9	12	SPECIAL	FULL
2*	A20-024	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR OLD PLANT 9	144	SPECIAL	HYDROTEST
2*	A20-024	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR OLD PLANT 9	1	INT/EXT	VIS
2*	A20-025	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR NORTH R-151	12	SPECIAL	FULL
2*	A20-025	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR NORTH R-151	144	SPECIAL	HYDROTEST
2*	A20-025	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR NORTH R-151	1	INT/EXT	VIS
2*	A20-026	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR SOUTH WALL	12	SPECIAL	FULL
2*	A20-026	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR SOUTH WALL	144	SPECIAL	HYDROTEST
2*	A20-026	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR SOUTH WALL	1	INT/EXT	VIS
2*	A20-029	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR PACKAGING ROOM WALL	12	SPECIAL	FULL
2*	A20-029	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR PACKAGING ROOM WALL	144	SPECIAL	HYDROTEST
2*	A20-029	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	1ST FLOOR PACKAGING ROOM WALL	1	INT/EXT	VIS
S*	A20-030	FIRE	EXTINGUISHER	ANSUL	20 LB	AMBULANCE BUILDING	IN CAGE	1	INT/EXT	VIS
S*	A20-030	FIRE	EXTINGUISHER	ANSUL	20 LB	AMBULANCE BUILDING	IN CAGE	144	SPECIAL	HYDROTEST
S*	A20-030	FIRE	EXTINGUISHER	ANSUL	20 LB	AMBULANCE BUILDING	IN CAGE	12	SPECIAL	FULL
3*	A20-031	FIRE	EXTINGUISHER	ANSUL	20 LB	HYDROGEN TANK	MOUNTED ON FENCE	12	SPECIAL	FULL
3*	A20-031	FIRE	EXTINGUISHER	ANSUL	20 LB	HYDROGEN TANK	MOUNTED ON FENCE	1	INT/EXT	VIS
3*	A20-031	FIRE	EXTINGUISHER	ANSUL	20 LB	HYDROGEN TANK	MOUNTED ON FENCE	144	SPECIAL	HYDROTEST
2*	A20-032	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	OSI PLANT - ROOF	144	SPECIAL	HYDROTEST
2*	A20-032	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	OSI PLANT - ROOF	1	INT/EXT	VIS
2*	A20-032	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	OSI PLANT - ROOF	12	SPECIAL	FULL
2*	A20-033	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	OSI PLANT - ROOF	1	INT/EXT	VIS
2*	A20-033	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	OSI PLANT - ROOF	144	SPECIAL	HYDROTEST
2*	A20-033	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9	OSI PLANT - ROOF	12	SPECIAL	FULL
3*	A20-034	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SOUTHEAST SIDE @ GATE	144	SPECIAL	HYDROTEST
3*	A20-034	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SOUTHEAST SIDE @ GATE	12	SPECIAL	FULL
3*	A20-034	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SOUTHEAST SIDE @ GATE	1	INT/EXT	VIS
4	A20-035	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HYSTER 90-1	144	SPECIAL	HYDROTEST
4	A20-035	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HYSTER 90-1	12	SPECIAL	FULL
4	A20-035	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HYSTER 90-1	1	INT/EXT	VIS
4	A20-036	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R121 CELL - EAST WALL	1	INT/EXT	VIS
4	A20-036	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R121 CELL - EAST WALL	12	SPECIAL	FULL

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4	A20-036	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R121 CELL - EAST WALL	144	SPECIAL	HYDROTEST
4	A20-037	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R131 CELL - EAST SIDE	1	INT/EXT	VIS
4	A20-037	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R131 CELL - EAST SIDE	12	SPECIAL	FULL
4	A20-037	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R131 CELL - EAST SIDE	144	SPECIAL	HYDROTEST
1*	A20-038	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 MMT TANK FARM	PDC-20-B - WEST SIDE INSIDE	144	SPECIAL	HYDROTEST
1*	A20-038	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 MMT TANK FARM	PDC-20-B - WEST SIDE INSIDE	12	SPECIAL	FULL
1*	A20-038	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 MMT TANK FARM	PDC-20-B - WEST SIDE INSIDE	1	INT/EXT	VIS
3*	A20-039	FIRE	EXTINGUISHER	ANSUL	20 LB	AREA 1 MAINTENANCE SHOP	CSE CART	144	SPECIAL	HYDROTEST
3*	A20-039	FIRE	EXTINGUISHER	ANSUL	20 LB	AREA 1 MAINTENANCE SHOP	CSE CART	1	INT/EXT	VIS
3*	A20-039	FIRE	EXTINGUISHER	ANSUL	20 LB	AREA 1 MAINTENANCE SHOP	CSE CART	12	SPECIAL	FULL
2*	A20-040	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR 1122 CELL	144	SPECIAL	HYDROTEST
2*	A20-040	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR 1122 CELL	1	INT/EXT	VIS
2*	A20-040	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR 1122 CELL	12	SPECIAL	FULL
2*	A20-041	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR NEW MPBACH	144	SPECIAL	HYDROTEST
2*	A20-041	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR NEW MPBACH	1	INT/EXT	VIS
2*	A20-041	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR NEW MPBACH	12	SPECIAL	FULL
2*	A20-042	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR EAST	144	SPECIAL	HYDROTEST
2*	A20-042	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR EAST	1	INT/EXT	VIS
2*	A20-042	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR EAST	12	SPECIAL	FULL
2*	A20-043	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR CENTER	144	SPECIAL	HYDROTEST
2*	A20-043	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR CENTER	1	INT/EXT	VIS
2*	A20-043	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	2ND FLOOR CENTER	12	SPECIAL	FULL
2*	A20-044	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	NSU CONTROL ROOM	144	SPECIAL	HYDROTEST
2*	A20-044	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	NSU CONTROL ROOM	1	INT/EXT	VIS
2*	A20-044	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	NSU CONTROL ROOM	12	SPECIAL	FULL
2*	A20-045	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 NSU	2ND FLOOR	144	SPECIAL	HYDROTEST
2*	A20-045	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 NSU	2ND FLOOR	1	INT/EXT	VIS
2*	A20-045	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 NSU	2ND FLOOR	12	SPECIAL	FULL
2*	A20-047	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	1ST FLOOR EAST OF HGN PLANT	144	SPECIAL	HYDROTEST
2*	A20-047	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	1ST FLOOR EAST OF HGN PLANT	1	INT/EXT	VIS
2*	A20-047	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 9 OSI	1ST FLOOR EAST OF HGN PLANT	12	SPECIAL	FULL
4*	A300-001	FIRE	EXTINGUISHER	ANSUL WU	350 LB	CONTRACTOR COMPOUND	Helipad	144	SPECIAL	HYDROTEST
4*	A300-001	FIRE	EXTINGUISHER	ANSUL WU	350 LB	CONTRACTOR COMPOUND	Helipad	1	INT/EXT	VIS
1	A30-001	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB STORAGE BUILDING	OUTSIDE - NORTHEAST CORNER	1	INT/EXT	VIS
1	A30-001	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB STORAGE BUILDING	OUTSIDE - NORTHEAST CORNER	144	SPECIAL	HYDROTEST
1	A30-001	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB STORAGE BUILDING	OUTSIDE - NORTHEAST CORNER	12	SPECIAL	FULL
1*	A30-002	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	NORTH SIDE	144	SPECIAL	HYDROTEST
1*	A30-002	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	NORTH SIDE	1	INT/EXT	VIS
1*	A30-002	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	NORTH SIDE	12	SPECIAL	FULL
2*	A30-003	FIRE	EXTINGUISHER	ANSUL	30 LB	Plant 15	DIP Packaging Room	12	SPECIAL	FULL
2*	A30-003	FIRE	EXTINGUISHER	ANSUL	30 LB	Plant 15	DIP Packaging Room	144	SPECIAL	HYDROTEST
2*	A30-003	FIRE	EXTINGUISHER	ANSUL	30 LB	Plant 15	DIP Packaging Room	1	INT/EXT	VIS
1*	A30-004	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	BOTTOM OF V2 CELL	1	INT/EXT	VIS
1*	A30-004	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	BOTTOM OF V2 CELL	12	SPECIAL	FULL
1*	A30-004	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	BOTTOM OF V2 CELL	144	SPECIAL	HYDROTEST
2*	A30-005	FIRE	EXTINGUISHER	ANSUL	30 LB	A AND 3RD	STORAGE SHED	1	INT/EXT	VIS
2*	A30-005	FIRE	EXTINGUISHER	ANSUL	30 LB	A AND 3RD	STORAGE SHED	12	SPECIAL	FULL
2*	A30-005	FIRE	EXTINGUISHER	ANSUL	30 LB	A AND 3RD	STORAGE SHED	144	SPECIAL	HYDROTEST
2*	A30-006	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 1ST FLOOR - NORTH	1	INT/EXT	VIS
2*	A30-006	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 1ST FLOOR - NORTH	144	SPECIAL	HYDROTEST
2*	A30-006	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 1ST FLOOR - NORTH	12	SPECIAL	FULL
1*	A30-007	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	12	SPECIAL	FULL
1*	A30-007	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	144	SPECIAL	HYDROTEST
1*	A30-007	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	1	INT/EXT	VIS
1	A30-008	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	1	INT/EXT	VIS
1	A30-008	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	12	SPECIAL	FULL
1	A30-008	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	144	SPECIAL	HYDROTEST
2	A30-009	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	4TH STREET ENTRANCE TO AREA	12	SPECIAL	FULL
2	A30-009	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	4TH STREET ENTRANCE TO AREA	144	SPECIAL	HYDROTEST
2	A30-009	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	4TH STREET ENTRANCE TO AREA	1	INT/EXT	VIS
1*	A30-010	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	CENTER STAIR WELL	12	SPECIAL	FULL
1*	A30-010	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	CENTER STAIR WELL	1	INT/EXT	VIS
1*	A30-010	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	CENTER STAIR WELL	144	SPECIAL	HYDROTEST
1*	A30-011	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 3RD FLOOR	NORTH SIDE - NORTH WALL	1	INT/EXT	VIS
1*	A30-011	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 3RD FLOOR	NORTH SIDE - NORTH WALL	12	SPECIAL	FULL
1*	A30-011	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 3RD FLOOR	NORTH SIDE - NORTH WALL	144	SPECIAL	HYDROTEST
1*	A30-012	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	UNLOAD STATION #21	12	SPECIAL	FULL

1*	A30-012	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	UNLOAD STATION #21	144	SPECIAL	HYDROTEST
1*	A30-012	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	UNLOAD STATION #21	1	INT/EXT	VIS
3*	A30-013	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN Warehouse #4 West wall	144	SPECIAL	HYDROTEST
3*	A30-013	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN Warehouse #4 West wall	12	SPECIAL	FULL
3*	A30-013	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN Warehouse #4 West wall	1	INT/EXT	VIS
4*	A30-014	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	ON SHELF	144	SPECIAL	HYDROTEST
4*	A30-014	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	ON SHELF	12	SPECIAL	FULL
4*	A30-014	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	ON SHELF	1	INT/EXT	VIS
2	A30-015	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM - NORTH SIDE	1	INT/EXT	VIS
2	A30-015	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM - NORTH SIDE	144	SPECIAL	HYDROTEST
2	A30-015	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM - NORTH SIDE	12	SPECIAL	FULL
S*	A30-016	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	12	SPECIAL	FULL
S*	A30-016	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	144	SPECIAL	HYDROTEST
S*	A30-016	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	1	INT/EXT	VIS
1*	A30-017	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	TOP OF V2 PLATFORM	12	SPECIAL	FULL
1*	A30-017	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	TOP OF V2 PLATFORM	144	SPECIAL	HYDROTEST
1*	A30-017	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	TOP OF V2 PLATFORM	1	INT/EXT	VIS
2*	A30-018	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	2ND FLOOR NORTH DOOR	144	SPECIAL	HYDROTEST
2*	A30-018	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	2ND FLOOR NORTH DOOR	12	SPECIAL	FULL
2*	A30-018	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	2ND FLOOR NORTH DOOR	1	INT/EXT	VIS
1*	A30-019	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT	HOT WORK EXT INSIDE ZONE STORES	1	INT/EXT	VIS
1*	A30-019	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT	HOT WORK EXT INSIDE ZONE STORES	144	SPECIAL	HYDROTEST
1*	A30-019	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT	HOT WORK EXT INSIDE ZONE STORES	12	SPECIAL	FULL
1*	A30-020	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	ON WEST WALL OF BLAST WALL	1	INT/EXT	VIS
1*	A30-020	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	ON WEST WALL OF BLAST WALL	144	SPECIAL	HYDROTEST
1*	A30-020	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	ON WEST WALL OF BLAST WALL	12	SPECIAL	FULL
3*	A30-021	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	A' STREET EAST BY OIL DRUM	144	SPECIAL	HYDROTEST
3*	A30-021	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	A' STREET EAST BY OIL DRUM	12	SPECIAL	FULL
3*	A30-021	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	A' STREET EAST BY OIL DRUM	1	INT/EXT	VIS
2*	A30-022	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2nd floor west of R142	144	SPECIAL	HYDROTEST
2*	A30-022	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2nd floor west of R142	12	SPECIAL	FULL
2*	A30-022	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2nd floor west of R142	1	INT/EXT	VIS
3*	A30-023	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	SANDBLAST AREA - SPARE	144	SPECIAL	HYDROTEST
3*	A30-023	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	SANDBLAST AREA - SPARE	12	SPECIAL	FULL
3*	A30-023	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	SANDBLAST AREA - SPARE	1	INT/EXT	VIS
3*	A30-024	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	Construction area 7	144	SPECIAL	HYDROTEST
3*	A30-024	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	Construction area 7	12	SPECIAL	FULL
3*	A30-024	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	Construction area 7	1	INT/EXT	VIS
3*	A30-025	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	Weld Shop	12	SPECIAL	FULL
3*	A30-025	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	Weld Shop	1	INT/EXT	VIS
3*	A30-025	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	Weld Shop	144	SPECIAL	HYDROTEST
2*	A30-027	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9 OSI	OSI LOCKER ROOM	12	SPECIAL	FULL
2*	A30-027	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9 OSI	OSI LOCKER ROOM	1	INT/EXT	VIS
2*	A30-027	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9 OSI	OSI LOCKER ROOM	144	SPECIAL	HYDROTEST
2*	A30-028	FIRE	EXTINGUISHER	ANSUL	30 LB	BRICK WAREHOUSE	North side on wall	1	INT/EXT	VIS
2*	A30-028	FIRE	EXTINGUISHER	ANSUL	30 LB	BRICK WAREHOUSE	North side on wall	144	SPECIAL	HYDROTEST
2*	A30-028	FIRE	EXTINGUISHER	ANSUL	30 LB	BRICK WAREHOUSE	North side on wall	12	SPECIAL	FULL
1	A30-029	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	TRACTOR W/ FRONT LOADER 83-1	1	INT/EXT	VIS
1	A30-029	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	TRACTOR W/ FRONT LOADER 83-1	12	SPECIAL	FULL
1	A30-029	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	TRACTOR W/ FRONT LOADER 83-1	144	SPECIAL	HYDROTEST
3*	A30-031	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	H2 TANK ON FENCE	144	SPECIAL	HYDROTEST
3*	A30-031	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	H2 TANK ON FENCE	12	SPECIAL	FULL
3*	A30-031	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	H2 TANK ON FENCE	1	INT/EXT	VIS
1*	A30-033	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	RIVER PUMP HOUSE	12	SPECIAL	FULL
1*	A30-033	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	RIVER PUMP HOUSE	144	SPECIAL	HYDROTEST
1*	A30-033	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	RIVER PUMP HOUSE	1	INT/EXT	VIS
3*	A30-034	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	WEST OF METAL SHED	1	INT/EXT	VIS
3*	A30-034	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	WEST OF METAL SHED	144	SPECIAL	HYDROTEST
3*	A30-034	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	WEST OF METAL SHED	12	SPECIAL	FULL
4	A30-035	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15		1	INT/EXT	VIS
4	A30-035	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15		144	SPECIAL	HYDROTEST
4	A30-035	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15		12	SPECIAL	FULL
1*	A30-036	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-20M-1 DIKE WALL EAST SIDE	144	SPECIAL	HYDROTEST
1*	A30-036	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-20M-1 DIKE WALL EAST SIDE	12	SPECIAL	FULL

1"	A30-037	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SE SIDE AT GATE	144	SPECIAL	HYDROTEST
1"	A30-037	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SE SIDE AT GATE	12	SPECIAL	FULL
1"	A30-037	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SE SIDE AT GATE	1	INT/EXT	VIS
1"	A30-038	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	CENTER STAIRS - WEST SIDE	1	INT/EXT	VIS
1"	A30-038	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	CENTER STAIRS - WEST SIDE	12	SPECIAL	FULL
1"	A30-038	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	CENTER STAIRS - WEST SIDE	144	SPECIAL	HYDROTEST
1"	A30-039	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	T-300-7 SOUTHEAST DOOR NEAR TANK	12	SPECIAL	FULL
1"	A30-039	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	T-300-7 SOUTHEAST DOOR NEAR TANK	1	INT/EXT	VIS
1"	A30-039	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	T-300-7 SOUTHEAST DOOR NEAR TANK	144	SPECIAL	HYDROTEST
1"	A30-040	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	SOUTHEAST CENTER WALL	12	SPECIAL	FULL
1"	A30-040	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	SOUTHEAST CENTER WALL	144	SPECIAL	HYDROTEST
1"	A30-040	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	SOUTHEAST CENTER WALL	1	INT/EXT	VIS
1"	A30-042	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/c WORKSHOP	INSIDE - WEST DOOR	144	SPECIAL	HYDROTEST
1"	A30-042	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/c WORKSHOP	INSIDE - WEST DOOR	1	INT/EXT	VIS
1"	A30-042	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/c WORKSHOP	INSIDE - WEST DOOR	12	SPECIAL	FULL
1"	A30-043	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/c WORKSHOP	INSIDE - NORTH WALL	144	SPECIAL	HYDROTEST
1"	A30-043	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/c WORKSHOP	INSIDE - NORTH WALL	12	SPECIAL	FULL
1"	A30-043	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/c WORKSHOP	INSIDE - NORTH WALL	1	INT/EXT	VIS
3"	A30-045	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	NTRACTOR AREA - SHED EAST OF CANTE	12	SPECIAL	FULL
3"	A30-045	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	NTRACTOR AREA - SHED EAST OF CANTE	144	SPECIAL	HYDROTEST
3"	A30-045	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	NTRACTOR AREA - SHED EAST OF CANTE	1	INT/EXT	VIS
2"	A30-046	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	STAIRS - NORTH SIDE	1	INT/EXT	VIS
2"	A30-046	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	STAIRS - NORTH SIDE	144	SPECIAL	HYDROTEST
2"	A30-046	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	STAIRS - NORTH SIDE	12	SPECIAL	FULL
1"	A30-047	FIRE	EXTINGUISHER	ANSUL	30 LB	LANT 8 CONTROL ROOM - NORTH SIDSOUTH OF HE-1350-1 (THERMINOL BOILER		12	SPECIAL	FULL
1"	A30-047	FIRE	EXTINGUISHER	ANSUL	30 LB	LANT 8 CONTROL ROOM - NORTH SIDSOUTH OF HE-1350-1 (THERMINOL BOILER		144	SPECIAL	HYDROTEST
1"	A30-047	FIRE	EXTINGUISHER	ANSUL	30 LB	LANT 8 CONTROL ROOM - NORTH SIDSOUTH OF HE-1350-1 (THERMINOL BOILER		1	INT/EXT	VIS
1"	A30-048	FIRE	EXTINGUISHER	ANSUL	30 LB	CAFETERIA	KITCHEN - EAST WALL	144	SPECIAL	HYDROTEST
1"	A30-048	FIRE	EXTINGUISHER	ANSUL	30 LB	CAFETERIA	KITCHEN - EAST WALL	12	SPECIAL	FULL
1"	A30-048	FIRE	EXTINGUISHER	ANSUL	30 LB	CAFETERIA	KITCHEN - EAST WALL	1	INT/EXT	VIS
1	A30-049	FIRE	EXTINGUISHER	ANSUL	30 LB	CHANGE HOUSE	NORTH SIDE	144	SPECIAL	HYDROTEST
1	A30-049	FIRE	EXTINGUISHER	ANSUL	30 LB	CHANGE HOUSE	NORTH SIDE	1	INT/EXT	VIS
1	A30-049	FIRE	EXTINGUISHER	ANSUL	30 LB	CHANGE HOUSE	NORTH SIDE	12	SPECIAL	FULL
1	A30-050	FIRE	EXTINGUISHER	ANSUL	30 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1	A30-050	FIRE	EXTINGUISHER	ANSUL	30 LB	3RD & "A" STREET	STORAGE SHED	12	SPECIAL	FULL
1	A30-050	FIRE	EXTINGUISHER	ANSUL	30 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
1"	A30-051	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	-5M-4 SOUTHEAST OF TANK (HORIZONTAI	1	INT/EXT	VIS
1"	A30-051	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	-5M-4 SOUTHEAST OF TANK (HORIZONTAI	144	SPECIAL	HYDROTEST
1"	A30-051	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	-5M-4 SOUTHEAST OF TANK (HORIZONTAI	12	SPECIAL	FULL
1"	A30-052	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT SHOP	HOT WORK EXT INSIDE ZONE STORES	12	SPECIAL	FULL
1"	A30-052	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-5M-12 DIKE - NORTHEAST CORNER	1	INT/EXT	VIS
1"	A30-052	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-5M-12 DIKE - NORTHEAST CORNER	144	SPECIAL	HYDROTEST
1"	A30-053	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-30M-45 SOUTHWEST OF DIKE	12	SPECIAL	FULL
1"	A30-053	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-30M-45 SOUTHWEST OF DIKE	144	SPECIAL	HYDROTEST
1"	A30-053	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 TANK FARM	T-30M-45 SOUTHWEST OF DIKE	1	INT/EXT	VIS
1"	A30-054	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	ELEVATOR - WEST SIDE	12	SPECIAL	FULL
1"	A30-054	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	ELEVATOR - WEST SIDE	144	SPECIAL	HYDROTEST
1"	A30-054	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	ELEVATOR - WEST SIDE	1	INT/EXT	VIS
1"	A30-055	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	CENTER STAIRS - EAST SIDE	1	INT/EXT	VIS
1"	A30-055	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	CENTER STAIRS - EAST SIDE	12	SPECIAL	FULL
1"	A30-055	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 2ND FLOOR	CENTER STAIRS - EAST SIDE	144	SPECIAL	HYDROTEST
1"	A30-056	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	144	SPECIAL	HYDROTEST
1"	A30-056	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	12	SPECIAL	FULL
1"	A30-056	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	1	INT/EXT	VIS
1"	A30-057	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	ER LOAD AREA - NORTH END - EAST RR T	12	SPECIAL	FULL
1"	A30-057	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	ER LOAD AREA - NORTH END - EAST RR T	144	SPECIAL	HYDROTEST
1"	A30-057	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	ER LOAD AREA - NORTH END - EAST RR T	1	INT/EXT	VIS
1"	A30-059	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	D FLOOR HAZARD AREA - BETWEEN V12 &	1	INT/EXT	VIS
1"	A30-059	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	D FLOOR HAZARD AREA - BETWEEN V12 &	144	SPECIAL	HYDROTEST
1"	A30-059	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	D FLOOR HAZARD AREA - BETWEEN V12 &	12	SPECIAL	FULL
2	A30-061	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINTENANCE SHED	FORD F-150 PICKUP	144	SPECIAL	HYDROTEST
2	A30-061	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINTENANCE SHED	FORD F-150 PICKUP	1	INT/EXT	VIS
2	A30-061	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINTENANCE SHED	FORD F-150 PICKUP	12	SPECIAL	FULL
2	A30-062	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	V-CELL IN HAZARDOUS AREA	144	SPECIAL	HYDROTEST
2	A30-062	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	V-CELL IN HAZARDOUS AREA	1	INT/EXT	VIS
2	A30-062	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	V-CELL IN HAZARDOUS AREA	12	SPECIAL	FULL
1"	A30-063	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	NORTHEAST SIDE ON 3RD STREET	1	INT/EXT	VIS

1*	A30-0[illegible]	FIRE	EXTINGUISHER	ANSUL	30 LB	PL[illegible]4	NORTHEAST SIDE ON 3RD STREET	12	SPEC[illegible]	FULL
1*	A30-063	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	NORTHEAST SIDE ON 3RD STREET	144	SPECIAL	HYDROTEST
2*	A30-065	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	NSU WAREHOUSE	1	INT/EXT	VIS
2*	A30-065	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	NSU WAREHOUSE	144	SPECIAL	HYDROTEST
2*	A30-065	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	NSU WAREHOUSE	12	SPECIAL	FULL
1*	A30-067	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA	BOILER - BETWEEN HE-2290-1 AND H3-289	144	SPECIAL	HYDROTEST
1*	A30-067	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA	BOILER - BETWEEN HE-2290-1 AND H3-289	1	INT/EXT	VIS
1*	A30-067	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA	BOILER - BETWEEN HE-2290-1 AND H3-239	12	SPECIAL	FULL
2*	A30-069	FIRE	EXTINGUISHER	ANSUL	30 LB	SOUTH DRUMMING SHED	NORTH WALL UNDER SHED	12	SPECIAL	FULL
2*	A30-069	FIRE	EXTINGUISHER	ANSUL	30 LB	SOUTH DRUMMING SHED	NORTH WALL UNDER SHED	144	SPECIAL	HYDROTEST
2*	A30-069	FIRE	EXTINGUISHER	ANSUL	30 LB	SOUTH DRUMMING SHED	NORTH WALL UNDER SHED	1	INT/EXT	VIS
2*	A30-070	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD TANK CAR LOADING PLATFORM	144	SPECIAL	HYDROTEST
2*	A30-070	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD TANK CAR LOADING PLATFORM	12	SPECIAL	FULL
2*	A30-070	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD TANK CAR LOADING PLATFORM	1	INT/EXT	VIS
3*	A30-071	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1	EASC TANK CAR - LOADING PLATFORM	12	SPECIAL	FULL
3*	A30-071	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1	EASC TANK CAR - LOADING PLATFORM	1	INT/EXT	VIS
3*	A30-071	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1	EASC TANK CAR - LOADING PLATFORM	144	SPECIAL	HYDROTEST
S*	A30-072	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBUALNCE SHED	IN CAGE	1	INT/EXT	VIS
S*	A30-072	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBUALNCE SHED	IN CAGE	144	SPECIAL	HYDROTEST
S*	A30-072	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBUALNCE SHED	IN CAGE	12	SPECIAL	FULL
2*	A30-073	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	North east side	144	SPECIAL	HYDROTEST
2*	A30-073	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	North east side	12	SPECIAL	FULL
2*	A30-073	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	North east side	1	INT/EXT	VIS
1	A30-074	FIRE	EXTINGUISHER	ANSUL	30 LB	3RD & "A" STREET	STORAGE SHED	12	SPECIAL	FULL
1	A30-074	FIRE	EXTINGUISHER	ANSUL	30 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
1	A30-074	FIRE	EXTINGUISHER	ANSUL	30 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1	A30-075	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA - EAST SIDE	T-30M-6	12	SPECIAL	FULL
1	A30-075	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA - EAST SIDE	T-30M-6	144	SPECIAL	HYDROTEST
1	A30-075	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA - EAST SIDE	T-30M-6	1	INT/EXT	VIS
1*	A30-076	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT	HOT WORK EXT INSIDE ZONE STORES	12	SPECIAL	FULL
1*	A30-076	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT	HOT WORK EXT INSIDE ZONE STORES	144	SPECIAL	HYDROTEST
1*	A30-076	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT	HOT WORK EXT INSIDE ZONE STORES	1	INT/EXT	VIS
2*	A30-077	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	PCL3 TANK CAR LOADING PLATFORM	1	INT/EXT	VIS
2*	A30-077	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	PCL3 TANK CAR LOADING PLATFORM	144	SPECIAL	HYDROTEST
2*	A30-077	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	PCL3 TANK CAR LOADING PLATFORM	12	SPECIAL	FULL
1*	A30-078	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2	3RD ST WEST OF RR ON POLE	12	SPECIAL	FULL
1*	A30-078	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2	3RD ST WEST OF RR ON POLE	1	INT/EXT	VIS
1*	A30-078	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2	3RD ST WEST OF RR ON POLE	144	SPECIAL	HYDROTEST
2*	A30-079	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	3RD FLOOR - EPTD CELL EAST END	12	SPECIAL	FULL
2*	A30-079	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	3RD FLOOR - EPTD CELL EAST END	1	INT/EXT	VIS
2*	A30-079	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	3RD FLOOR - EPTD CELL EAST END	144	SPECIAL	HYDROTEST
2	A30-080	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	KENWORTH	12	SPECIAL	FULL
2	A30-080	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	KENWORTH	1	INT/EXT	VIS
2	A30-080	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	KENWORTH	144	SPECIAL	HYDROTEST
1*	A30-081	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 CONTROL ROOM	CYLINDER LOAD STATION	1	INT/EXT	VIS
1*	A30-081	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 CONTROL ROOM	CYLINDER LOAD STATION	144	SPECIAL	HYDROTEST
1*	A30-081	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 CONTROL ROOM	CYLINDER LOAD STATION	12	SPECIAL	FULL
1*	A30-082	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH WELDING SHOP	OUTSIDE NORTH WALL	1	INT/EXT	VIS
1*	A30-082	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH WELDING SHOP	OUTSIDE NORTH WALL	12	SPECIAL	FULL
1*	A30-082	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH WELDING SHOP	OUTSIDE NORTH WALL	144	SPECIAL	HYDROTEST
4	A30-083	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 1ST FLOOR	1	INT/EXT	VIS
4	A30-083	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 1ST FLOOR	12	SPECIAL	FULL
4	A30-083	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 1ST FLOOR	144	SPECIAL	HYDROTEST
2*	A30-084	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 2ND FLOOR	1	INT/EXT	VIS
2*	A30-084	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 2ND FLOOR	12	SPECIAL	FULL
2*	A30-084	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 2ND FLOOR	144	SPECIAL	HYDROTEST
2*	A30-085	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 3RD FLOOR	12	SPECIAL	FULL
2*	A30-085	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 3RD FLOOR	144	SPECIAL	HYDROTEST
2*	A30-085	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL - 3RD FLOOR	1	INT/EXT	VIS
3*	A30-086	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1	SATELLITE SHOP-NORTH SIDE	1	INT/EXT	VIS
3*	A30-086	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1	SATELLITE SHOP-NORTH SIDE	144	SPECIAL	HYDROTEST
3*	A30-086	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1	SATELLITE SHOP-NORTH SIDE	12	SPECIAL	FULL
1*	A30-087	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	EAST SIDE - EAST WALL	144	SPECIAL	HYDROTEST
1*	A30-087	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	EAST SIDE - EAST WALL	12	SPECIAL	FULL
1*	A30-087	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 3RD FLOOR	EAST SIDE - EAST WALL	1	INT/EXT	VIS
4	A30-088	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	2ND FLOOR - CATWALK	12	SPECIAL	FULL

0800

4	A30-088	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	2ND FLOOR - CATWALK	1	INT/EXT	VIS
4	A30-088	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	2ND FLOOR - CATWALK	144	SPECIAL	HYDROTEST
2*	A30-089	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL3RD FLOOR	144	SPECIAL	HYDROTEST
2*	A30-089	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL3RD FLOOR	12	SPECIAL	FULL
2*	A30-089	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 1	EPTD CELL3RD FLOOR	1	INT/EXT	VIS
1*	A30-090	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 1ST FLOOR	K-2400-1 - NORTHEAST SIDE ON "I" BEAM	12	SPECIAL	FULL
1*	A30-090	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 1ST FLOOR	K-2400-1 - NORTHEAST SIDE ON "I" BEAM	144	SPECIAL	HYDROTEST
1*	A30-090	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 1ST FLOOR	K-2400-1 - NORTHEAST SIDE ON "I" BEAM	1	INT/EXT	VIS
1*	A30-091	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - WEST WALL @ DOOR	144	SPECIAL	HYDROTEST
1*	A30-091	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - WEST WALL @ DOOR	12	SPECIAL	FULL
1*	A30-091	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - WEST WALL @ DOOR	1	INT/EXT	VIS
1*	A30-092	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER UNLOAD AREA	12	SPECIAL	FULL
1*	A30-092	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER UNLOAD AREA	144	SPECIAL	HYDROTEST
1*	A30-092	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER UNLOAD AREA	1	INT/EXT	VIS
1*	A30-093	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - EAST RR TRACKS	12	SPECIAL	FULL
1*	A30-093	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - EAST RR TRACKS	1	INT/EXT	VIS
1*	A30-093	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - EAST RR TRACKS	144	SPECIAL	HYDROTEST
1	A30-094	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #9	12	SPECIAL	FULL
1	A30-094	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #9	144	SPECIAL	HYDROTEST
1	A30-094	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #9	1	INT/EXT	VIS
1	A30-096	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #12	1	INT/EXT	VIS
1	A30-096	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #12	12	SPECIAL	FULL
1	A30-096	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #12	144	SPECIAL	HYDROTEST
1*	A30-099	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER UNLOAD AREA	12	SPECIAL	FULL
1*	A30-099	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER UNLOAD AREA	1	INT/EXT	VIS
1*	A30-099	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER UNLOAD AREA	144	SPECIAL	HYDROTEST
3*	A30-100	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE#4 WEST WALL	1	INT/EXT	VIS
3*	A30-100	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE#4 WEST WALL	12	SPECIAL	FULL
3*	A30-100	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE#4 WEST WALL	144	SPECIAL	HYDROTEST
2*	A30-101	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	3RD FLOOR - STACKUP	1	INT/EXT	VIS
2*	A30-101	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	3RD FLOOR - STACKUP	144	SPECIAL	HYDROTEST
2*	A30-101	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	3RD FLOOR - STACKUP	12	SPECIAL	FULL
2*	A30-102	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	3RD FLOOR - ALCL3 CELL	144	SPECIAL	HYDROTEST
2*	A30-102	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	3RD FLOOR - ALCL3 CELL	12	SPECIAL	FULL
2*	A30-102	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	3RD FLOOR - ALCL3 CELL	1	INT/EXT	VIS
1*	A30-104	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	PENTHOUSE - NORTHEAST CORNER	12	SPECIAL	FULL
1*	A30-104	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	PENTHOUSE - NORTHEAST CORNER	1	INT/EXT	VIS
1*	A30-104	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	PENTHOUSE - NORTHEAST CORNER	144	SPECIAL	HYDROTEST
4	A30-105	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R151 BAY - EAST SIDE	144	SPECIAL	HYDROTEST
4	A30-105	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R151 BAY - EAST SIDE	12	SPECIAL	FULL
4	A30-105	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R151 BAY - EAST SIDE	1	INT/EXT	VIS
4	A30-106	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R131 BAY - NORTH SIDE	1	INT/EXT	VIS
4	A30-106	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R131 BAY - NORTH SIDE	144	SPECIAL	HYDROTEST
4	A30-106	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R131 BAY - NORTH SIDE	12	SPECIAL	FULL
3*	A30-107	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	EAST OF EMERGENCY GENERATOR	12	SPECIAL	FULL
3*	A30-107	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	EAST OF EMERGENCY GENERATOR	1	INT/EXT	VIS
3*	A30-107	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	EAST OF EMERGENCY GENERATOR	144	SPECIAL	HYDROTEST
4	A30-108	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R161 BAY - SOUTH WALL	12	SPECIAL	FULL
4	A30-108	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R161 BAY - SOUTH WALL	144	SPECIAL	HYDROTEST
4	A30-108	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R161 BAY - SOUTH WALL	1	INT/EXT	VIS
2*	A30-110	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R111 BAY - NORTHEAST WALL	144	SPECIAL	HYDROTEST
2*	A30-110	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R111 BAY - NORTHEAST WALL	12	SPECIAL	FULL
2*	A30-110	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R111 BAY - NORTHEAST WALL	1	INT/EXT	VIS
2*	A30-111	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R161 CELL - EAST WALL	12	SPECIAL	FULL
2*	A30-111	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R161 CELL - EAST WALL	1	INT/EXT	VIS
2*	A30-111	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - R161 CELL - EAST WALL	144	SPECIAL	HYDROTEST
4	A30-112	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	FLOOR - PACKAGING DRUM WALL - WEST	1	INT/EXT	VIS
4	A30-112	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	FLOOR - PACKAGING DRUM WALL - WEST	12	SPECIAL	FULL
4	A30-112	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	FLOOR - PACKAGING DRUM WALL - WEST	144	SPECIAL	HYDROTEST
4	A30-113	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R121 CELL - WEST WALL	12	SPECIAL	FULL
4	A30-113	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R121 CELL - WEST WALL	1	INT/EXT	VIS
4	A30-113	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - R121 CELL - WEST WALL	144	SPECIAL	HYDROTEST
1*	A30-114	FIRE	EXTINGUISHER	ANSUL	30 LB	T/T TURN AROUND	ST STREET - NORTH SIDE - PROPANE TAN	1	INT/EXT	VIS
1*	A30-114	FIRE	EXTINGUISHER	ANSUL	30 LB	T/T TURN AROUND	ST STREET - NORTH SIDE - PROPANE TAN	12	SPECIAL	FULL
1*	A30-114	FIRE	EXTINGUISHER	ANSUL	30 LB	T/T TURN AROUND	ST STREET - NORTH SIDE - PROPANE TAN	144	SPECIAL	HYDROTEST
2*	A30-115	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	144	SPECIAL	HYDROTEST
2*	A30-115	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	12	SPECIAL	FULL

2*	A30-115	FIRE	EXTINGUISHER	ANSUL	30 LB	A[illegible]3	A3 ZONE STORES	1	INT/E[illegible]	VIS
3*	A30-116	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	8TH ST WEAT OD PCL3	12	SPECIAL	FULL
3*	A30-116	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	8TH ST WEAT OD PCL3	144	SPECIAL	HYDROTEST
3*	A30-116	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	8TH ST WEAT OD PCL3	1	INT/EXT	VIS
4	A30-117	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	2ND FLOOR - NAPROXEN STACK UP	144	SPECIAL	HYDROTEST
4	A30-117	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	2ND FLOOR - NAPROXEN STACK UP	12	SPECIAL	FULL
4	A30-117	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 15	2ND FLOOR - NAPROXEN STACK UP	1	INT/EXT	VIS
3*	A30-118	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 HOUSE - SOUTH END	144	SPECIAL	HYDROTEST
3*	A30-118	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 HOUSE - SOUTH END	1	INT/EXT	VIS
3*	A30-118	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 HOUSE - SOUTH END	12	SPECIAL	FULL
2*	A30-119	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	12	SPECIAL	FULL
2*	A30-119	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	1	INT/EXT	VIS
2*	A30-119	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	144	SPECIAL	HYDROTEST
3*	A30-120	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 HOUSE - EAST SIDE	144	SPECIAL	HYDROTEST
3*	A30-120	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 HOUSE - EAST SIDE	12	SPECIAL	FULL
3*	A30-120	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 HOUSE - EAST SIDE	1	INT/EXT	VIS
2*	A30-122	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	144	SPECIAL	HYDROTEST
2*	A30-122	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	12	SPECIAL	FULL
2*	A30-122	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 3	A3 ZONE STORES	1	INT/EXT	VIS
3*	A30-123	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	NORTH SIDE	144	SPECIAL	HYDROTEST
3*	A30-123	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	NORTH SIDE	1	INT/EXT	VIS
3*	A30-123	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	NORTH SIDE	12	SPECIAL	FULL
3*	A30-124	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	WEST SIDE	1	INT/EXT	VIS
3*	A30-124	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	WEST SIDE	12	SPECIAL	FULL
3*	A30-124	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	WEST SIDE	144	SPECIAL	HYDROTEST
3*	A30-125	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	330 DRUM PACKAGING BUILDING	144	SPECIAL	HYDROTEST
3*	A30-125	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	330 DRUM PACKAGING BUILDING	12	SPECIAL	FULL
3*	A30-125	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	330 DRUM PACKAGING BUILDING	1	INT/EXT	VIS
3*	A30-126	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	2ND FLOOR - EAST WALL	12	SPECIAL	FULL
3*	A30-126	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	2ND FLOOR - EAST WALL	144	SPECIAL	HYDROTEST
3*	A30-126	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	2ND FLOOR - EAST WALL	1	INT/EXT	VIS
3*	A30-127	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	3RD FLOOR - WEST WALL	12	SPECIAL	FULL
3*	A30-127	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	3RD FLOOR - WEST WALL	1	INT/EXT	VIS
3*	A30-127	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	3RD FLOOR - WEST WALL	144	SPECIAL	HYDROTEST
3*	A30-128	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	WEST SIDE - INSIDE DIKE BY STAIRS	12	SPECIAL	FULL
3*	A30-128	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	WEST SIDE - INSIDE DIKE BY STAIRS	144	SPECIAL	HYDROTEST
3*	A30-128	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	WEST SIDE - INSIDE DIKE BY STAIRS	1	INT/EXT	VIS
3*	A30-129	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	SECOND FLOOR - INSIDE DIKE	144	SPECIAL	HYDROTEST
3*	A30-129	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	SECOND FLOOR - INSIDE DIKE	12	SPECIAL	FULL
3*	A30-129	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	SECOND FLOOR - INSIDE DIKE	1	INT/EXT	VIS
3*	A30-130	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	THIRD FLOOR - INSIDE DIKE	1	INT/EXT	VIS
3*	A30-130	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	THIRD FLOOR - INSIDE DIKE	144	SPECIAL	HYDROTEST
3*	A30-130	FIRE	EXTINGUISHER	ANSUL	30 LB	EDWIN COOPER	THIRD FLOOR - INSIDE DIKE	12	SPECIAL	FULL
1	A30-131	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	YLINDER LOAD AREA - NORTHEASE CORNI	1	INT/EXT	VIS
1	A30-131	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	YLINDER LOAD AREA - NORTHEASE CORNI	12	SPECIAL	FULL
1	A30-131	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	YLINDER LOAD AREA - NORTHEASE CORNI	144	SPECIAL	HYDROTEST
2	A30-133	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	FORK TRUCK VH-00016	12	SPECIAL	FULL
2	A30-133	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	FORK TRUCK VH-00016	1	INT/EXT	VIS
2	A30-133	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	FORK TRUCK VH-00016	144	SPECIAL	HYDROTEST
4*	A30-134	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1 MAINTENANCE SHED	EAST WALL - INSIDE OF BUILDING	144	SPECIAL	HYDROTEST
4*	A30-134	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1 MAINTENANCE SHED	EAST WALL - INSIDE OF BUILDING	12	SPECIAL	FULL
4*	A30-134	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 1 MAINTENANCE SHED	EAST WALL - INSIDE OF BUILDING	1	INT/EXT	VIS
1*	A30-135	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	W OF T-250M-2 DIKE ON I BEAM	144	SPECIAL	HYDROTEST
1*	A30-135	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	W OF T-250M-2 DIKE ON I BEAM	12	SPECIAL	FULL
1*	A30-135	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	W OF T-250M-2 DIKE ON I BEAM	1	INT/EXT	VIS
1	A30-137	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	DER RESTORATION AREA - CYL CLEANING	12	SPECIAL	FULL
1	A30-137	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	DER RESTORATION AREA - CYL CLEANING	144	SPECIAL	HYDROTEST
1	A30-137	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	DER RESTORATION AREA - CYL CLEANING	1	INT/EXT	VIS
5	A30-138	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	BOOM TRUCK 1	144	SPECIAL	HYDROTEST
5	A30-138	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	BOOM TRUCK 1	12	SPECIAL	FULL
5	A30-138	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	BOOM TRUCK 1	1	INT/EXT	VIS
1*	A30-139	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULALNCE SHED	ON SHELF	1	INT/EXT	VIS
1*	A30-139	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULALNCE SHED	ON SHELF	144	SPECIAL	HYDROTEST
1*	A30-139	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULALNCE SHED	ON SHELF	12	SPECIAL	FULL
2*	A30-140	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING WAREHOUSE	INSIDE EAST DOOR	1	INT/EXT	VIS
2*	A30-140	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING WAREHOUSE	INSIDE EAST DOOR	144	SPECIAL	HYDROTEST

1*	A30-141	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SOUTH SIDE OF PLANT	1	INT/EXT	VIS
1*	A30-141	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SOUTH SIDE OF PLANT	12	SPECIAL	FULL
1*	A30-141	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	SOUTH SIDE OF PLANT	144	SPECIAL	HYDROTEST
2*	A30-142	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	SHIPPING OFFICE DOOR	144	SPECIAL	HYDROTEST
2*	A30-142	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	SHIPPING OFFICE DOOR	1	INT/EXT	VIS
2*	A30-142	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	SHIPPING OFFICE DOOR	12	SPECIAL	FULL
2*	A30-143	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	SOUTHEAST CORNER	1	INT/EXT	VIS
2*	A30-143	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	SOUTHEAST CORNER	144	SPECIAL	HYDROTEST
2*	A30-143	FIRE	EXTINGUISHER	ANSUL	30 LB	RAW MATERIAL WAREHOUSE	SOUTHEAST CORNER	12	SPECIAL	FULL
1*	A30-144	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	T-15M-29 - SOUTH SIDE	12	SPECIAL	FULL
1*	A30-144	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	T-15M-29 - SOUTH SIDE	144	SPECIAL	HYDROTEST
1*	A30-144	FIRE	EXTINGUISHER	ANSUL	30 LB	MAALOX AREA	T-15M-29 - SOUTH SIDE	1	INT/EXT	VIS
1*	A30-145	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "A"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT	VIS
1*	A30-145	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "A"	TANK FARM SOUTH OF SUBOFFICE	144	SPECIAL	HYDROTEST
1*	A30-145	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "A"	TANK FARM SOUTH OF SUBOFFICE	12	SPECIAL	FULL
3*	A30-146	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	SOUTH SIDE OF DIKED AREA	144	SPECIAL	HYDROTEST
3*	A30-146	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	SOUTH SIDE OF DIKED AREA	1	INT/EXT	VIS
3*	A30-146	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	SOUTH SIDE OF DIKED AREA	12	SPECIAL	FULL
3*	A30-147	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	INSIDE DIKED AREA	1	INT/EXT	VIS
3*	A30-147	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	INSIDE DIKED AREA	144	SPECIAL	HYDROTEST
3*	A30-147	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	INSIDE DIKED AREA	12	SPECIAL	FULL
3*	A30-148	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	DEWATERING PLANT - 1ST FLOOR CENTEF	144	SPECIAL	HYDROTEST
3*	A30-148	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	DEWATERING PLANT - 1ST FLOOR CENTEF	12	SPECIAL	FULL
3*	A30-148	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	DEWATERING PLANT - 1ST FLOOR CENTEF	1	INT/EXT	VIS
3*	A30-149	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	DEWATERING PLANT - 2ND FLOOR	144	SPECIAL	HYDROTEST
3*	A30-149	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	DEWATERING PLANT - 2ND FLOOR	1	INT/EXT	VIS
3*	A30-149	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	DEWATERING PLANT - 2ND FLOOR	12	SPECIAL	FULL
3*	A30-151	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor Compound	Weld Shop	1	INT/EXT	VIS
3*	A30-151	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	CRASH CART - OUTSIDE WEST DOOR	144	SPECIAL	HYDROTEST
3*	A30-151	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	CRASH CART - OUTSIDE WEST DOOR	12	SPECIAL	FULL
1*	A30-152	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5	OLD 701 COLUMNS - NORTH WALL	144	SPECIAL	HYDROTEST
1*	A30-152	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5	OLD 701 COLUMNS - NORTH WALL	1	INT/EXT	VIS
1*	A30-152	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5	OLD 701 COLUMNS - NORTH WALL	12	SPECIAL	FULL
1*	A30-153	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR MMT-C	MIDDLE I BEAM	144	SPECIAL	HYDROTEST
1*	A30-153	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR MMT-C	MIDDLE I BEAM	1	INT/EXT	VIS
1*	A30-153	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR MMT-C	MIDDLE I BEAM	12	SPECIAL	FULL
1*	A30-154	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	A - SOUTH OF SUBOFFICE @ CORNER OF S	1	INT/EXT	VIS
1*	A30-154	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	A - SOUTH OF SUBOFFICE @ CORNER OF S	144	SPECIAL	HYDROTEST
1*	A30-154	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	A - SOUTH OF SUBOFFICE @ CORNER OF S	12	SPECIAL	FULL
1*	A30-155	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	EAST WING - HALLWAY	12	SPECIAL	FULL
1*	A30-155	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	EAST WING - HALLWAY	144	SPECIAL	HYDROTEST
1*	A30-155	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	EAST WING - HALLWAY	1	INT/EXT	VIS
1*	A30-157	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 143	1	INT/EXT	VIS
1*	A30-157	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 143	144	SPECIAL	HYDROTEST
1*	A30-157	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 143	12	SPECIAL	FULL
1*	A30-158	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	SOUTH WING	12	SPECIAL	FULL
1*	A30-158	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	SOUTH WING	144	SPECIAL	HYDROTEST
1*	A30-158	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	SOUTH WING	1	INT/EXT	VIS
1*	A30-159	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 134 - BREEZEWAY	1	INT/EXT	VIS
1*	A30-159	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 134 - BREEZEWAY	144	SPECIAL	HYDROTEST
1*	A30-159	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 134 - BREEZEWAY	12	SPECIAL	FULL
1*	A30-160	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	NORTH WING - HALLWAY	12	SPECIAL	FULL
1*	A30-160	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	NORTH WING - HALLWAY	1	INT/EXT	VIS
1*	A30-160	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	NORTH WING - HALLWAY	144	SPECIAL	HYDROTEST
1*	A30-161	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	WASTE STORAGE SHED NORTH WALL	12	SPECIAL	FULL
1*	A30-161	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	WASTE STORAGE SHED NORTH WALL	1	INT/EXT	VIS
1*	A30-161	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 4	WASTE STORAGE SHED NORTH WALL	144	SPECIAL	HYDROTEST
1*	A30-163	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	SOUTHWEST HALLWAY	1	INT/EXT	VIS
1*	A30-163	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	SOUTHWEST HALLWAY	144	SPECIAL	HYDROTEST
1*	A30-163	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	SOUTHWEST HALLWAY	12	SPECIAL	FULL
1	A30-164	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 112 - GENERAL LAB	144	SPECIAL	HYDROTEST
1	A30-164	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 112 - GENERAL LAB	12	SPECIAL	FULL
1	A30-164	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	ROOM 112 - GENERAL LAB	1	INT/EXT	VIS
3*	A30-165	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	VALVE SHOP - SOUTH WALL	144	SPECIAL	HYDROTEST
3*	A30-165	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	VALVE SHOP - SOUTH WALL	12	SPECIAL	FULL
3*	A30-165	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	VALVE SHOP - SOUTH WALL	1	INT/EXT	VIS
1	A30-166	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	EAST SIDE	1	INT/EXT	VIS

1	A30-166	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	EAST SIDE	144	SPECIAL	HYDROTEST
1	A30-166	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	EAST SIDE	12	SPECIAL	FULL
3*	A30-167	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	DRYER PLATFORM	12	SPECIAL	FULL
3*	A30-167	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	DRYER PLATFORM	1	INT/EXT	VIS
3*	A30-167	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 10	DRYER PLATFORM	144	SPECIAL	HYDROTEST
5	A30-168	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	BACKHOE 89-1	12	SPECIAL	FULL
5	A30-168	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	BACKHOE 89-1	144	SPECIAL	HYDROTEST
5	A30-168	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	BACKHOE 89-1	1	INT/EXT	VIS
2*	A30-169	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	2ND FLOOR - NORTH OF R-141	1	INT/EXT	VIS
2*	A30-169	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	2ND FLOOR - NORTH OF R-141	144	SPECIAL	HYDROTEST
2*	A30-169	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD PLANT 9	2ND FLOOR - NORTH OF R-141	12	SPECIAL	FULL
1	A30-170	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2	SATELLITE SHOP	1	INT/EXT	VIS
1	A30-170	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2	SATELLITE SHOP	12	SPECIAL	FULL
1	A30-170	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2	SATELLITE SHOP	144	SPECIAL	HYDROTEST
1*	A30-171	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT SHOP	INSIDE ON WEST WALL	12	SPECIAL	FULL
1*	A30-171	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT SHOP	INSIDE ON WEST WALL	144	SPECIAL	HYDROTEST
1*	A30-171	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 MAINT SHOP	INSIDE ON WEST WALL	1	INT/EXT	VIS
1	A30-172	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #?	1	INT/EXT	VIS
1	A30-172	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #?	144	SPECIAL	HYDROTEST
1	A30-172	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #?	12	SPECIAL	FULL
1	A30-173	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA	T-2M-40 GAS TANK	12	SPECIAL	FULL
1	A30-173	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA	T-2M-40 GAS TANK	144	SPECIAL	HYDROTEST
1	A30-173	FIRE	EXTINGUISHER	ANSUL	30 LB	NORTH BOILER AREA	T-2M-40 GAS TANK	1	INT/EXT	VIS
2*	A30-174	FIRE	EXTINGUISHER	ANSUL	30 LB	BRICK WAREHOUSE	NORTH SIDE @ WEST DOOR	12	SPECIAL	FULL
2*	A30-174	FIRE	EXTINGUISHER	ANSUL	30 LB	BRICK WAREHOUSE	NORTH SIDE @ WEST DOOR	144	SPECIAL	HYDROTEST
2*	A30-174	FIRE	EXTINGUISHER	ANSUL	30 LB	BRICK WAREHOUSE	NORTH SIDE @ WEST DOOR	1	INT/EXT	VIS
1*	A30-175	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	OUTSIDE - WEST END	144	SPECIAL	HYDROTEST
1*	A30-175	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	OUTSIDE - WEST END	12	SPECIAL	FULL
1*	A30-175	FIRE	EXTINGUISHER	ANSUL	30 LB	T&V SHOP	OUTSIDE - WEST END	1	INT/EXT	VIS
3*	A30-176	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	TRUCK - DRIVER'S SIDE - REAR COMPARTI	12	SPECIAL	FULL
3*	A30-176	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	TRUCK - DRIVER'S SIDE - REAR COMPARTI	144	SPECIAL	HYDROTEST
3*	A30-176	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	TRUCK - DRIVER'S SIDE - REAR COMPARTI	1	INT/EXT	VIS
2*	A30-177	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - HCN PLANT	1	INT/EXT	VIS
2*	A30-177	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - HCN PLANT	144	SPECIAL	HYDROTEST
2*	A30-177	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	1ST FLOOR - HCN PLANT	12	SPECIAL	FULL
2*	A30-178	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - HCN PLANT	12	SPECIAL	FULL
2*	A30-178	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - HCN PLANT	144	SPECIAL	HYDROTEST
2*	A30-178	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - HCN PLANT	1	INT/EXT	VIS
3	A30-180	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	ORGANIC WASTE AREA	1	INT/EXT	VIS
3	A30-180	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	ORGANIC WASTE AREA	144	SPECIAL	HYDROTEST
3	A30-180	FIRE	EXTINGUISHER	ANSUL	30 LB	RIVER ROAD	ORGANIC WASTE AREA	12	SPECIAL	FULL
3*	A30-181	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	8TH ST NORTH OF PCL3	12	SPECIAL	FULL
3*	A30-181	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	8TH ST NORTH OF PCL3	144	SPECIAL	HYDROTEST
3*	A30-181	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	8TH ST NORTH OF PCL3	1	INT/EXT	VIS
1*	A30-182	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT	VIS
1*	A30-182	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	144	SPECIAL	HYDROTEST
1*	A30-182	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	12	SPECIAL	FULL
1*	A30-183	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	144	SPECIAL	HYDROTEST
1*	A30-183	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT	VIS
1*	A30-183	FIRE	EXTINGUISHER	ANSUL	30 LB	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	12	SPECIAL	FULL
2	A30-184	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	UNDER PLANT @ STAIRS	12	SPECIAL	FULL
2	A30-184	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	UNDER PLANT @ STAIRS	1	INT/EXT	VIS
2	A30-184	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	UNDER PLANT @ STAIRS	144	SPECIAL	HYDROTEST
2	A30-185	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	NORTH WALL - 2ND FLOOR - TOP OF STAIR	12	SPECIAL	FULL
2	A30-185	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	NORTH WALL - 2ND FLOOR - TOP OF STAIR	1	INT/EXT	VIS
2	A30-185	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	NORTH WALL - 2ND FLOOR - TOP OF STAIR	144	SPECIAL	HYDROTEST
2	A30-186	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	CONTROL ROOM - OUTSIDE DOOR	1	INT/EXT	VIS
2	A30-186	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	CONTROL ROOM - OUTSIDE DOOR	12	SPECIAL	FULL
2	A30-186	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	CONTROL ROOM - OUTSIDE DOOR	144	SPECIAL	HYDROTEST
2	A30-187	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	CENTRIFUGE PLATFORM - 2ND FLOOR	12	SPECIAL	FULL
2	A30-187	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	CENTRIFUGE PLATFORM - 2ND FLOOR	144	SPECIAL	HYDROTEST
2	A30-187	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	CENTRIFUGE PLATFORM - 2ND FLOOR	1	INT/EXT	VIS
3*	A30-189	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	NE MORTON BUILDING	1	INT/EXT	VIS
3*	A30-189	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	NE MORTON BUILDING	12	SPECIAL	FULL
3*	A30-189	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	NE MORTON BUILDING	144	SPECIAL	HYDROTEST
3*	A30-191	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 - WASTE UNLOADING STATION	1	INT/EXT	VIS

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3"	A30-191	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 - WASTE UNLOADING STATION	144	SPECIAL	HYDROTEST
1"	A30-192	FIRE	EXTINGUISHER	ANSUL	30 LB	T/T TURN AROUND	1ST STREET - NORTH SIDE	12	SPECIAL	FULL
1"	A30-192	FIRE	EXTINGUISHER	ANSUL	30 LB	T/T TURN AROUND	1ST STREET - NORTH SIDE	1	INT/EXT	VIS
1"	A30-192	FIRE	EXTINGUISHER	ANSUL	30 LB	T/T TURN AROUND	1ST STREET - NORTH SIDE	144	SPECIAL	HYDROTEST
1	A30-193	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - TRACKMOBILE	12	SPECIAL	FULL
1	A30-193	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - TRACKMOBILE	1	INT/EXT	VIS
1	A30-193	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - TRACKMOBILE	144	SPECIAL	HYDROTEST
3"	A30-194	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	CRANE	12	SPECIAL	FULL
3"	A30-194	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	CRANE	1	INT/EXT	VIS
3"	A30-194	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	CRANE	144	SPECIAL	HYDROTEST
1"	A30-195	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - EAST END	144	SPECIAL	HYDROTEST
1"	A30-195	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - EAST END	12	SPECIAL	FULL
1"	A30-195	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER LOAD AREA - EAST END	1	INT/EXT	VIS
2"	A30-196	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING WAREHOUSE	EAST WALL - SHIPPING WAREHOUSE	1	INT/EXT	VIS
2"	A30-196	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING WAREHOUSE	EAST WALL - SHIPPING WAREHOUSE	12	SPECIAL	FULL
2"	A30-196	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING WAREHOUSE	EAST WALL - SHIPPING WAREHOUSE	144	SPECIAL	HYDROTEST
1"	A30-197	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	YLINDER RESTORATION AREA - PAINT SHE	1	INT/EXT	VIS
1"	A30-197	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	YLINDER RESTORATION AREA - PAINT SHE	12	SPECIAL	FULL
1"	A30-197	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	YLINDER RESTORATION AREA - PAINT SHE	144	SPECIAL	HYDROTEST
3"	A30-198	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN BULK STORAGE	12	SPECIAL	FULL
3"	A30-198	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN BULK STORAGE	144	SPECIAL	HYDROTEST
3"	A30-198	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN BULK STORAGE	1	INT/EXT	VIS
1"	A30-199	FIRE	EXTINGUISHER	ANSUL	30 LB	E&I NORTH SHOP	NORTH WALL E&I SHOP	12	SPECIAL	FULL
1"	A30-199	FIRE	EXTINGUISHER	ANSUL	30 LB	E&I NORTH SHOP	NORTH WALL E&I SHOP	1	INT/EXT	VIS
1"	A30-199	FIRE	EXTINGUISHER	ANSUL	30 LB	E&I NORTH SHOP	NORTH WALL E&I SHOP	144	SPECIAL	HYDROTEST
1"	A30-200	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	1	INT/EXT	VIS
1"	A30-200	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	144	SPECIAL	HYDROTEST
1"	A30-200	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	12	SPECIAL	FULL
1"	A30-201	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - R7 PLATFORM	1	INT/EXT	VIS
1"	A30-201	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - R7 PLATFORM	144	SPECIAL	HYDROTEST
1"	A30-201	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - R7 PLATFORM	12	SPECIAL	FULL
1	A30-202	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #?	1	INT/EXT	VIS
1	A30-202	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #?	144	SPECIAL	HYDROTEST
1	A30-202	FIRE	EXTINGUISHER	ANSUL	30 LB	M/C WELDING SHOP	PORTABLE WELDER #?	12	SPECIAL	FULL
3"	A30-203	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND		12	SPECIAL	FULL
3"	A30-203	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	CRANE 6 (20 TON)	1	INT/EXT	VIS
3"	A30-203	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	CRANE 6 (20 TON)	144	SPECIAL	HYDROTEST
3"	A30-204	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - WEST SIDE	1	INT/EXT	VIS
3"	A30-204	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - WEST SIDE	12	SPECIAL	FULL
3"	A30-204	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - WEST SIDE	144	SPECIAL	HYDROTEST
3"	A30-205	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - EAST SIDE	144	SPECIAL	HYDROTEST
3"	A30-205	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - EAST SIDE	1	INT/EXT	VIS
3"	A30-205	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - EAST SIDE	12	SPECIAL	FULL
3"	A30-206	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - SOUTH SIDE	12	SPECIAL	FULL
3"	A30-206	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - SOUTH SIDE	144	SPECIAL	HYDROTEST
3"	A30-206	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - SOUTH SIDE	1	INT/EXT	VIS
3"	A30-207	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - NORTHEAST CORNER	12	SPECIAL	FULL
3"	A30-207	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - NORTHEAST CORNER	144	SPECIAL	HYDROTEST
3"	A30-207	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - NORTHEAST CORNER	1	INT/EXT	VIS
3"	A30-208	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR - SOUTH STAIRS	1	INT/EXT	VIS
3"	A30-208	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR - SOUTH STAIRS	12	SPECIAL	FULL
3"	A30-208	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR - SOUTH STAIRS	144	SPECIAL	HYDROTEST
3"	A30-209	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR - WEST WALL	1	INT/EXT	VIS
3"	A30-209	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR - WEST WALL	144	SPECIAL	HYDROTEST
3"	A30-209	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR - WEST WALL	12	SPECIAL	FULL
3"	A30-210	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR @ K-10M-1	12	SPECIAL	FULL
3"	A30-210	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR @ K-10M-1	144	SPECIAL	HYDROTEST
3"	A30-210	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	2ND FLOOR @ K-10M-1	1	INT/EXT	VIS
3"	A30-211	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	3RD FLOOR - WEST WALL	144	SPECIAL	HYDROTEST
3"	A30-211	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	3RD FLOOR - WEST WALL	12	SPECIAL	FULL
3"	A30-211	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	3RD FLOOR - WEST WALL	1	INT/EXT	VIS
3"	A30-212	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	CARPENTER SHOP - SOUTH WALL	12	SPECIAL	FULL
3"	A30-212	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	CARPENTER SHOP - SOUTH WALL	1	INT/EXT	VIS
3"	A30-212	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	CARPENTER SHOP - SOUTH WALL	144	SPECIAL	HYDROTEST
3"	A30-213	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	WEST WALL BY SOUTH DOOR	12	SPECIAL	FULL
3"	A30-213	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	WEST WALL BY SOUTH DOOR	144	SPECIAL	HYDROTEST
		FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	WEST WALL BY SOUTH DOOR	1	INT/EXT	VIS

5	A30-215	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	ESIDE MAINTENANCE SUPERINTENDENT'S	1	INT/EXT	VIS
5	A30-215	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	ESIDE MAINTENANCE SUPERINTENDENT'S	12	SPECIAL	FULL
5	A30-215	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	ESIDE MAINTENANCE SUPERINTENDENT'S	144	SPECIAL	HYDROTEST
3*	A30-216	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - NORTH SIDE	144	SPECIAL	HYDROTEST
3*	A30-216	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - NORTH SIDE	1	INT/EXT	VIS
3*	A30-216	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	1ST FLOOR - NORTH SIDE	12	SPECIAL	FULL
2*	A30-218	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	NORTH SIDE @ EAST DOOR	1	INT/EXT	VIS
2*	A30-218	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	NORTH SIDE @ EAST DOOR	12	SPECIAL	FULL
2*	A30-218	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	NORTH SIDE @ EAST DOOR	144	SPECIAL	HYDROTEST
2*	A30-219	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	OUTSIDE OF BUILDING - SOUTH WALL	1	INT/EXT	VIS
2*	A30-219	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	OUTSIDE OF BUILDING - SOUTH WALL	144	SPECIAL	HYDROTEST
2*	A30-219	FIRE	EXTINGUISHER	ANSUL	30 LB	CHEMICAL WAREHOUSE	OUTSIDE OF BUILDING - SOUTH WALL	12	SPECIAL	FULL
1*	A30-220	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - SOUTH END	12	SPECIAL	FULL
1*	A30-220	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - SOUTH END	144	SPECIAL	HYDROTEST
1*	A30-220	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - SOUTH END	1	INT/EXT	VIS
1*	A30-221	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - MIDDLE	1	INT/EXT	VIS
1*	A30-221	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - MIDDLE	144	SPECIAL	HYDROTEST
1*	A30-221	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - MIDDLE	12	SPECIAL	FULL
1*	A30-222	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - NORTH END	12	SPECIAL	FULL
1*	A30-222	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - NORTH END	144	SPECIAL	HYDROTEST
1*	A30-222	FIRE	EXTINGUISHER	ANSUL	30 LB	ISOBUTYLENE TANK FARM	RAILCAR LPG SPOT - NORTH END	1	INT/EXT	VIS
3*	A30-226	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	ORTH SIDE ON TOP OF T-36M-3 (TEA) TAN	144	SPECIAL	HYDROTEST
3*	A30-226	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	ORTH SIDE ON TOP OF T-36M-3 (TEA) TAN	12	SPECIAL	FULL
3*	A30-226	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 11	ORTH SIDE ON TOP OF T-36M-3 (TEA) TAN	1	INT/EXT	VIS
3*	A30-227	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	NEW ADDITION EAST OF K-5M-3	12	SPECIAL	FULL
3*	A30-227	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	NEW ADDITION EAST OF K-5M-3	144	SPECIAL	HYDROTEST
3*	A30-227	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 14	NEW ADDITION EAST OF K-5M-3	1	INT/EXT	VIS
4	A30-228	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - NSU - NORTH SIDE	12	SPECIAL	FULL
4	A30-228	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - NSU - NORTH SIDE	1	INT/EXT	VIS
4	A30-228	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - NSU - NORTH SIDE	144	SPECIAL	HYDROTEST
2*	A30-229	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	3RD FLOOR - NSU - WEST SIDE	1	INT/EXT	VIS
2*	A30-229	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	3RD FLOOR - NSU - WEST SIDE	144	SPECIAL	HYDROTEST
2*	A30-229	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	3RD FLOOR - NSU - WEST SIDE	12	SPECIAL	FULL
3*	A30-231	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	EAST SIDE STORAGE AREA	1	INT/EXT	VIS
3*	A30-231	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	EAST SIDE STORAGE AREA	144	SPECIAL	HYDROTEST
3*	A30-231	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINTENANCE COMPLEX	EAST SIDE STORAGE AREA	12	SPECIAL	FULL
4	A30-232	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - NEW MPBACH - WEST SIDE	1	INT/EXT	VIS
4	A30-232	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - NEW MPBACH - WEST SIDE	12	SPECIAL	FULL
4	A30-232	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	2ND FLOOR - NEW MPBACH - WEST SIDE	144	SPECIAL	HYDROTEST
4	A30-233	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	I PLANT - 1ST FLOOR - NORTHEAST CORN	144	SPECIAL	HYDROTEST
4	A30-233	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	I PLANT - 1ST FLOOR - NORTHEAST CORN	1	INT/EXT	VIS
4	A30-233	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	I PLANT - 1ST FLOOR - NORTHEAST CORN	12	SPECIAL	FULL
3*	A30-234	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE #5	12	SPECIAL	FULL
3*	A30-234	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE #5	144	SPECIAL	HYDROTEST
3*	A30-234	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE #5	1	INT/EXT	VIS
4	A30-235	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	??????????????????????????	12	SPECIAL	FULL
4	A30-235	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	??????????????????????????	144	SPECIAL	HYDROTEST
4	A30-235	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	??????????????????????????	1	INT/EXT	VIS
4*	A30-236	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULALNCE SHED	ON SHELF	12	SPECIAL	FULL
4*	A30-236	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULALNCE SHED	ON SHELF	144	SPECIAL	HYDROTEST
4*	A30-236	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULALNCE SHED	ON SHELF	1	INT/EXT	VIS
3*	A30-237	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	UCTION AREA - RECEIVING AREA 10 - NOF	1	INT/EXT	VIS
3*	A30-237	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	UCTION AREA - RECEIVING AREA 10 - NOF	144	SPECIAL	HYDROTEST
3*	A30-237	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	UCTION AREA - RECEIVING AREA 10 - NOF	12	SPECIAL	FULL
3*	A30-239	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 TANK FARM	12	SPECIAL	FULL
3*	A30-239	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 TANK FARM	1	INT/EXT	VIS
3*	A30-239	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	HE-3800-1 TANK FARM	144	SPECIAL	HYDROTEST
3*	A30-240	FIRE	EXTINGUISHER	ANSUL	30 LB	GUARD OFFICE	WEST DOOR	1	INT/EXT	VIS
3*	A30-240	FIRE	EXTINGUISHER	ANSUL	30 LB	GUARD OFFICE	WEST DOOR	144	SPECIAL	HYDROTEST
3*	A30-240	FIRE	EXTINGUISHER	ANSUL	30 LB	GUARD OFFICE	WEST DOOR	12	SPECIAL	FULL
3*	A30-241	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #1	INSIDE	1	INT/EXT	VIS
3*	A30-241	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #1	INSIDE	12	SPECIAL	FULL
3*	A30-241	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #1	INSIDE	144	SPECIAL	HYDROTEST
3*	A30-242	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #2	INSIDE	1	INT/EXT	VIS
3*	A30-242	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #2	INSIDE	144	SPECIAL	HYDROTEST
3*	A30-242	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #2	INSIDE	12	SPECIAL	FULL

2*	A30-243	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 1ST FLOOR - CENTER	12	SPECIAL	FULL
2*	A30-243	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 1ST FLOOR - CENTER	1	INT/EXT	VIS
4	A30-245	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - EAST	144	SPECIAL	HYDROTEST
4	A30-245	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - EAST	12	SPECIAL	FULL
4	A30-245	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - EAST	1	INT/EXT	VIS
4	A30-246	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - CENTER	144	SPECIAL	HYDROTEST
4	A30-246	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - CENTER	1	INT/EXT	VIS
4	A30-246	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - CENTER	12	SPECIAL	FULL
3*	A30-247	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	EMERGENCY GENERATOR A & 9TH ST	1	INT/EXT	VIS
3*	A30-247	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	EMERGENCY GENERATOR A & 9TH ST	144	SPECIAL	HYDROTEST
3*	A30-247	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	EMERGENCY GENERATOR A & 9TH ST	12	SPECIAL	FULL
3*	A30-248	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	INCINERATOR	1	INT/EXT	VIS
3*	A30-248	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	INCINERATOR	12	SPECIAL	FULL
3*	A30-248	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	INCINERATOR	144	SPECIAL	HYDROTEST
S*	A30-250	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBUALNCE SHED	IN CAGE	12	SPECIAL	FULL
S*	A30-250	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBUALNCE SHED	IN CAGE	1	INT/EXT	VIS
S*	A30-250	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBUALNCE SHED	IN CAGE	144	SPECIAL	HYDROTEST
1	A30-252	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/C SHOP	MASSEY FERGUSON TRACTOR 89-2	12	SPECIAL	FULL
1	A30-252	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/C SHOP	MASSEY FERGUSON TRACTOR 89-2	144	SPECIAL	HYDROTEST
1	A30-252	FIRE	EXTINGUISHER	ANSUL	30 LB	OLD M/C SHOP	MASSEY FERGUSON TRACTOR 89-2	1	INT/EXT	VIS
1*	A30-253	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	HIGH PRESSURE CELL	144	SPECIAL	HYDROTEST
1*	A30-253	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	HIGH PRESSURE CELL	1	INT/EXT	VIS
1*	A30-253	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	HIGH PRESSURE CELL	12	SPECIAL	FULL
1*	A30-254	FIRE	EXTINGUISHER	ANSUL	30 LB	ANALYTICAL SERVICES	WET LAB	12	SPECIAL	FULL
1*	A30-254	FIRE	EXTINGUISHER	ANSUL	30 LB	ANALYTICAL SERVICES	WET LAB	1	INT/EXT	VIS
1*	A30-254	FIRE	EXTINGUISHER	ANSUL	30 LB	ANALYTICAL SERVICES	WET LAB	144	SPECIAL	HYDROTEST
1*	A30-255	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB - OUTSIDE	BUG HOUSE - SOUTHSIDE	1	INT/EXT	VIS
1*	A30-255	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB - OUTSIDE	BUG HOUSE - SOUTHSIDE	144	SPECIAL	HYDROTEST
1*	A30-255	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB - OUTSIDE	BUG HOUSE - SOUTHSIDE	12	SPECIAL	FULL
1*	A30-256	FIRE	EXTINGUISHER	ANSUL	30 LB	ANALYTICAL SERVICES - OUTSIDE	EAST SIDE	144	SPECIAL	HYDROTEST
1*	A30-256	FIRE	EXTINGUISHER	ANSUL	30 LB	ANALYTICAL SERVICES - OUTSIDE	EAST SIDE	1	INT/EXT	VIS
1*	A30-256	FIRE	EXTINGUISHER	ANSUL	30 LB	ANALYTICAL SERVICES - OUTSIDE	EAST SIDE	12	SPECIAL	FULL
1*	A30-260	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	CENTER STAIRS - WEST SIDE	12	SPECIAL	FULL
1*	A30-260	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	CENTER STAIRS - WEST SIDE	144	SPECIAL	HYDROTEST
1*	A30-260	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	CENTER STAIRS - WEST SIDE	1	INT/EXT	VIS
1	A30-261	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	NORTHWEST SIDE	144	SPECIAL	HYDROTEST
1	A30-261	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	NORTHWEST SIDE	1	INT/EXT	VIS
1	A30-261	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	NORTHWEST SIDE	12	SPECIAL	FULL
1	A30-262	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	2ND FLOOR	144	SPECIAL	HYDROTEST
1	A30-262	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	2ND FLOOR	1	INT/EXT	VIS
1	A30-262	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	2ND FLOOR	12	SPECIAL	FULL
1	A30-263	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	3RD FLOOR	144	SPECIAL	HYDROTEST
1	A30-263	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	3RD FLOOR	12	SPECIAL	FULL
1	A30-263	FIRE	EXTINGUISHER	ANSUL	30 LB	PT PILOT PLANT	3RD FLOOR	1	INT/EXT	VIS
5	A30-266	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	EAT VAN - CARGO BAY	1	INT/EXT	VIS
5	A30-266	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	EAT VAN - CARGO BAY	12	SPECIAL	FULL
5	A30-266	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	EAT VAN - CARGO BAY	144	SPECIAL	HYDROTEST
3*	A30-267	FIRE	EXTINGUISHER	ANSUL	30 LB	Thompson	Construction #9	12	SPECIAL	FULL
3*	A30-267	FIRE	EXTINGUISHER	ANSUL	30 LB	Thompson	Construction #9	144	SPECIAL	HYDROTEST
3*	A30-267	FIRE	EXTINGUISHER	ANSUL	30 LB	Thompson	Construction #9	1	INT/EXT	VIS
2	A30-27	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	WHITE TRUCK	1	INT/EXT	VIS
2	A30-27	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	WHITE TRUCK	12	SPECIAL	FULL
2	A30-27	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	WHITE TRUCK	144	SPECIAL	HYDROTEST
4*	A30-270	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	Construction E&I area	1	INT/EXT	VIS
4*	A30-270	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	Construction E&I area	144	SPECIAL	HYDROTEST
4*	A30-270	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	Construction E&I area	12	SPECIAL	FULL
3*	A30-274	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE #5	1	INT/EXT	VIS
3*	A30-274	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE #5	144	SPECIAL	HYDROTEST
3*	A30-274	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	HCN WAREHOUSE #5	12	SPECIAL	FULL
1*	A30-275	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	1	INT/EXT	VIS
1*	A30-275	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	12	SPECIAL	FULL
1*	A30-275	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CYLINDER READY AREA	144	SPECIAL	HYDROTEST
3*	A30-276	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA #5	12	SPECIAL	FULL
3*	A30-276	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA #5	144	SPECIAL	HYDROTEST
3*	A30-276	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA #5	1	INT/EXT	VIS
3*	A30-277	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	PAINT SHED - SANDBLAST AREA	12	SPECIAL	FULL

3*	A30-277	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	PAINT SHED - SANDBLAST AREA	144	SPECIAL	HYDROTEST
3*	A30-277	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	PAINT SHED - SANDBLAST AREA	1	INT/EXT	VIS
3*	A30-278	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - NORTH WELD SHO	1	INT/EXT	VIS
3*	A30-278	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - NORTH WELD SHO	12	SPECIAL	FULL
3*	A30-278	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - NORTH WELD SHO	144	SPECIAL	HYDROTEST
3*	A30-279	FIRE	EXTINGUISHER	ANSUL	30 LB	SHAW CONSTRUCTORS COMPOUND	ON AREA - FUEL TANK @ NORTH WELD SH	12	SPECIAL	FULL
3*	A30-279	FIRE	EXTINGUISHER	ANSUL	30 LB	SHAW CONSTRUCTORS COMPOUND	ON AREA - FUEL TANK @ NORTH WELD SH	1	INT/EXT	VIS
3*	A30-279	FIRE	EXTINGUISHER	ANSUL	30 LB	SHAW CONSTRUCTORS COMPOUND	ON AREA - FUEL TANK @ NORTH WELD SH	144	SPECIAL	HYDROTEST
2	A30-281	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	YELLOW YARD TRUCK	144	SPECIAL	HYDROTEST
2	A30-281	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	YELLOW YARD TRUCK	1	INT/EXT	VIS
2	A30-281	FIRE	EXTINGUISHER	ANSUL	30 LB	SHIPPING VEHICLES	YELLOW YARD TRUCK	12	SPECIAL	FULL
3*	A30-282	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - METAL WORK SHE	1	INT/EXT	VIS
3*	A30-282	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - METAL WORK SHE	12	SPECIAL	FULL
3*	A30-282	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - METAL WORK SHE	144	SPECIAL	HYDROTEST
3*	A30-283	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - NORTH WELD SHO	1	INT/EXT	VIS
3*	A30-283	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - NORTH WELD SHO	144	SPECIAL	HYDROTEST
3*	A30-283	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	ONSTRUCTION AREA - NORTH WELD SHO	12	SPECIAL	FULL
3*	A30-288	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA - BREAKROOM	1	INT/EXT	VIS
3*	A30-288	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA - BREAKROOM	12	SPECIAL	FULL
3*	A30-288	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA - BREAKROOM	144	SPECIAL	HYDROTEST
3*	A30-289	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA - BREAKROOM	144	SPECIAL	HYDROTEST
3*	A30-289	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA - BREAKROOM	1	INT/EXT	VIS
3*	A30-289	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	CONSTRUCTION AREA - BREAKROOM	12	SPECIAL	FULL
3*	A30-290	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	TRUCK DOCK	1	INT/EXT	VIS
3*	A30-290	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	TRUCK DOCK	12	SPECIAL	FULL
3*	A30-290	FIRE	EXTINGUISHER	ANSUL	30 LB	#4 BOILER	TRUCK DOCK	144	SPECIAL	HYDROTEST
2*	A30-291	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	I PLANT - 1ST FLOOR - NORTHWEST CORN	144	SPECIAL	HYDROTEST
2*	A30-291	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	I PLANT - 1ST FLOOR - NORTHWEST CORN	12	SPECIAL	FULL
2*	A30-291	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	I PLANT - 1ST FLOOR - NORTHWEST CORN	1	INT/EXT	VIS
2*	A30-292	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - WEST @ R9306	1	INT/EXT	VIS
2*	A30-292	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - WEST @ R9306	12	SPECIAL	FULL
2*	A30-292	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR - WEST @ R9306	144	SPECIAL	HYDROTEST
2*	A30-293	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	PLANT - 2ND FLOOR - NORTHWEST CORI	144	SPECIAL	HYDROTEST
2*	A30-293	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	PLANT - 2ND FLOOR - NORTHWEST CORI	12	SPECIAL	FULL
2*	A30-293	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	PLANT - 2ND FLOOR - NORTHWEST CORI	1	INT/EXT	VIS
2*	A30-294	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR	12	SPECIAL	FULL
2*	A30-294	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR	1	INT/EXT	VIS
2*	A30-294	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR	144	SPECIAL	HYDROTEST
2*	A30-295	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR	144	SPECIAL	HYDROTEST
2*	A30-295	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR	1	INT/EXT	VIS
2*	A30-295	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI PLANT - 2ND FLOOR	12	SPECIAL	FULL
2*	A30-296	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	NSU - OUTSIDE OF PACKAGING ROOM	12	SPECIAL	FULL
2*	A30-296	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	NSU - OUTSIDE OF PACKAGING ROOM	1	INT/EXT	VIS
2*	A30-296	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	NSU - OUTSIDE OF PACKAGING ROOM	144	SPECIAL	HYDROTEST
3*	A30-297	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #3	INSIDE	144	SPECIAL	HYDROTEST
3*	A30-297	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #3	INSIDE	1	INT/EXT	VIS
3*	A30-297	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #3	INSIDE	12	SPECIAL	FULL
3*	A30-298	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #3	INSIDE	12	SPECIAL	FULL
3*	A30-298	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #3	INSIDE	144	SPECIAL	HYDROTEST
3*	A30-298	FIRE	EXTINGUISHER	ANSUL	30 LB	DR3 WAREHOUSE #3	INSIDE	1	INT/EXT	VIS
4*	A30-299	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	WELDSHOP FIRE WATCH	1	INT/EXT	VIS
4*	A30-299	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	WELDSHOP FIRE WATCH	144	SPECIAL	HYDROTEST
4*	A30-299	FIRE	EXTINGUISHER	ANSUL	30 LB	CONTRACTOR COMPOUND	WELDSHOP FIRE WATCH	12	SPECIAL	FULL
1	A30-300	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	CLEANING PAD	12	SPECIAL	FULL
1	A30-300	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	CLEANING PAD	144	SPECIAL	HYDROTEST
1	A30-300	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	CLEANING PAD	1	INT/EXT	VIS
1*	A30-301	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	12	SPECIAL	FULL
1*	A30-301	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	1	INT/EXT	VIS
1*	A30-301	FIRE	EXTINGUISHER	ANSUL	30 LB	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	144	SPECIAL	HYDROTEST
1*	A30-302	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	DER RESTORATION AREA - RAILCAR PLAT	12	SPECIAL	FULL
1*	A30-302	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	DER RESTORATION AREA - RAILCAR PLAT	144	SPECIAL	HYDROTEST
1*	A30-302	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	DER RESTORATION AREA - RAILCAR PLAT	1	INT/EXT	VIS
2*	A30-303	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	PLANT 12 1ST FLOOR	12	SPECIAL	FULL
2*	A30-303	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	PLANT 12 1ST FLOOR	144	SPECIAL	HYDROTEST
2*	A30-303	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 12	PLANT 12 1ST FLOOR	1	INT/EXT	VIS
3*	A30-306	FIRE	EXTINGUISHER	ANSUL	30 LB	Plant11	R-1111 Digester	12	SPECIAL	FULL

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3"	A30-306	FIRE	EXTINGUISHER	ANSUL	30 LB	Plant11	R-1111 Digester	144	SPECIAL	HYDROTEST
3"	A30-306	FIRE	EXTINGUISHER	ANSUL	30 LB	Plant11	R-1111 Digester	1	INT/EXT	VIS
3"	A30-309	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI 2ND FLOOR	12	SPECIAL	FULL
3"	A30-309	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI 2ND FLOOR	144	SPECIAL	HYDROTEST
3"	A30-309	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 9	OSI 2ND FLOOR	1	INT/EXT	VIS
1"	A30-310	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CLEANING PAD OUTSIDE NORTH WALL	12	SPECIAL	FULL
1"	A30-310	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CLEANING PAD OUTSIDE NORTH WALL	144	SPECIAL	HYDROTEST
1"	A30-310	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	CLEANING PAD OUTSIDE NORTH WALL	1	INT/EXT	VIS
2	A30-311	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 VEHICLES	FORK TRUCK VH-00022	1	INT/EXT	VIS
2	A30-311	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 VEHICLES	FORK TRUCK VH-00022	144	SPECIAL	HYDROTEST
2	A30-311	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 VEHICLES	FORK TRUCK VH-00022	12	SPECIAL	FULL
1"	A30-312	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	)ER LOAD AREA - NORTH END - EAST RR T	144	SPECIAL	HYDROTEST
1"	A30-312	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	)ER LOAD AREA - NORTH END - EAST RR T	12	SPECIAL	FULL
1"	A30-312	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 7	)ER LOAD AREA - NORTH END - EAST RR T	1	INT/EXT	VIS
3"	A30-318	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	PAINT SHED - SANDBLAST AREA	144	SPECIAL	HYDROTEST
3"	A30-318	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	PAINT SHED - SANDBLAST AREA	1	INT/EXT	VIS
3"	A30-318	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	PAINT SHED - SANDBLAST AREA	12	SPECIAL	FULL
4"	A30-319	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	WEST SIDE	144	SPECIAL	HYDROTEST
4"	A30-319	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	WEST SIDE	12	SPECIAL	FULL
4"	A30-319	FIRE	EXTINGUISHER	ANSUL	30 LB	PT LAB	WEST SIDE	1	INT/EXT	VIS
1"	A30-320	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	701 DRYER - NORTH SIDE	1	INT/EXT	VIS
1"	A30-320	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	701 DRYER - NORTH SIDE	144	SPECIAL	HYDROTEST
1"	A30-320	FIRE	EXTINGUISHER	ANSUL	30 LB	PLANT 8 1ST FLOOR	701 DRYER - NORTH SIDE	12	SPECIAL	FULL
2"	A30-321	FIRE	EXTINGUISHER	ANSUL	30 LB	CO AREA	CO TUBE TRAILER AREA	1	INT/EXT	FULL
2"	A30-321	FIRE	EXTINGUISHER	ANSUL	30 LB	CO AREA	CO TUBE TRAILER AREA	144	SPECIAL	HYDROTEST
2"	A30-321	FIRE	EXTINGUISHER	ANSUL	30 LB	CO AREA	CO TUBE TRAILER AREA	12	SPECIAL	VIS
2"	A30-322	FIRE	EXTINGUISHER	ANSUL	30 LB	CO AREA	CO TUBE TRAILER AREA	1	INT/EXT	FULL
2"	A30-322	FIRE	EXTINGUISHER	ANSUL	30 LB	CO AREA	CO TUBE TRAILER AREA	144	SPECIAL	HYDROTEST
2"	A30-322	FIRE	EXTINGUISHER	ANSUL	30 LB	CO AREA	CO TUBE TRAILER AREA	12	SPECIAL	VIS
1"	A30-323	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 7	CYLINDER LOAD AREA	1	SPECIAL	FULL
1"	A30-323	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 7	CYLINDER LOAD AREA	144	SPECIAL	HYDROTEST
1"	A30-323	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 7	CYLINDER LOAD AREA	12	SPECIAL	VIS
1	A30-324	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
1	A30-324	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
1	A30-324	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
1"	A30-325	FIRE	EXTINGUISHER	BADGER	30 LB	NORTH BOILER AREA	T-2M-40 GAS TANK	1	SPECIAL	FULL
1"	A30-325	FIRE	EXTINGUISHER	BADGER	30 LB	NORTH BOILER AREA	T-2M-40 GAS TANK	144	SPECIAL	HYDROTEST
1"	A30-325	FIRE	EXTINGUISHER	BADGER	30 LB	NORTH BOILER AREA	T-2M-40 GAS TANK	12	SPECIAL	VIS
2"	A30-326	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 15	3RD FLOOR CLEAN ROOM	1	SPECIAL	FULL
2"	A30-326	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 15	3RD FLOOR CLEAN ROOM	144	SPECIAL	HYDROTEST
2"	A30-326	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 15	3RD FLOOR CLEAN ROOM	12	SPECIAL	VIS
1"	A30-327	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 4	PDC SOUTH OF PLANT 4	1	SPECIAL	FULL
1"	A30-327	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 4	PDC SOUTH OF PLANT 4	144	SPECIAL	HYDROTEST
1"	A30-327	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 4	PDC SOUTH OF PLANT 4	12	SPECIAL	VIS
2	A30-328	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
2	A30-328	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
2	A30-328	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
2	A30-329	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
2	A30-329	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
2	A30-329	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
1"	A30-330	FIRE	EXTINGUISHER	BADGER	30 LB	MAALOX AREA	T-15M-29 - SOUTH SIDE	1	SPECIAL	FULL
1"	A30-330	FIRE	EXTINGUISHER	BADGER	30 LB	MAALOX AREA	T-15M-29 - SOUTH SIDE	144	SPECIAL	HYDROTEST
1"	A30-330	FIRE	EXTINGUISHER	BADGER	30 LB	MAALOX AREA	T-15M-29 - SOUTH SIDE	12	SPECIAL	VIS
1"	A30-331	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 8 COLUMNS	WEST OF PDC-9 @ 3RD ST	1	SPECIAL	FULL
1"	A30-331	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 8 COLUMNS	WEST OF PDC-9 @ 3RD ST	144	SPECIAL	HYDROTEST
1"	A30-331	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 8 COLUMNS	WEST OF PDC-9 @ 3RD ST	12	SPECIAL	VIS
2	A30-332	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 12	DIP WAREHOUSE	1	SPECIAL	FULL
2	A30-332	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 12	DIP WAREHOUSE	144	SPECIAL	HYDROTEST
2	A30-332	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 12	DIP WAREHOUSE	12	SPECIAL	VIS
3	A30-333	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
3	A30-333	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
3	A30-333	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
1"	A30-334	FIRE	EXTINGUISHER	BADGER	30 LB	NORTH BOILER AREA	T-30M-6	1	SPECIAL	FULL
1"	A30-334	FIRE	EXTINGUISHER	BADGER	30 LB	NORTH BOILER AREA	T-30M-6	144	SPECIAL	HYDROTEST
1"	A30-334	FIRE	EXTINGUISHER	BADGER	30 LB	NORTH BOILER AREA	T-30M-6	12	SPECIAL	VIS
1"	A30-335	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM NORTH SIDE	1	SPECIAL	FULL

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1*	A30-335	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM NORTH SIDE	144	SPECIAL	HYDROTEST
1*	A30-335	FIRE	EXTINGUISHER	BADGER	30 LB	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM NORTH SIDE	12	SPECIAL	VIS
1*	A30-336	FIRE	EXTINGUISHER	BADGER	30 LB	PT Lab	BUG HOUSE - SOUTHSIDE	1	SPECIAL	FULL
1*	A30-336	FIRE	EXTINGUISHER	BADGER	30 LB	PT Lab	BUG HOUSE - SOUTHSIDE	144	SPECIAL	HYDROTEST
1*	A30-336	FIRE	EXTINGUISHER	BADGER	30 LB	PT Lab	BUG HOUSE - SOUTHSIDE	12	SPECIAL	VIS
3	A30-337	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
3	A30-337	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
3	A30-337	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
5	A30-338	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
5	A30-338	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
5	A30-338	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
5	A30-339	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
5	A30-339	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
5	A30-339	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
5	A30-340	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
5	A30-340	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
5	A30-340	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
5	A30-341	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
5	A30-341	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
5	A30-341	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
5	A30-342	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	1	SPECIAL	FULL
5	A30-342	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	144	SPECIAL	HYDROTEST
5	A30-342	FIRE	EXTINGUISHER	BADGER	30 LB	STORAGE	SPARE	12	SPECIAL	VIS
1*	A30-343	FIRE	EXTINGUISHER	ANSUL	30 LB	CARPENTER SHOP	SOUTHEAST DOOR	144	SPECIAL	HYDROTEST
1*	A30-343	FIRE	EXTINGUISHER	ANSUL	30 LB	CARPENTER SHOP	SOUTHEAST DOOR	12	SPECIAL	FULL
1*	A30-343	FIRE	EXTINGUISHER	ANSUL	30 LB	CARPENTER SHOP	SOUTHEAST DOOR	1	INT/EXT	VIS
1*	A30-344	FIRE	EXTINGUISHER	ANSUL	30 LB	WELDING SHOP	OUTSIDE EAST DOOR	144	SPECIAL	HYDROTEST
1*	A30-344	FIRE	EXTINGUISHER	ANSUL	30 LB	WELDING SHOP	OUTSIDE EAST DOOR	12	SPECIAL	FULL
1*	A30-344	FIRE	EXTINGUISHER	ANSUL	30 LB	WELDING SHOP	OUTSIDE EAST DOOR	1	INT/EXT	VIS
2*	A30-345	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR	12	SPECIAL	FULL
2*	A30-345	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR	1	INT/EXT	VIS
2*	A30-345	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	1ST FLOOR	144	SPECIAL	HYDROTEST
2*	A30-346	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	2ND FLOOR-EAST WALL	12	SPECIAL	FULL
2*	A30-346	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	2ND FLOOR-EAST WALL	144	SPECIAL	HYDROTEST
2*	A30-346	FIRE	EXTINGUISHER	ANSUL	20 LB	OLD PLANT 9	2ND FLOOR-EAST WALL	1	INT/EXT	VIS
2*	A30-347	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	2ND FLOOR	12	SPECIAL	FULL
2*	A30-347	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	2ND FLOOR	1	INT/EXT	VIS
2*	A30-347	FIRE	EXTINGUISHER	ANSUL	20 LB	PLANT 15	2ND FLOOR	144	SPECIAL	HYDROTEST
3*	A30-348	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINT COMPLEX	STOCKROOM	144	SPECIAL	HYDROTEST
3*	A30-348	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINT COMPLEX	STOCKROOM	12	SPECIAL	FULL
3*	A30-348	FIRE	EXTINGUISHER	ANSUL	30 LB	MAINT COMPLEX	STOCKROOM	1	INT/EXT	VIS
S*	A30-361	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	144	SPECIAL	HYDROTEST
S*	A30-361	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	12	SPECIAL	FULL
S*	A30-361	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	1	INT/EXT	VIS
S*	A30-362	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	144	SPECIAL	HYDROTEST
S*	A30-362	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	12	SPECIAL	FULL
S*	A30-362	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	1	INT/EXT	VIS
3*	A30-363	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	Weld Shop	144	SPECIAL	HYDROTEST
3*	A30-363	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	Weld Shop	12	SPECIAL	FULL
3*	A30-363	FIRE	EXTINGUISHER	ANSUL	30 LB	Contractor compound	Weld Shop	1	INT/EXT	VIS
S*	A30-364	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	144	SPECIAL	HYDROTEST
S*	A30-364	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	12	SPECIAL	FULL
S*	A30-364	FIRE	EXTINGUISHER	ANSUL	30 LB	AMBULANCE BUILDING	IN CAGE	1	INT/EXT	VIS
1*	A350-001	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHSIDE BY 1C4 ON4TH STREET	144	SPECIAL	HYDROTEST
1*	A350-001	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHSIDE BY 1C4 ON4TH STREET	1	INT/EXT	VIS
2	A350-002	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 MMT PLANT	CORNER 5TH & "B" STREET	1	INT/EXT	VIS
2	A350-002	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 MMT PLANT	CORNER 5TH & "B" STREET	144	SPECIAL	HYDROTEST
3	A350-003	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 1	2ND FLOOR EPTD CELL	1	INT/EXT	VIS
3	A350-003	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 1	2ND FLOOR EPTD CELL	144	SPECIAL	HYDROTEST
3*	A350-005	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 8 SOUTH TANK FARM	LANT14 N/CONTROL ROOMON 8TH STREE	144	SPECIAL	HYDROTEST
3*	A350-005	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 8 SOUTH TANK FARM	LANT14 N/CONTROL ROOMON 8TH STREE	1	INT/EXT	VIS
4*	A350-006	FIRE	EXTINGUISHER	ANSUL WU	350 LB	AREA 1 SUBOFFICE	EAST END OF BUILDING	144	SPECIAL	HYDROTEST
4*	A350-006	FIRE	EXTINGUISHER	ANSUL WU	350 LB	AREA 1 SUBOFFICE	EAST END OF BUILDING	1	INT/EXT	VIS
1*	A350-007	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	CYLINDER LOAD AREA - SOUTH END	1	INT/EXT	VIS
1*	A350-007	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	CYLINDER LOAD AREA - SOUTH END	144	SPECIAL	HYDROTEST
3	A350-008	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 11	1ST FLOOR	144	SPECIAL	HYDROTEST

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3*	A350-009	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	CORNER OF 8TH AND D ST	1	INT/EXT	VIS
3*	A350-009	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	CORNER OF 8TH AND D ST	144	SPECIAL	HYDROTEST
1	A350-010	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	CYLINDER LOAD AREA - NORTH END	1	INT/EXT	VIS
1	A350-010	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	CYLINDER LOAD AREA - NORTH END	144	SPECIAL	HYDROTEST
1*	A350-011	FIRE	EXTINGUISHER	ANSUL WU	350 LB	AREA 2 SUBOFFICE	SOUTH OF N2 PLANT	144	SPECIAL	HYDROTEST
1*	A350-011	FIRE	EXTINGUISHER	ANSUL WU	350 LB	AREA 2 SUBOFFICE	SOUTH OF N2 PLANT	1	INT/EXT	VIS
2	A350-013	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 WEST	T-6M-5/6 - NORTH SIDE	144	SPECIAL	HYDROTEST
2	A350-013	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 WEST	T-6M-5/6 - NORTH SIDE	1	INT/EXT	VIS
2	A350-014	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 1ST FLOOR	K-4M-12 - NORTHWES SIDE	144	SPECIAL	HYDROTEST
2	A350-014	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 1ST FLOOR	K-4M-12 - NORTHWES SIDE	1	INT/EXT	VIS
2	A350-015	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 1ST FLOOR	K-4M-12 - NORTHWES SIDE	144	SPECIAL	HYDROTEST
2	A350-015	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 1ST FLOOR	K-4M-12 - NORTHWES SIDE	1	INT/EXT	VIS
1	A350-016	FIRE	EXTINGUISHER	ANSUL WU	350 LB	SHAW COMPLEX	HELIPAD	1	INT/EXT	VIS
1	A350-016	FIRE	EXTINGUISHER	ANSUL WU	350 LB	SHAW COMPLEX	HELIPAD	144	SPECIAL	HYDROTEST
3*	A350-017	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	HELIPAD	144	SPECIAL	HYDROTEST
3*	A350-017	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	HELIPAD	1	INT/EXT	VIS
1*	A350-018	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHWEST SIDE	144	SPECIAL	HYDROTEST
1*	A350-018	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHWEST SIDE	1	INT/EXT	VIS
2*	A350-019	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	NORTHWEST CORNER A & 7TH	1	INT/EXT	VIS
2*	A350-019	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	NORTHWEST CORNER A & 7TH	144	SPECIAL	HYDROTEST
3*	A350-020	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 11	CONTROL ROOM - NORTHEAST CORNER	144	SPECIAL	HYDROTEST
3*	A350-020	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 11	CONTROL ROOM - NORTHEAST CORNER	1	INT/EXT	VIS
3*	A350-021	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 14	HCN BULK STORAGE	1	INT/EXT	VIS
3*	A350-021	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 14	HCN BULK STORAGE	144	SPECIAL	HYDROTEST
3	A350-022	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 10	CONTROL ROOM - WEST SIDE	1	INT/EXT	VIS
3	A350-022	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 10	CONTROL ROOM - WEST SIDE	144	SPECIAL	HYDROTEST
2	A350-022	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	NORTH SIDE	144	SPECIAL	HYDROTEST
2	A350-022	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	NORTH SIDE	1	INT/EXT	VIS
2	A350-023	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 1	NORTHEAST CORNER @ 8TH STREET	1	INT/EXT	VIS
2	A350-023	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 1	NORTHEAST CORNER @ 8TH STREET	144	SPECIAL	HYDROTEST
1	A350-024	FIRE	EXTINGUISHER	ANSUL WU	350 LB	TRAFFIC	T/T TURN AROUND	1	INT/EXT	VIS
1	A350-024	FIRE	EXTINGUISHER	ANSUL WU	350 LB	TRAFFIC	T/T TURN AROUND	144	SPECIAL	HYDROTEST
1*	A350-025	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5	CORNER OF 5TH AND B	144	SPECIAL	HYDROTEST
1*	A350-025	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5	CORNER OF 5TH AND B	1	INT/EXT	VIS
2*	A350-026	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	NORTH WEST CORNER A & 7TH	1	INT/EXT	VIS
2*	A350-026	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 9	NORTH WEST CORNER A & 7TH	144	SPECIAL	HYDROTEST
1	A350-027	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	ALKYL CLEANING PAD	1	INT/EXT	VIS
1	A350-027	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	ALKYL CLEANING PAD	144	SPECIAL	HYDROTEST
1*	A350-029	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	NORTHSIDE OF PLANT 4	144	SPECIAL	HYDROTEST
1*	A350-029	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	NORTHSIDE OF PLANT 4	1	INT/EXT	VIS
1*	A350-031	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	CYLINDER FILL AREA	144	SPECIAL	HYDROTEST
1*	A350-031	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 7	CYLINDER FILL AREA	1	INT/EXT	VIS
2*	A350-033	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 8	TANK FARM EAST OF OSI	144	SPECIAL	HYDROTEST
2*	A350-033	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 8	TANK FARM EAST OF OSI	1	INT/EXT	VIS
1*	A350-033	FIRE	EXTINGUISHER	ANSUL WU	350 LB	RAW MATERIAL WAREHOUSE	SOUTH END	144	SPECIAL	HYDROTEST
1*	A350-033	FIRE	EXTINGUISHER	ANSUL WU	350 LB	RAW MATERIAL WAREHOUSE	SOUTH END	1	INT/EXT	VIS
1*	A350-034	FIRE	EXTINGUISHER	ANSUL WU	350 LB	Plant 4	South side by IC4 coalescer	1	INT/EXT	VIS
1*	A350-034	FIRE	EXTINGUISHER	ANSUL WU	350 LB	Plant 4	South side by IC4 coalescer	144	SPECIAL	HYDROTEST
1*	A350-035	FIRE	EXTINGUISHER	ANSUL WU	350 LB	Plant 8 South Farm	4th street east of T20m dike	1	INT/EXT	VIS
1*	A350-035	FIRE	EXTINGUISHER	ANSUL WU	350 LB	Plant 8 South Farm	4th street east of T20m dike	144	SPECIAL	HYDROTEST
1	A350-036	FIRE	EXTINGUISHER	ANSUL WU	350 LB	TANK TRUCK TURN AROUND	NTRANCE TO TANK TRUCK TURN AROUN	144	SPECIAL	HYDROTEST
1	A350-036	FIRE	EXTINGUISHER	ANSUL WU	350 LB	TANK TRUCK TURN AROUND	NTRANCE TO TANK TRUCK TURN AROUN	1	INT/EXT	VIS
2	A350-038	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHWEST SIDE	1	INT/EXT	VIS
2	A350-038	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHWEST SIDE	144	SPECIAL	HYDROTEST
2	A350-37	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHWEST of PLT 4	1	INT/EXT	VIS
2	A350-37	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 4	SOUTHWEST of PLT 4	144	SPECIAL	HYDROTEST
1*	A350-52	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 MMT TANK FARM	4TH STREET AT RR TRACKS	1	INT/EXT	VIS
1*	A350-52	FIRE	EXTINGUISHER	ANSUL WU	350 LB	PLANT 5 MMT TANK FARM	4TH STREET AT RR TRACKS	144	SPECIAL	HYDROTEST
5	ALT374-4178	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
5	ALT374-7830	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST
2*	AS-001	BREATHING	AIR	STATION		PLANT 1	PGL3 LOADING DOCK	1	INT/EXT	VIS
2*	AS-002	BREATHING	AIR	STATION		PLANT 1	T-1800-1 - EAST SIDE	1	INT/EXT	VIS
4	AS-003	BREATHING	AIR	STATION		PLANT 15	@ RAILROAD TRACKS	1	INT/EXT	VIS
4	AS-004	BREATHING	AIR	STATION		PLANT 1	SOUTHEAST SIDE OF NCENDX PLANT	1	INT/EXT	VIS
2*	AS-005	BREATHING	AIR	STATION		PLANT 15	K-2100-2 - EAST SIDE	1	INT/EXT	VIS
4	AS-006	BREATHING	AIR	STATION		PLANT 1	ST FLOOR - EAST OF SPRINKLER HOUSE 2	1	INT/EXT	VIS

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2"	AS-007	BREATHING	AIR	STATION		PLANT 1	1ST FLOOR - EPTD CELL - SOUTH SIDE	1	INT/EXT	VIS	
4	AS-008	BREATHING	AIR	STATION		PLANT 1	1ST FLOOR - EPTD CELL - EAST WALL	1	INT/EXT	VIS	
2"	AS-009	BREATHING	AIR	STATION		PLANT 1	1ST FLOOR - SOUTH OF K-4M-8	1	INT/EXT	VIS	
4	AS-010	BREATHING	AIR	STATION		PLANT 1	SOUTHWEST OF T-8M-2	1	INT/EXT	VIS	
2"	AS-011	BREATHING	AIR	STATION		PLANT 1	1ST FLOOR - EPTD CELL - NORTH WALL	1	INT/EXT	VIS	
2"	AS-012	BREATHING	AIR	STATION		PLANT 15	1ST FLOOR - STACKUP - SOUTH END	1	INT/EXT	VIS	
2"	AS-013	BREATHING	AIR	STATION		PLANT 15	ST FLOOR - STACKUP - NORTH WEST SID	1	INT/EXT	VIS	
2"	AS-014	BREATHING	AIR	STATION		PLANT 15	1ST FLOOR - NORTHWEST CORNER	1	INT/EXT	VIS	
4	AS-015	BREATHING	AIR	STATION		PLANT 15	1ST FLOOR - NORTHEASE CORNER	1	INT/EXT	VIS	
2"	AS-016	BREATHING	AIR	STATION		PLANT 16	2ND FLOOR - WEST WALL	1	INT/EXT	VIS	
2"	AS-017	BREATHING	AIR	STATION		PLANT 15	3RD FLOOR - SOUTH WALL	1	INT/EXT	VIS	
2"	AS-018	BREATHING	AIR	STATION		PLANT 15 1st floor	7th st North side	1	INT/EXT	VIS	
2"	AS-022	BREATHING	AIR	STATION		PLANT 12	702 HOPPER PLATFORM - SOUTH SIDE	1	INT/EXT	VIS	
2"	AS-023	BREATHING	AIR	STATION		PLANT 9	NSU - 2ND FLOOR	1	INT/EXT	VIS	
3	AS-024	BREATHING	AIR	STATION		PLANT 9	NEW MPBACH DOCK	1	INT/EXT	VIS	
3	AS-025	BREATHING	AIR	STATION		PLANT 9	NEW MPBACH DOCK	1	INT/EXT	VIS	
4	AS-026	BREATHING	AIR	STATION		PLANT 1	EPTD CELL - 2ND FLOOR - WEST WALL	1	INT/EXT	VIS	
4	AS-027	BREATHING	AIR	STATION		PLANT 1	EPTD CELL - 2ND FLOOR - SOUTH WALL	1	INT/EXT	VIS	
2"	AS-028	BREATHING	AIR	STATION		PLANT 1	EPTD CELL - 2ND FLOOR - EAST WALL	1	INT/EXT	VIS	
4	AS-029	BREATHING	AIR	STATION		PLANT 1	D FLOOR - NAPROXEN STACK UP - NEW W	1	INT/EXT	VIS	
4	AS-030	BREATHING	AIR	STATION		PLANT 15	EPTD CELL - 3RD FLOOR - SALT ROOM	1	INT/EXT	VIS	
2"	AS-031	BREATHING	AIR	STATION		PLANT 1	EPTD CELL - 3RD FLOOR - EAST WALL	1	INT/EXT	VIS	
2"	AS-033	BREATHING	AIR	STATION		PLANT 9	NSU - 2ND FLOOR	1	INT/EXT	VIS	
2"	AS-034	BREATHING	AIR	STATION		PLANT 9	NORTH HCN CELL 2ND FLOOR	1	INT/EXT	VIS	
2"	AS-035	BREATHING	AIR	STATION		PLANT 9	WEST OF HCN ON MEZZANINE	1	INT/EXT	VIS	
3"	AS-036	BREATHING	AIR	STATION		PLANT 9	5 TANK FARM - WEST OF COOLING TOWE	1	INT/EXT	VIS	
2"	AS-037	BREATHING	AIR	STATION		PLANT 1	ROOF - EAST SIDE	1	INT/EXT	VIS	
3"	AS-038	BREATHING	AIR	STATION		PLANT 14	2ND FLOOR - WEST SIDE	1	INT/EXT	VIS	
2"	AS-039	BREATHING	AIR	STATION		PLANT 9	TANK FARM EAST OF OSI	1	INT/EXT	VIS	
2"	AS-040	BREATHING	AIR	STATION		PLANT 9	1ST FLOOR - WEST WALL	1	INT/EXT	VIS	
2"	AS-041	BREATHING	AIR	STATION		PLANT 9	1ST FLOOR - SOUTH WALL	1	INT/EXT	VIS	
2"	AS-042	BREATHING	AIR	STATION		PLANT 9	PLANT - R112 CELL - 1ST FLOOR - NORTH	1	INT/EXT	VIS	
2"	AS-043	BREATHING	AIR	STATION		PLANT 9	1ST FLOOR - HCN CELL	1	INT/EXT	VIS	
2"	AS-044	BREATHING	AIR	STATION		PLANT 9	2ND FLOOR - SOUTH WALL	1	INT/EXT	VIS	
2"	AS-045	BREATHING	AIR	STATION		PLANT 9	2ND FLOOR - SOUTH SIDE	1	INT/EXT	VIS	
2"	AS-046	BREATHING	AIR	STATION		PLANT 9	3RD FLOOR - CENTRIFUGE ROOM	1	INT/EXT	VIS	
2"	AS-047	BREATHING	AIR	STATION		PLANT 9	3RD FLOOR - WEST SIDE	1	INT/EXT	VIS	
2"	AS-048	BREATHING	AIR	STATION		PLANT 9	3RD FLOOR - ALCL3 CELL	1	INT/EXT	VIS	
2"	AS-049	BREATHING	AIR	STATION		PLANT 9	4TH FLOOR - NORTH END	1	INT/EXT	VIS	
3"	AS-050	BREATHING	AIR	STATION		PLANT 9	SOUTH TANK FARM	1	INT/EXT	VIS	
4	AS-051	BREATHING	AIR	STATION		PLANT 9	HCN BUILDING - WEST SIDE	1	INT/EXT	VIS	
4	AS-052	BREATHING	AIR	STATION		PLANT 9	HCN BUILDING - EAST SIDE	1	INT/EXT	VIS	
3"	AS-053	BREATHING	AIR	STATION		PLANT 9	WEST OF D-446	1	INT/EXT	VIS	
3"	AS-054	BREATHING	AIR	STATION		PLANT 10	1ST FLOOR - WEST WALL	1	INT/EXT	VIS	
3"	AS-055	BREATHING	AIR	STATION		PLANT 10	2ND FLOOR - EAST WALL	1	INT/EXT	VIS	
3	AS-056	BREATHING	AIR	STATION		PLANT 1	ARBON DRUMS - EPTD AREA - SOUTH SID	1	INT/EXT	VIS	
3"	AS-057	BREATHING	AIR	STATION		PLANT 14	SOUTH SIDE @ PCL3 SHED	1	INT/EXT	VIS	
3	AS-058	BREATHING	AIR	STATION		AREA 1	EASC ULOADING PLATFORM	1	INT/EXT	VIS	
2"	AS-060	BREATHING	AIR	STATION		PLANT 15	1ST FLOOR - WEST WALL	1	INT/EXT	VIS	
2"	AS-062	BREATHING	AIR	STATION		PLANT 9	1ST FLOOR - PACKAGING ROOM	1	INT/EXT	VIS	
4	AS-066	BREATHING	AIR	STATION		PLANT 9	EW HCN BUILDING 2 - SOUTHEAST CORNE	1	INT/EXT	VIS	
4	AS-067	BREATHING	AIR	STATION		PLANT 9	NEW HCN BUILDING - EAST SIDE	1	INT/EXT	VIS	
4	AS-068	BREATHING	AIR	STATION		PLANT 9	EW HCN BUILDING - NORTHEAST CORNE	1	INT/EXT	VIS	
4	AS-069	BREATHING	AIR	STATION		PLANT 1	EPTD CELL - NORTHEAST CORNER	1	INT/EXT	VIS	
3"	AS-070	BREATHING	AIR	STATION		PLANT 14	3RD FLOOR - NORTH WALL	1	INT/EXT	VIS	
2"	AS-071	BREATHING	AIR	STATION		PLANT 9	HCN PLANT - 2ND FLOOR	1	INT/EXT	VIS	
2"	AS-072	BREATHING	AIR	STATION		PLANT 9	HCN PLANT - 1ST FLOOR	1	INT/EXT	VIS	
2"	AS-073	BREATHING	AIR	STATION		PLANT 9	N PLANT - 1ST FLOOR - SOUTHWEST CORI	1	INT/EXT	VIS	
4	AS-074	BREATHING	AIR	STATION		PLANT 9	N PLANT - 2ND FLOOR - SOUTHWALL OF C	1	INT/EXT	VIS	
2"	AS-075	BREATHING	AIR	STATION		PLANT 9	LANT - 2ND FLOOR - EAST WALL - OUTSIDI	1	INT/EXT	VIS	
2"	AS-076	BREATHING	AIR	STATION		PLANT 9	1ST FLOOR - NORTHEAST CORNER	1	INT/EXT	VIS	
3"	AS-077	BREATHING	AIR	STATION		PLANT 14	2ND FLOOR	1	INT/EXT	VIS	
2"	AS-078	BREATHING	AIR	STATION		PLANT 12	T 8M-18 (FORMALDEHYDE TANK)	1	INT/EXT	VIS	

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2"	AS-080	BREATHING	AIR	STATION		PLANT 12	NORTH WALL - 2ND FLOOR - TOP OF STAIR	1	INT/EXT	VIS
4	AS-081	BREATHING	AIR	STATION		PLANT 9	PLANT - 1ST FLOOR - NORTH WALL (NEW AD	1	INT/EXT	VIS
3"	AS-082	BREATHING	AIR	STATION		PLANT 14	1ST FLOOR - EAST SIDE	1	INT/EXT	VIS
2"	AS-083	BREATHING	AIR	STATION		PLANT 9	EAST OF T 9143	1	INT/EXT	VIS
2"	AS-084	BREATHING	AIR	STATION		PLANT 9	OSI PLANT 1ST FLOOR	1	INT/EXT	VIS
2"	AS-085	BREATHING	AIR	STATION		PLANT 9	OSI PLANT - 1ST FLOOR - WEST	1	INT/EXT	VIS
2"	AS-086	BREATHING	AIR	STATION		PLANT 9	OSI PLANT - 2ND FLOOR - EAST	1	INT/EXT	VIS
2"	AS-087	BREATHING	AIR	STATION		PLANT 9	OSI PLANT - 2ND FLOOR - EAST	1	INT/EXT	VIS
5	AS-088	BREATHING	AIR	STATION		#4 BOILER	HE-3800-1	1	INT/EXT	VIS
3"	AS-089	BREATHING	AIR	STATION		#4 BOILER	E-3800-1 - SOUTHWEST CORNER OF BOILE	1	INT/EXT	VIS
2"	AS-090	BREATHING	AIR	STATION		PLANT 9	OSI PLANT - OSI TANK FARM - CENTER	1	INT/EXT	VIS
1"	AS-092	BREATHING	AIR	AIR		PT LAB	ROOM 115 - CHEMICAL LAB	1	INT/EXT	VIS
2"	AS-093	BREATHING	AIR	STATION		PLANT 9	EAST TANK FARM	1	INT/EXT	VIS
2"	AS-095	BREATHING	AIR	STATION		PLANT 1	TD CELL - 2ND FLOOR - NORTHEAST CORN	1	INT/EXT	VIS
2"	AS-098	BREATHING	AIR	STATION		PLANT 9	OSI PLANT - SOUTH WALL - GROUND LEVE	1	INT/EXT	VIS
3"	AS-099	BREATHING	AIR	STATION		PLANT 14	8TH STREET - WEST END OF PCL3 SHED	1	INT/EXT	VIS
2"	AS-101	BREATHING	AIR	STATION		PLANT 9	HCN WAREHOUSE - EAST SIDE	1	INT/EXT	VIS
2"	AS-102	BREATHING	AIR	STATION		PLANT 9	HCN WAREHOUSE - NORTHWEST CORNER	1	INT/EXT	VIS
1"	AS-103	BREATHING	AIR	STATION		PT LAB	ROOM 112 - GENERAL LAB	1	INT/EXT	VIS
1"	AS-104	BREATHING	AIR	STATION		PT LAB	ROOM 110 - TOXIC LAB	1	INT/EXT	VIS
2"	AS-116	BREATHING	AIR	STATION		CHEMICAL WAREHOUSE	EAST END OF BUILDING - NORTH ROOM	1	INT/EXT	VIS
1	AS-118	BREATHING	AIR	STATION		TRAFFIC - LIQUID PACKAGING	CLEANING PAD	1	INT/EXT	VIS
2"	AS-120	BREATHING	AIR	STATION		PLANT 9	HCN WAREHOUSE - SOUTHEAST CORNER	1	INT/EXT	VIS
1	AS-121	BREATHING	AIR	STATION		PT LAB	ROOM 113 - CHEMICAL LAB	1	INT/EXT	VIS
3"	AS-126	BREATHING	AIR	STATION		PLANT 14	K-6M-8EAST SIDE	1	INT/EXT	VIS
3"	AS-127	BREATHING	AIR	STATION		PLANT 14	K-5M-3 - EAST SIDE	1	INT/EXT	VIS
3"	AS-128	BREATHING	AIR	STATION		PLANT 14	HCL LOADING DOCK 2 - EAST OF PLANT	1	INT/EXT	VIS
3"	AS-134	BREATHING	AIR	STATION		PLANT 14	PCL3 LOADING DOCK	1	INT/EXT	VIS
3"	AS-139	BREATHING	AIR	STATION		PLANT 9	HCN BULK STORAGE - NORTH CATWALK	1	INT/EXT	VIS
3"	AS-140	BREATHING	AIR	STATION		PLANT 9	HCN BULK STORAGE - CENTER CATWALK	1	INT/EXT	VIS
2"	AS-141	BREATHING	AIR	STATION		PLANT 9	R1122 CELL 3RD FLOOR 6th ST	1	INT/EXT	VIS
2"	AS-142	BREATHING	AIR	STATION		AREA 2	CO UNLOAD AREA - NORTH SIDE	1	INT/EXT	VIS
2"	AS-143	BREATHING	AIR	STATION		AREA 2	CO UNLOAD AREA - EAST SIDE	1	INT/EXT	VIS
2"	AS-144	BREATHING	AIR	STATION		PLANT 15	NAPROXEN STACKUP - 4TH FLOOR	1	INT/EXT	VIS
2"	AS-145	BREATHING	AIR	STATION		PLANT 15	NAPROXEN STACKUP - 2ND FLOOR	1	INT/EXT	VIS
3	AS-147	BREATHING	AIR	STATION		PLANT 11	cooling tower 12 drum shed	1	INT/EXT	VIS
3	AS-148	BREATHING	AIR	STATION		PLANT 9	corner of D and 8th st	1	INT/EXT	VIS
2"	AS-149	BREATHING	AIR	STATION		PLANT 1	ST FLOOR - NORTHEAST CORNER OF K12	1	INT/EXT	VIS
2"	AS-150	BREATHING	AIR	STATION		PLANT 1	3RD FLOOR - NORHT OF K123	1	INT/EXT	VIS
2"	AS-151	BREATHING	AIR	STATION		PLANT 1	ROOF - SOUTHEAST OF BPA HOPPER	1	INT/EXT	VIS
4	AS-152	BREATHING	AIR	STATION		PLANT 9	LIME SLAKER	1	INT/EXT	VIS
2"	AS-154	BREATHING	AIR	STATION		PLANT 9	OSI PLANT - ROOF - SOUTHWEST CORNER	1	INT/EXT	VIS
2"	AS-155	BREATHING	AIR	STATION		PLANT 9	4TH FLOOR - OLD PLANT 9 (ACCL)	1	INT/EXT	VIS
2	AS-156	BREATHING	AIR	STATION		PLANT 4	TOP OF D12 PLATFORM	1	INT/EXT	VIS
2	AS-157	BREATHING	AIR	STATION		PLANT 4	TOP OF V1 PLATFORM	1	INT/EXT	VIS
2"	AS-158	BREATHING	AIR	STATION		TRAFFIC	TRAFFIC WAREHOUSE ROOF	1	INT/EXT	VIS
2	AS-159	BREATHING	AIR	STATION		SPENT ACID LOAD SPOT	PLANT 11	1	INT/EXT	VIS
3"	AS-160	BREATHING	AIR	STATION		HCN BULK BUILDING	PLANT 9	1	INT/EXT	VIS
2"	AS-161	BREATHING	AIR	STATION		PLANT 15	1ST FLOOR	1	INT/EXT	VIS
2"	AS-162	BREATHING	AIR	STATION		PLANT 15	2ND FLOOR	1	INT/EXT	VIS
2"	AS-163	BREATHING	AIR	STATION		PLANT 15	3RD FLOOR	1	INT/EXT	VIS
2"	AS-164	BREATHING	AIR	STATION		PLANT 15	1ST CLEAN ROOMT 15	1	INT/EXT	VIS
5	AS-165	BREATHING	AIR	STATION		1ST FLOOR CLEAN ROOM	PLANT 15	1	INT/EXT	VIS
2"	AS-166	BREATHING	AIR	STATION		1ST FLOOR CLEAN ROOM	PLANT 15	1	INT/EXT	VIS
2"	AS-167	BREATHING	AIR	STATION		PLANT 15	T0134 SOUTHSIDE	1	INT/EXT	VIS
3"	AS-168	BREATHING	AIR	STATION		Plant 14	HCL Tube trailer unload	1	INT/EXT	VIS

2	CO2-001	FIRE	EXTINGUISHER	CO2		PLANT 9 OSI	2ND FLOOR IC ROOM	60	SPECIAL	HYDROTEST
2	CO2-001	FIRE	EXTINGUISHER	CO2		PLANT 9 OSI	2ND FLOOR IC ROOM	1	INT/EXT	VIS
3*	CO2-002	FIRE	EXTINGUISHER	CO2		PLANT 9	REET - ELECTRICAL BUILDING PDC-14-A - I	1	INT/EXT	VIS
3*	CO2-002	FIRE	EXTINGUISHER	CO2		PLANT 9	REET - ELECTRICAL BUILDING PDC-14-A - I	60	SPECIAL	HYDROTEST
4	CO2-003	FIRE	EXTINGUISHER	CO2		PLANT 1	ENGINE ROOM - 7TH STREET	60	SPECIAL	HYDROTEST
4	CO2-003	FIRE	EXTINGUISHER	CO2		PLANT 1	ENGINE ROOM - 7TH STREET	1	INT/EXT	VIS
1*	CO2-005	FIRE	EXTINGUISHER	CO2		PT LAB	NORTH WALL	1	INT/EXT	VIS
1*	CO2-005	FIRE	EXTINGUISHER	CO2		PT LAB	NORTH WALL	60	SPECIAL	HYDROTEST
3*	CO2-006	FIRE	EXTINGUISHER	CO2		PLANT 11	OOLING TOWER 15 - ELECTRICAL BUILIN(	60	SPECIAL	HYDROTEST
3*	CO2-006	FIRE	EXTINGUISHER	CO2		PLANT 11	OOLING TOWER 15 - ELECTRICAL BUILIN(	1	INT/EXT	VIS
1*	CO2-008	FIRE	EXTINGUISHER	CO2		ADMINISTRATION BUILDING	PDC 2F	1	INT/EXT	VIS
1*	CO2-008	FIRE	EXTINGUISHER	CO2		ADMINISTRATION BUILDING	PDC 2F	60	SPECIAL	HYDROTEST
1*	CO2-009	FIRE	EXTINGUISHER	CO2		PLANT 8 NORTH	VER DISTRIBUTION CENTER 9 @ 3RD STR	60	SPECIAL	HYDROTEST
1*	CO2-009	FIRE	EXTINGUISHER	CO2		PLANT 8 NORTH	VER DISTRIBUTION CENTER 9 @ 3RD STR	1	INT/EXT	VIS
2	CO2-010	FIRE	EXTINGUISHER	CO2		PLANT 8 TANK FARM	OLD PLANT 8 COLUMN CONTROL ROOM	60	SPECIAL	HYDROTEST
2	CO2-010	FIRE	EXTINGUISHER	CO2		PLANT 8 TANK FARM	OLD PLANT 8 COLUMN CONTROL ROOM	1	INT/EXT	VIS
3*	CO2-011	FIRE	EXTINGUISHER	CO2		PLANT 9	REET - ELECTRICAL BUILDING PDC-14-A - I	60	SPECIAL	HYDROTEST
3*	CO2-011	FIRE	EXTINGUISHER	CO2		PLANT 9	REET - ELECTRICAL BUILDING PDC-14-A - I	1	INT/EXT	VIS
1*	CO2-012	FIRE	EXTINGUISHER	CO2		ADMINISTRATION BUILDING	PDC 2E	60	SPECIAL	HYDROTEST
1*	CO2-012	FIRE	EXTINGUISHER	CO2		ADMINISTRATION BUILDING	PDC 2E	1	INT/EXT	VIS
1*	CO2-013	FIRE	EXTINGUISHER	CO2		PLANT 5 MMT TANK FARM	C-20-B - NORTH OF CONTROL ROOM - INSI	60	SPECIAL	HYDROTEST
1*	CO2-013	FIRE	EXTINGUISHER	CO2		PLANT 5 MMT TANK FARM	C-20-B - NORTH OF CONTROL ROOM - INSI	1	INT/EXT	VIS
3*	CO2-014	FIRE	EXTINGUISHER	CO2		PLANT 11	JILDING - INSIDE - SOUTH WALL BESIDE C	1	INT/EXT	VIS
3*	CO2-014	FIRE	EXTINGUISHER	CO2		PLANT 11	JILDING - INSIDE - SOUTH WALL BESIDE C	60	SPECIAL	HYDROTEST
2*	CO2-015	FIRE	EXTINGUISHER	CO2		PLANT 1	EPTD PDC	60	SPECIAL	HYDROTEST
2*	CO2-015	FIRE	EXTINGUISHER	CO2		PLANT 1	EPTD PDC	1	INT/EXT	VIS
3*	CO2-017	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	ELECTRIC SHOP - BAY ROOM	60	SPECIAL	HYDROTEST
3*	CO2-017	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	ELECTRIC SHOP - BAY ROOM	1	INT/EXT	VIS
3*	CO2-018	FIRE	EXTINGUISHER	CO2		PLANT 11	JLING TOWER 12 - INSIDE ELECTRICAL BU	60	SPECIAL	HYDROTEST
3*	CO2-018	FIRE	EXTINGUISHER	CO2		PLANT 11	JLING TOWER 12 - INSIDE ELECTRICAL BU	1	INT/EXT	VIS
3*	CO2-019	FIRE	EXTINGUISHER	CO2		PLANT 9	PDC-13-A A AND 8TH STREET	1	INT/EXT	VIS
3*	CO2-019	FIRE	EXTINGUISHER	CO2		PLANT 9	PDC-13-A A AND 8TH STREET	60	SPECIAL	HYDROTEST
1*	CO2-021	FIRE	EXTINGUISHER	CO2		ADMINISTRATION BUILDING	PDC 2D	1	INT/EXT	VIS
1*	CO2-021	FIRE	EXTINGUISHER	CO2		ADMINISTRATION BUILDING	PDC 2D	60	SPECIAL	HYDROTEST
3*	CO2-022	FIRE	EXTINGUISHER	CO2		ENVIRONMENTAL	2ND FLOOR	60	SPECIAL	HYDROTEST
3*	CO2-022	FIRE	EXTINGUISHER	CO2		ENVIRONMENTAL	2ND FLOOR	1	INT/EXT	VIS
3*	CO2-023	FIRE	EXTINGUISHER	CO2		ENVIRONMENTAL	ATERING PLANT - ELECTRICAL SWITCH HO	1	INT/EXT	VIS
3*	CO2-023	FIRE	EXTINGUISHER	CO2		ENVIRONMENTAL	ATERING PLANT - ELECTRICAL SWITCH HO	60	SPECIAL	HYDROTEST
3*	CO2-024	FIRE	EXTINGUISHER	CO2		PLANT 10	CONTROL ROOM	1	INT/EXT	VIS
3*	CO2-024	FIRE	EXTINGUISHER	CO2		PLANT 10	CONTROL ROOM	60	SPECIAL	HYDROTEST
3	CO2-025	FIRE	EXTINGUISHER	CO2		EDWIN COOPER	CONTROL ROOM	1	INT/EXT	VIS
3	CO2-025	FIRE	EXTINGUISHER	CO2		EDWIN COOPER	CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	CO2-026	FIRE	EXTINGUISHER	CO2		PLANT 15	ESSOR ROOM - WEST SIDE OF PLANT - O	60	SPECIAL	HYDROTEST
2*	CO2-026	FIRE	EXTINGUISHER	CO2		PLANT 15	ESSOR ROOM - WEST SIDE OF PLANT - O	1	INT/EXT	VIS
2	CO2-029	FIRE	EXTINGUISHER	CO2		PLANT 12	CONTROL ROOM - INSIDE DOOR	60	SPECIAL	HYDROTEST
2	CO2-029	FIRE	EXTINGUISHER	CO2		PLANT 12	CONTROL ROOM - INSIDE DOOR	1	INT/EXT	VIS
3*	CO2-030	FIRE	EXTINGUISHER	CO2		PLANT 14	PDC-21B	60	SPECIAL	HYDROTEST
3*	CO2-030	FIRE	EXTINGUISHER	CO2		PLANT 14	PDC-21B	1	INT/EXT	VIS
S*	SCO2-030	FIRE	EXTINGUISHER	CO2		PLANT 12	PDC-21B	60	SPECIAL	HYDROTEST
S*	SCO2-030	FIRE	EXTINGUISHER	CO2		PLANT 12	PDC-21B	1	INT/EXT	VIS
4	CO2-031	FIRE	EXTINGUISHER	CO2		PLANT 9	NSU - CONTROL ROOM	1	INT/EXT	VIS
4	CO2-031	FIRE	EXTINGUISHER	CO2		PLANT 9	NSU - CONTROL ROOM	60	SPECIAL	HYDROTEST
3*	CO2-032	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	STOCK ROOM - NORTH WALL	60	SPECIAL	HYDROTEST
3*	CO2-032	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	STOCK ROOM - NORTH WALL	1	INT/EXT	VIS
3*	CO2-033	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	SHOP - NORTH WALL	60	SPECIAL	HYDROTEST
3*	CO2-033	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	SHOP - NORTH WALL	1	INT/EXT	VIS
3*	CO2-035	FIRE	EXTINGUISHER	CO2		PLANT 14	CONTROL ROOM	60	SPECIAL	HYDROTEST
3*	CO2-035	FIRE	EXTINGUISHER	CO2		PLANT 14	CONTROL ROOM	1	INT/EXT	VIS
1	CO2-036	FIRE	EXTINGUISHER	CO2		PT LAB	ROOM 110 - TOXIC LAB	1	INT/EXT	VIS
1	CO2-036	FIRE	EXTINGUISHER	CO2		PT LAB	ROOM 110 - TOXIC LAB	60	SPECIAL	HYDROTEST
1	CO2-037	FIRE	EXTINGUISHER	CO2		PT LAB	WEST SIDE	60	SPECIAL	HYDROTEST
1	CO2-037	FIRE	EXTINGUISHER	CO2		PT LAB	WEST SIDE	1	INT/EXT	VIS
1*	CO2-039	FIRE	EXTINGUISHER	CO2		ADMIN BUILDING - NORTH SIDE	NORTHEAST WING	60	SPECIAL	HYDROTEST
1*	CO2-039	FIRE	EXTINGUISHER	CO2		ADMIN BUILDING - NORTH SIDE	NORTHEAST WING	1	INT/EXT	VIS
1*	CO2-044	FIRE	EXTINGUISHER	CO2		PT LAB	NORTH WING - HALLWAY	1	INT/EXT	VIS
1*	CO2-044	FIRE	EXTINGUISHER	CO2		PT LAB	NORTH WING - HALLWAY	60	SPECIAL	HYDROTEST

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1*	CO2-045	FIRE	EXTINGUISHER	CO2	PT LAB	WEST WING - HALLWAY	60	SPECIAL	HYDROTEST
1*	CO2-051	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 138 - CHEMICAL LAB	1	INT/EXT	VIS
1*	CO2-051	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 138 - CHEMICAL LAB	60	SPECIAL	HYDROTEST
1*	CO2-052	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 138 - CHEMICAL LAB	1	INT/EXT	VIS
1*	CO2-052	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 138 - CHEMICAL LAB	60	SPECIAL	HYDROTEST
1*	CO2-053	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 134 - INSTRUMENT LAB	60	SPECIAL	HYDROTEST
1*	CO2-053	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 134 - INSTRUMENT LAB	1	INT/EXT	VIS
1*	CO2-054	FIRE	EXTINGUISHER	CO2	PT LAB	EAST WING - HALLWAY	60	SPECIAL	HYDROTEST
1*	CO2-054	FIRE	EXTINGUISHER	CO2	PT LAB	EAST WING - HALLWAY	1	INT/EXT	VIS
1*	CO2-055	FIRE	EXTINGUISHER	CO2	PT LAB	EAST WING - HALLWAY	60	SPECIAL	HYDROTEST
1*	CO2-055	FIRE	EXTINGUISHER	CO2	PT LAB	EAST WING - HALLWAY	1	INT/EXT	VIS
4*	CO2-056	FIRE	EXTINGUISHER	CO2	AREA 1 SUBOFFICE	INSIDE BUILDING	1	INT/EXT	VIS
4*	CO2-056	FIRE	EXTINGUISHER	CO2	AREA 1 SUBOFFICE	INSIDE BUILDING	60	SPECIAL	HYDROTEST
1	CO2-057	FIRE	EXTINGUISHER	CO2	ADMIN BUILDING - NORTH SIDE	SOUTH WING	1	INT/EXT	VIS
1	CO2-057	FIRE	EXTINGUISHER	CO2	ADMIN BUILDING - NORTH SIDE	SOUTH WING	60	SPECIAL	HYDROTEST
3*	CO2-058	FIRE	EXTINGUISHER	CO2	A AND 3RD ST	STORAGE	1	INT/EXT	VIS
3*	CO2-058	FIRE	EXTINGUISHER	CO2	PT Lab	Room 126	60	SPECIAL	HYDROTEST
1*	CO2-059	FIRE	EXTINGUISHER	CO2	PT Lab	Room 126	1	INT/EXT	VIS
1*	CO2-059	FIRE	EXTINGUISHER	CO2	A AND 3RD ST	STORAGE	60	SPECIAL	HYDROTEST
1	CO2-060	FIRE	EXTINGUISHER	CO2	T&V SHOP	HVAC SHOP	1	INT/EXT	VIS
1	CO2-060	FIRE	EXTINGUISHER	CO2	T&V SHOP	HVAC SHOP	60	SPECIAL	HYDROTEST
2*	CO2-061	FIRE	EXTINGUISHER	CO2	PLANT 15	DIP PACKAGING ROOM	60	SPECIAL	HYDROTEST
2*	CO2-061	FIRE	EXTINGUISHER	CO2	PLANT 15	DIP PACKAGING ROOM	1	INT/EXT	VIS
2*	CO2-061	FIRE	EXTINGUISHER	CO2	PT LAB	EAST WING - HALLWAY	1	INT/EXT	VIS
2*	CO2-061	FIRE	EXTINGUISHER	CO2	PT LAB	EAST WING - HALLWAY	60	SPECIAL	HYDROTEST
3*	CO2-062	FIRE	EXTINGUISHER	CO2	MAINTENANCE COMPLEX	STORES - RECEIVING OFFICE	1	INT/EXT	VIS
3*	CO2-062	FIRE	EXTINGUISHER	CO2	MAINTENANCE COMPLEX	STORES - RECEIVING OFFICE	60	SPECIAL	HYDROTEST
1*	CO2-064	FIRE	EXTINGUISHER	CO2	PLANT 8 NORTH	NT 8 CONTROL ROOM - OUTSIDE SOUTH V	60	SPECIAL	HYDROTEST
1*	CO2-064	FIRE	EXTINGUISHER	CO2	PLANT 8 NORTH	NT 8 CONTROL ROOM - OUTSIDE SOUTH V	1	INT/EXT	VIS
1*	CO2-065	FIRE	EXTINGUISHER	CO2	PT LAB - OUTSIDE	NORTH SIDE - EMERGENCY GENERATOR	60	SPECIAL	HYDROTEST
1*	CO2-065	FIRE	EXTINGUISHER	CO2	PT LAB - OUTSIDE	NORTH SIDE - EMERGENCY GENERATOR	1	INT/EXT	VIS
1*	CO2-066	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 112 - GENERAL LAB	1	INT/EXT	VIS
1*	CO2-066	FIRE	EXTINGUISHER	CO2	PT LAB	ROOM 112 - GENERAL LAB	60	SPECIAL	HYDROTEST
3*	CO2-068	FIRE	EXTINGUISHER	CO2	GUARD OFFICE	EAST DOOR	1	INT/EXT	VIS
3*	CO2-068	FIRE	EXTINGUISHER	CO2	GUARD OFFICE	EAST DOOR	60	SPECIAL	HYDROTEST
5	CO2-069	FIRE	EXTINGUISHER	CO2	MAINTENANCE COMPLEX	STOCK ROOM - ISSUE WINDOW	1	INT/EXT	VIS
5	CO2-069	FIRE	EXTINGUISHER	CO2	MAINTENANCE COMPLEX	STOCK ROOM - ISSUE WINDOW	60	SPECIAL	HYDROTEST
1*	CO2-070	FIRE	EXTINGUISHER	CO2	ANALYTICAL SERVICES	ALKYL LAB	60	SPECIAL	HYDROTEST
1*	CO2-070	FIRE	EXTINGUISHER	CO2	ANALYTICAL SERVICES	ALKYL LAB	1	INT/EXT	VIS
1*	CO2-071	FIRE	EXTINGUISHER	CO2	ANALYTICAL SERVICES	MECHANICAL ROOM	60	SPECIAL	HYDROTEST
1*	CO2-071	FIRE	EXTINGUISHER	CO2	ANALYTICAL SERVICES	MECHANICAL ROOM	1	INT/EXT	VIS
4	CO2-072	FIRE	EXTINGUISHER	CO2	PLANT 15	FIELD LAB - SOUTH OF PLANT 15	60	SPECIAL	HYDROTEST
4*	CO2-072	FIRE	EXTINGUISHER	CO2	PLANT 15	FIELD LAB - SOUTH OF PLANT 15	1	INT/EXT	VIS
3*	CO2-073	FIRE	EXTINGUISHER	CO2	#4 BOILER	CONTROL ROOM	1	INT/EXT	VIS
3	CO2-073	FIRE	EXTINGUISHER	CO2	#4 BOILER	CONTROL ROOM	60	SPECIAL	HYDROTEST
1*	CO2-074	FIRE	EXTINGUISHER	CO2	PLANT 5 2ND FLOOR	UTH SIDE - MMT CONTROL ROOM - EAST W	60	SPECIAL	HYDROTEST
1*	CO2-074	FIRE	EXTINGUISHER	CO2	PLANT 5 2ND FLOOR	UTH SIDE - MMT CONTROL ROOM - EAST W	1	INT/EXT	VIS
1*	CO2-076	FIRE	EXTINGUISHER	CO2	RIVER ROAD	EFFLUENT HOUSE	60	SPECIAL	HYDROTEST
1*	CO2-076	FIRE	EXTINGUISHER	CO2	RIVER ROAD	EFFLUENT HOUSE	1	INT/EXT	VIS
1*	CO2-077	FIRE	EXTINGUISHER	CO2	PT LAB	PDC 2H	60	SPECIAL	HYDROTEST
1*	CO2-077	FIRE	EXTINGUISHER	CO2	PT LAB	PDC 2H	1	INT/EXT	VIS
2*	CO2-078	FIRE	EXTINGUISHER	CO2	PLANT 15	PDC	1	INT/EXT	VIS
2*	CO2-078	FIRE	EXTINGUISHER	CO2	PLANT 15	PDC	60	SPECIAL	HYDROTEST
5	CO2-079	FIRE	EXTINGUISHER	CO2	MAINTENANCE COMPLEX	2ND FLOOR - E&I OFFICES	1	INT/EXT	VIS
5	CO2-079	FIRE	EXTINGUISHER	CO2	MAINTENANCE COMPLEX	2ND FLOOR - E&I OFFICES	60	SPECIAL	HYDROTEST
1*	CO2-080	FIRE	EXTINGUISHER	CO2	PLANT 5 MMTTANK FARM	C-20-B - NORTH OF CONTROL ROOM - INSI	1	INT/EXT	VIS
1*	CO2-080	FIRE	EXTINGUISHER	CO2	PLANT 5 MMTTANK FARM	C-20-B - NORTH OF CONTROL ROOM - INSI	60	SPECIAL	HYDROTEST
1*	CO2-081	FIRE	EXTINGUISHER	CO2	PLANT8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1*	CO2-081	FIRE	EXTINGUISHER	CO2	PLANT8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
	CO2-082	FIRE	EXTINGUISHER	CO2	PLANT 8 TANK FARM	OLD PLANT 8 COLUMN CONTROL ROOM	1	INT/EXT	VIS
5	CO2-082	FIRE	EXTINGUISHER	CO2	PLANT 8 TANK FARM	OLD PLANT 8 COLUMN CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	CO2-083	FIRE	EXTINGUISHER	CO2	PLANT 15	ENGINE ROOM - 7TH STREET	1	INT/EXT	VIS
2*	CO2-083	FIRE	EXTINGUISHER	CO2	PLANT 15	ENGINE ROOM - 7TH STREET	60	SPECIAL	HYDROTEST
2*	CO2-084	FIRE	EXTINGUISHER	CO2	AMBULANCE SHED	IN CAGE	1	INT/EXT	VIS
2*	CO2-084	FIRE	EXTINGUISHER	CO2	AMBULANCE SHED	IN CAGE	60	SPECIAL	HYDROTEST
2*	CO2-085	FIRE	EXTINGUISHER	CO2	PLANT 9 OSI	NSU CONTROL ROOM	1	INT/EXT	VIS
2*	CO2-085	FIRE	EXTINGUISHER	CO2	PLANT 9 OSI	NSU CONTROL ROOM	60	SPECIAL	HYDROTEST

2"	CO2-085	FIRE	EXTINGUISHER	CO2		PLANT 9 OSI	EAST IO ROOM	1	INT/EXT	VIS
2"	CO2-086	FIRE	EXTINGUISHER	CO2		PLANT 9 OSI	EAST IO ROOM	60	SPECIAL	HYDROTEST
3"	CO2-087	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	STOCK ROOM WINDOW	1	INT/EXT	VIS
3"	CO2-087	FIRE	EXTINGUISHER	CO2		MAINTENANCE COMPLEX	STOCK ROOM WINDOW	60	SPECIAL	HYDROTEST
1"	CO2-89	FIRE	EXTINGUISHER	CO2		CHANGE HOUSE	FITNESS CENTER	1	INT/EXT	HYDROTEST
1"	CO2-89	FIRE	EXTINGUISHER	CO2		CHANGE HOUSE	FITNESS CENTER	60	SPECIAL	VIS
	CO2-90	FIRE	EXTINGUISHER	CO2		3RD & "A" STREET	STORAGE SHED			VIS
	CO2-90	FIRE	EXTINGUISHER	CO2		3RD & "A" STREET	STORAGE SHED			HYDROTEST
	CO2-91	FIRE	EXTINGUISHER	CO2		3RD & "A" STREET	STORAGE SHED			HYDROTEST
	CO2-91	FIRE	EXTINGUISHER	CO2		3RD & "A" STREET	STORAGE SHED			VIS
	CO2-92	FIRE	EXTINGUISHER	CO2		3RD & "A" STREET	STORAGE SHED			VIS
	CO2-92	FIRE	EXTINGUISHER	CO2		3RD & "A" STREET	STORAGE SHED			HYDROTEST
1"	CO2-93	FIRE	EXTINGUISHER	CO2		ANALYTICAL SERVICES	ELECTRICAL PHONE ROOM	1	INT/EXT	VIS
1"	CO2-93	FIRE	EXTINGUISHER	CO2		ANALYTICAL SERVICES	ELECTRICAL PHONE ROOM	60	SPECIAL	HYDROTEST
1"	C02-94	FIRE	EXTINGUISHER	CO2		ANALYTICAL SERVICES	WET LAB N DOOR	1	INT/EXT	VIS
1"	C02-94	FIRE	EXTINGUISHER	CO2		ANALYTICAL SERVICES	WET LAB N DOOR	60	SPECIAL	HYDROTEST
1"	CO2-95	FIRE	EXTINGUISHER	CO2		ANALYTICAL SERVICES	SOUTH END OF HALL	1	INT/EXT	VIS
1"	CO2-95	FIRE	EXTINGUISHER	CO2		ANALYTICAL SERVICES	SOUTH END OF HALL	60	SPECIAL	HYDROTEST
2"	CO2-100	FIRE	EXTINGUISHER	CO2		PLANT 9 OSI	EAST IO ROOM			
2"	CO2-100	FIRE	EXTINGUISHER	CO2		PLANT 9 OSI	EAST IO ROOM			
3"	CO2-118	FIRE	EXTINGUISHER	CO2		AMBULANCE SHED	IN CAGE	1	INT/EXT	VIS
3"	CO2-118	FIRE	EXTINGUISHER	CO2		AMBULANCE SHED	IN CAGE	60	SPECIAL	HYDROTEST
1"	D30-011	FIRE	EXTINGUISHER	METAL X 30#		ANALYTICAL SERVICES	ALKYL LAB SOUTH DOOR	144	SPECIAL	HYDROTEST
1"	D30-011	FIRE	EXTINGUISHER	METAL X 30#		ANALYTICAL SERVICES	ALKYL LAB SOUTH DOOR	12	SPECIAL	FULL
1"	D30-011	FIRE	EXTINGUISHER	METAL X 30#		ANALYTICAL SERVICES	ALKYL LAB SOUTH DOOR	1	INT/EXT	VIS
3"	Scott-45-01	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-02	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-03	Scott	AP-75	SCBA		ERT SHED	Fire Truck	All Cylinders	Hydro 5 years	start 2021
3"	Scott-45-04	Scott	AP-75	SCBA		ERT SHED	Fire Truck	All Packs	Flow Test	Annually
3"	Scott-45-05	Scott	AP-75	SCBA		ERT SHED	Fire Truck	Inspect	Visual	Monthly
3"	Scott-45-06	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-07	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-08	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-09	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-10	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-11	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-12	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-13	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-14	Scott	AP-75	SCBA		ERT SHED	Fire Truck			
3"	Scott-45-15	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-16	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-17	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-18	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-19	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-20	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-21	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-22	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-23	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-24	Scott	AP-75	SCBA		ERT SHED	ERT RESPONSE VAN			
3"	Scott-45-25	Scott	AP-75	SCBA		ERT SHED	Confined Space Trailer			
3"	Scott-45-26	Scott	AP-75	SCBA		ERT SHED	Confined Space Trailer			
3"	Scott-45-27	Scott	AP-75	SCBA		ERT SHED	Confined Space Trailer			
3"	Scott-45-28	Scott	AP-75	SCBA		ERT SHED	Confined Space Trailer			
3"	Scott Cyl-01	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-02	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-03	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-04	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-05	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-06	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-07	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-08	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-09	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-10	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-11	Scott	Cylinder	4500		ERT SHED	Fire Truck			
3"	Scott Cyl-12	Scott	Cylinder	4500		ERT SHED	Fire Truck			

3*	Scott Cyl-14	Scott	Cylinder	4500	ERT SHED	Fire Truck	
3*	Scott Cyl-15	Scott	Cylinder	4500	ERT SHED	Fire Truck	
3*	Scott Cyl-16	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-17	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-18	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-19	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-20	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-21	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-22	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-23	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-24	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-25	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-26	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-27	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-28	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-29	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-30	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-31	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-32	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-33	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-34	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-35	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-36	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-37	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-38	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-39	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-40	Scott	Cylinder	4500	ERT SHED	ERT RESPONSE VAN	
3*	Scott Cyl-41	Scott	Cylinder	4500	ERT SHED	Confined Space Trailer	
3*	Scott Cyl-42	Scott	Cylinder	4500	ERT SHED	Confined Space Trailer	
3*	Scott Cyl-43	Scott	Cylinder	4500	ERT SHED	Confined Space Trailer	
3*	Scott Cyl-44	Scott	Cylinder	4500	ERT SHED	Confined Space Trailer	
3*	Scott Maint 01	Scott	Ap75 I	4500	ERT SHED	Maintenance Packs	
3*	Scott Maint 02	Scott	Ap75 I	4500	ERT SHED	Maintenance Packs	
3*	Scott Maint 03	Scott	Ap75 I	4500	ERT SHED	Maintenance Packs	
3*	Scott Maint 04	Scott	Ap75 I	4500	ERT SHED	Maintenance Packs	
3*	Scott Maint 05	Scott	Ap75 I	4500	ERT SHED	Maintenance Packs	
3*	Scott Maint 06	Scott	Ap75 I	4500	ERT SHED	Maintenance Packs	
1*	Drager	Drager	Cylinder	4500	QC Lab Cart	Alkyl Lab	
1*	Drager	Drager	Cylinder	4500	QC lab Cart	Alkyl Lab	
1*	Drager	Drager	Pro Air	4500	QC Lab	Alkyl Lab	
3*	Drager 30-15	Drager	Air Pack	2200	Pit 14	West wall of Control Room	
3*	Drager30-58	Drager	Air Pack	2200	Pit 14	West wall of Control Room	
2*	Drager30-48	Drager	Air Pack	2200	Pit 9	DR-3 Warehouse west wall	
2*	Drager30-13	Drager	Air Pack	2200	Pit 9	DR-3 Warehouse west wall	
2*	Drager30-12	Drager	Air Pack	2200	Pit 9	DR-3 Warehouse west wall	
2*	Drager 30-08	Drager	Air Pack	2200	Pit 9	DR-3 Warehouse west wall	
2*	Drager30-47	Drager	Air Pack	2200	CO Area	South wall of MMT Generator	
2*	Drager 30-05	Drager	Air Pack	2200	CO Area	South wall of MMT Generator	

1*	ED-001	ESCAPE	DEVICE	CYLINDER	PLANT 5 2ND FLOOR	ITH SIDE - MMT CONTROL ROOM - WEST W	1	INT/EXT	VIS
1*	ED-001	ESCAPE	DEVICE	CYLINDER	PLANT 5 2ND FLOOR	ITH SIDE - MMT CONTROL ROOM - WEST W	60	SPECIAL	HYDROTEST
1*	ED-002	ESCAPE	DEVICE	CYLINDER	PLANT 5 2ND FLOOR	ITH SIDE - MMT CONTROL ROOM - WEST W	1	INT/EXT	VIS
1*	ED-002	ESCAPE	DEVICE	CYLINDER	PLANT 5 2ND FLOOR	ITH SIDE - MMT CONTROL ROOM - WEST W	60	SPECIAL	HYDROTEST
1*	ED-003	ESCAPE	DEVICE	CYLINDER	PLANT 5 2ND FLOOR	ITH SIDE - MMT CONTROL ROOM - WEST W	1	INT/EXT	VIS
1*	ED-003	ESCAPE	DEVICE	CYLINDER	PLANT 5 2ND FLOOR	ITH SIDE - MMT CONTROL ROOM - WEST W	60	SPECIAL	HYDROTEST
2	ED-004	ESCAPE	DEVICE	CYLINDER	AREA 2 SUBOFFICE @ 4TH & "A"	OLD FOREMAN'S OFFICE	1	INT/EXT	VIS
2	ED-004	ESCAPE	DEVICE	CYLINDER	AREA 2 SUBOFFICE @ 4TH & "A"	OLD FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
2	ED-005	ESCAPE	DEVICE	CYLINDER	PLANT 8 1ST FLOOR	AU-3500-3 - NORTH SIDE	1	INT/EXT	VIS
2	ED-005	ESCAPE	DEVICE	CYLINDER	PLANT 8 1ST FLOOR	AU-3500-3 - NORTH SIDE	60	SPECIAL	HYDROTEST
1*	ED-006	ESCAPE	DEVICE	CYLINDER	PLANT 5	701 CONTROL ROOM	1	INT/EXT	VIS
1*	ED-006	ESCAPE	DEVICE	CYLINDER	PLANT 5	701 CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	ED-008	ESCAPE	DEVICE	CYLINDER	PLANT 8	2ND FLOOR - SOUTH PORCH	1	INT/EXT	VIS
2*	ED-008	ESCAPE	DEVICE	CYLINDER	PLANT 8	2ND FLOOR - SOUTH PORCH	60	SPECIAL	HYDROTEST
2*	ED-009	ESCAPE	DEVICE	CYLINDER	PLANT 15	ROXEN STACK UP - 3RD FLOOR - CENTRIF	1	INT/EXT	VIS
2*	ED-009	ESCAPE	DEVICE	CYLINDER	PLANT 15	ROXEN STACK UP - 3RD FLOOR - CENTRIF	60	SPECIAL	HYDROTEST
1*	ED-012	ESCAPE	DEVICE	CYLINDER	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	1	INT/EXT	VIS
1*	ED-012	ESCAPE	DEVICE	CYLINDER	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	60	SPECIAL	HYDROTEST

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	ED-13	ESCAPE	DEVICE		CYLINDER	[illegible]	RELOCATED TO STORAGE	1	INT/EXT	VIS
	ED-13	ESCAPE	DEVICE		CYLINDER	[illegible]	RELOCATED TO STORAGE	60	SPECIAL	HYDROTEST
2"	ED-014	ESCAPE	DEVICE		CYLINDER	PLANT 12	CONTROL ROOM - INSIDE DOOR	1	INT/EXT	VIS
2"	ED-014	ESCAPE	DEVICE		CYLINDER	PLANT 12	CONTROL ROOM - INSIDE DOOR	60	SPECIAL	HYDROTEST
2"	ED-015	ESCAPE	DEVICE		CYLINDER	PLANT 12	SOUTHEAST CORNER @ DOOR TO STAIRS	1	INT/EXT	VIS
2"	ED-015	ESCAPE	DEVICE		CYLINDER	PLANT 12	SOUTHEAST CORNER @ DOOR TO STAIRS	60	SPECIAL	HYDROTEST
1"	ED-016	ESCAPE	DEVICE		CYLINDER	ANALYTICAL SERVICES	SAMPLE INLET AREA	1	INT/EXT	VIS
1"	ED-016	ESCAPE	DEVICE		CYLINDER	ANALYTICAL SERVICES	SAMPLE INLET AREA	60	SPECIAL	HYDROTEST
3"	ED-017	ESCAPE	DEVICE		CYLINDER	PLANT 10	2ND FLOOR - SOUTH WALL	1	INT/EXT	VIS
3"	ED-017	ESCAPE	DEVICE		CYLINDER	PLANT 10	2ND FLOOR - SOUTH WALL	60	SPECIAL	HYDROTEST
3"	ED-018	ESCAPE	DEVICE		CYLINDER	PLANT 10	2ND FLOOR - NORTH WALL	1	INT/EXT	VIS
3"	ED-018	ESCAPE	DEVICE		CYLINDER	PLANT 10	2ND FLOOR - NORTH WALL	60	SPECIAL	HYDROTEST
3	ED-019	ESCAPE	DEVICE		CYLINDER	PLANT 10	2ND FLOOR - NORTHEAST WALL	1	INT/EXT	VIS
3	ED-019	ESCAPE	DEVICE		CYLINDER	PLANT 10	2ND FLOOR - NORTHEAST WALL	60	SPECIAL	HYDROTEST
3"	ED-020	ESCAPE	DEVICE		CYLINDER	PLANT 10	WAREHOUSE - WEST WALL	1	INT/EXT	VIS
3"	ED-020	ESCAPE	DEVICE		CYLINDER	PLANT 10	WAREHOUSE - WEST WALL	60	SPECIAL	HYDROTEST
3"	ED-021	ESCAPE	DEVICE		CYLINDER	PLANT 10	WAREHOUSE - WEST WALL	1	INT/EXT	VIS
3"	ED-021	ESCAPE	DEVICE		CYLINDER	PLANT 10	WAREHOUSE - WEST WALL	60	SPECIAL	HYDROTEST
3"	ED-022	ESCAPE	DEVICE		CYLINDER	PLANT 14	2ND FLOOR	1	INT/EXT	VIS
3"	ED-022	ESCAPE	DEVICE		CYLINDER	PLANT 14	2ND FLOOR	60	SPECIAL	HYDROTEST
3"	ED-023	ESCAPE	DEVICE		CYLINDER	PLANT 14	3RD FLOOR	1	INT/EXT	VIS
3"	ED-023	ESCAPE	DEVICE		CYLINDER	PLANT 14	3RD FLOOR	60	SPECIAL	HYDROTEST
2"	ED-024	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN PLANT - 1ST FLOOR - SOUTH SIDE	1	INT/EXT	VIS
2"	ED-024	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN PLANT - 1ST FLOOR - SOUTH SIDE	60	SPECIAL	HYDROTEST
1"	ED-025	ESCAPE	DEVICE		CYLINDER	ANALYTICAL SERVICES	PHARMACEUTICAL LABORATORY	1	INT/EXT	VIS
1"	ED-025	ESCAPE	DEVICE		CYLINDER	ANALYTICAL SERVICES	PHARMACEUTICAL LABORATORY	60	SPECIAL	HYDROTEST
2"	ED-026	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - NORTHEAST CORNER	1	INT/EXT	VIS
2"	ED-026	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - NORTHEAST CORNER	60	SPECIAL	HYDROTEST
5	ED-027	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN BULK STORAGE - CONTROL ROOM	1	INT/EXT	VIS
5	ED-027	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN BULK STORAGE - CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-028	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - CENTER WALL	1	INT/EXT	VIS
2"	ED-028	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - CENTER WALL	60	SPECIAL	HYDROTEST
2"	ED-029	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - FOREMAN'S OFFICE	1	INT/EXT	VIS
2"	ED-029	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
2"	ED-030	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	2ND FLOOR - FOREMAN'S OFFICE	1	INT/EXT	VIS
2"	ED-030	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	2ND FLOOR - FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
4	ED-031	ESCAPE	DEVICE		CYLINDER	PLANT 9	NSU - CONTROL ROOM	1	INT/EXT	VIS
4	ED-031	ESCAPE	DEVICE		CYLINDER	PLANT 9	NSU - CONTROL ROOM	60	SPECIAL	HYDROTEST
4	ED-032	ESCAPE	DEVICE		CYLINDER	PLANT 9	NSU - CONTROL ROOM	1	INT/EXT	VIS
4	ED-032	ESCAPE	DEVICE		CYLINDER	PLANT 9	NSU - CONTROL ROOM	60	SPECIAL	HYDROTEST
4	ED-033	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - CONTROL ROOM	1	INT/EXT	VIS
4	ED-033	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - CONTROL ROOM	60	SPECIAL	HYDROTEST
4	ED-034	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - CONTROL ROOM	1	INT/EXT	VIS
4	ED-034	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - CONTROL ROOM	60	SPECIAL	HYDROTEST
1"	ED-035	ESCAPE	DEVICE		CYLINDER	PT LAB	EAST WING - HALLWAY	1	INT/EXT	VIS
1"	ED-035	ESCAPE	DEVICE		CYLINDER	PT LAB	EAST WING - HALLWAY	60	SPECIAL	HYDROTEST
3"	ED-036	ESCAPE	DEVICE		CYLINDER	PLANT 14	NORTH SIDE BY 8TH STREET	1	INT/EXT	VIS
3"	ED-036	ESCAPE	DEVICE		CYLINDER	PLANT 14	NORTH SIDE BY 8TH STREET	60	SPECIAL	HYDROTEST
4	ED-037	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT - CONTROL ROOM	1	INT/EXT	VIS
4	ED-037	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT - CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-038	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	1ST FLOOR - NORTH OF SINK	1	INT/EXT	VIS
2"	ED-038	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	1ST FLOOR - NORTH OF SINK	60	SPECIAL	HYDROTEST
2"	ED-039	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - REST ROOM	1	INT/EXT	VIS
2"	ED-039	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - REST ROOM	60	SPECIAL	HYDROTEST
2"	ED-040	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	2ND FLOOR - FOREMAN'S OFFICE	1	INT/EXT	VIS
2"	ED-040	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	2ND FLOOR - FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
4	ED-041	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	2ND FLOOR - FOREMAN'S OFFICE	1	INT/EXT	VIS
4	ED-041	ESCAPE	DEVICE		CYLINDER	PLANT 9 - OLD PLANT	2ND FLOOR - FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
2"	ED-042	ESCAPE	DEVICE		CYLINDER	PLANT 9	3RD FLOOR - WEST PORCH	1	INT/EXT	VIS
2"	ED-042	ESCAPE	DEVICE		CYLINDER	PLANT 9	3RD FLOOR - WEST PORCH	60	SPECIAL	HYDROTEST
2"	ED-043	ESCAPE	DEVICE		CYLINDER	PLANT 9	4TH FLOOR - SOUTH WALL	1	INT/EXT	VIS
2"	ED-043	ESCAPE	DEVICE		CYLINDER	PLANT 9	4TH FLOOR - SOUTH WALL	60	SPECIAL	HYDROTEST
2"	ED-044	ESCAPE	DEVICE		CYLINDER	PLANT 1	EPTD CONTROL ROOM	1	INT/EXT	VIS
2"	ED-044	ESCAPE	DEVICE		CYLINDER	PLANT 1	EPTD CONTROL ROOM	60	SPECIAL	HYDROTEST
3	ED-045	ESCAPE	DEVICE		CYLINDER	PLANT 11	CONTROL ROOM	1	INT/EXT	VIS
3	ED-045	ESCAPE	DEVICE		CYLINDER	PLANT 11	CONTROL ROOM	60	SPECIAL	HYDROTEST

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1"	ED-046	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1"	ED-046	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
1"	ED-047	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1"	ED-047	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
3"	ED-048	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	1	INT/EXT	VIS
3"	ED-048	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	60	SPECIAL	HYDROTEST
3"	ED-049	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	1	INT/EXT	VIS
3"	ED-049	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	60	SPECIAL	HYDROTEST
3"	ED-050	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	1	INT/EXT	VIS
3"	ED-050	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	60	SPECIAL	HYDROTEST
3"	ED-051	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	1	INT/EXT	VIS
3"	ED-051	ESCAPE	DEVICE		CYLINDER	#4 Boiler	Control Room	60	SPECIAL	HYDROTEST
2"	ED-052	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT - CONTROL ROOM	1	INT/EXT	VIS
2"	ED-052	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT - CONTROL ROOM	60	SPECIAL	HYDROTEST
2	ED-053	ESCAPE	DEVICE		CYLINDER	PLANT 12	IORTH WALL - 2ND FLOOR - TOP OF STAIR	1	INT/EXT	VIS
2	ED-053	ESCAPE	DEVICE		CYLINDER	PLANT 12	IORTH WALL - 2ND FLOOR - TOP OF STAIR	60	SPECIAL	HYDROTEST
3"	ED-054	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	1	INT/EXT	VIS
3"	ED-054	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	60	SPECIAL	HYDROTEST
3"	ED-055	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	1	INT/EXT	VIS
3"	ED-055	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	60	SPECIAL	HYDROTEST
3"	ED-056	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	1	INT/EXT	VIS
3"	ED-056	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	60	SPECIAL	HYDROTEST
3"	ED-057	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	1	INT/EXT	VIS
3"	ED-057	ESCAPE	DEVICE		CYLINDER	PLANT 14	CONTROL ROOM	60	SPECIAL	HYDROTEST
4	ED-063	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN WAREHOUSE - EAST SIDE	1	INT/EXT	VIS
4	ED-063	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN WAREHOUSE - EAST SIDE	60	SPECIAL	HYDROTEST
3"	ED-064	ESCAPE	DEVICE		CYLINDER	GUARD OFFICE	NORTH WALL	1	INT/EXT	VIS
3"	ED-064	ESCAPE	DEVICE		CYLINDER	GUARD OFFICE	NORTH WALL	60	SPECIAL	HYDROTEST
3"	ED-065	ESCAPE	DEVICE		CYLINDER	GUARD OFFICE	NORTH WALL	1	INT/EXT	VIS
3"	ED-065	ESCAPE	DEVICE		CYLINDER	GUARD OFFICE	NORTH WALL	60	SPECIAL	HYDROTEST
	ED-066	ESCAPE	DEVICE		CYLINDER	A & 3rd	A & 3rd	1	INT/EXT	VIS
	ED-066	ESCAPE	DEVICE		CYLINDER	A & 3rd	A & 3rd	60	SPECIAL	HYDROTEST
	ED-067	ESCAPE	DEVICE		CYLINDER	A & 3rd	A & 3rd	1	INT/EXT	VIS
	ED-067	ESCAPE	DEVICE		CYLINDER	A & 3rd	A & 3rd	60	SPECIAL	HYDROTEST
	ED-068	ESCAPE	DEVICE		CYLINDER	A & 3rd	A & 3rd	1	INT/EXT	VIS
	ED-068	ESCAPE	DEVICE		CYLINDER	A & 3rd	A & 3rd	60	SPECIAL	HYDROTEST
2	ED-069	ESCAPE	DEVICE		CYLINDER	PLANT 5 2ND FLOOR	ONTROL ROOM - NORTH SIDE - NORTH WA	1	INT/EXT	VIS
2	ED-069	ESCAPE	DEVICE		CYLINDER	PLANT 5 2ND FLOOR	ONTROL ROOM - NORTH SIDE - NORTH WA	60	SPECIAL	HYDROTEST
3	ED-070	ESCAPE	DEVICE		CYLINDER	PLANT 11	CONTROL ROOM	1	INT/EXT	VIS
3	ED-070	ESCAPE	DEVICE		CYLINDER	PLANT 11	CONTROL ROOM	60	SPECIAL	HYDROTEST
5	ED-071	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN BULK STORAGE - CONTROL ROOM	1	INT/EXT	VIS
5	ED-071	ESCAPE	DEVICE		CYLINDER	PLANT 9	HCN BULK STORAGE - CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-074	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	1	INT/EXT	VIS
2"	ED-074	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-075	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	1	INT/EXT	VIS
2"	ED-075	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-076	ESCAPE	DEVICE		CYLINDER	PLANT 9	NSU - 2ND FLOOR	1	INT/EXT	VIS
2"	ED-076	ESCAPE	DEVICE		CYLINDER	PLANT 9	NSU - 2ND FLOOR	60	SPECIAL	HYDROTEST
2"	ED-077	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - OSI	1	INT/EXT	VIS
2"	ED-077	ESCAPE	DEVICE		CYLINDER	PLANT 9	1ST FLOOR - OSI	60	SPECIAL	HYDROTEST
2"	ED-078	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - OSI FOREMAN'S OFFICE	1	INT/EXT	VIS
2"	ED-078	ESCAPE	DEVICE		CYLINDER	PLANT 9	2ND FLOOR - OSI FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
2"	ED-079	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	1	INT/EXT	VIS
2"	ED-079	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-080	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	1	INT/EXT	VIS
2"	ED-080	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-082	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	1	INT/EXT	VIS
2"	ED-082	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	60	SPECIAL	HYDROTEST
2"	ED-082	ESCAPE	DEVICE		CYLINDER	PLANT 9	SOUTHWEST OF MMT GENERATOR	1	INT/EXT	VIS
2"	ED-082	ESCAPE	DEVICE		CYLINDER	PLANT 9	SOUTHWEST OF MMT GENERATOR	60	SPECIAL	HYDROTEST
4	ED-083	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	1	INT/EXT	VIS
4	ED-083	ESCAPE	DEVICE		CYLINDER	PLANT 15	CONTROL ROOM	60	SPECIAL	HYDROTEST
3"	ED-084	ESCAPE	DEVICE		CYLINDER	PLANT 10	CONTROL ROOM SOUTH WALL	1	INT/EXT	VIS
3"	ED-084	ESCAPE	DEVICE		CYLINDER	PLANT 10	CONTROL ROOM SOUTH WALL	60	SPECIAL	HYDROTEST
5	ED-085	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-085	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
	ED-086	ESCAPE	DEVICE		CYLINDER	PLANT 10	CONTROL ROOM NORTH WALL	1	INT/EXT	VIS

3*	ED-086	ESCAPE	DEVICE		CYLINDER	PLANT 10	CONTROL ROOM NORTH WALL	60	SPECIAL	HYDROTEST
5	ED-087	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-087	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
5	ED-088	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-088	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
2*	ED-089	ESCAPE	DEVICE		CYLINDER	OLD PLANT 9	2ND FLR STACK UP	1	INT/EXT	VIS
2*	ED-089	ESCAPE	DEVICE		CYLINDER	OLD PLANT 9	2ND FLR STACK UP	60	SPECIAL	HYDROTEST
5	ED-090	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-090	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
5	ED-091	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-091	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
5	ED-092	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-092	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
5	ED-093	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-093	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
5	ED-094	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	1	INT/EXT	VIS
5	ED-094	ESCAPE	DEVICE		CYLINDER	AMBULANCE BUILDING	BREATHING AIR CABINET	60	SPECIAL	HYDROTEST
2*	ED-095	ESCAPE	DEVICE		CYLINDER	PLANT 9 OSI	NSU CONTROL ROOM	1	INT/EXT	VIS
2*	ED-095	ESCAPE	DEVICE		CYLINDER	PLANT 9 OSI	NSU CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	ED-096	ESCAPE	DEVICE		CYLINDER	PLANT 9 OSI	NSU CONTROL ROOM	1	INT/EXT	VIS
2*	ED-096	ESCAPE	DEVICE		CYLINDER	PLANT 9 OSI	NSU CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	ED-098	ESCAPE	DEVICE		CYLINDER	PLANT 9	DRUM PACKAGING SHED S/W	1	INT/EXT	VIS
2*	ED-098	ESCAPE	DEVICE		CYLINDER	PLANT 9	DRUM PACKAGING SHED S/W	60	SPECIAL	HYDROTEST
2*	ED-099	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT NAPROXEN CONTROL ROOM	1	INT/EXT	VIS
2*	ED-099	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT NAPROXEN CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	ED-100	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT NAPROXEN CONTROL ROOM	1	INT/EXT	VIS
2*	ED-100	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT NAPROXEN CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	ED-101	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT NAPROXEN CONTROL ROOM	1	INT/EXT	VIS
2*	ED-101	ESCAPE	DEVICE		CYLINDER	PLANT 9	OSI PLANT NAPROXEN CONTROL ROOM	60	SPECIAL	HYDROTEST
2*	ED-102	ESCAPE	DEVICE		CYLINDER	PLANT 15	2ND STACK UP	1	INT/EXT	VIS
2*	ED-102	ESCAPE	DEVICE		CYLINDER	PLANT 15	2ND STACK UP	60	SPECIAL	HYDROTEST
1*	ED-105	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1*	ED-105	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
1*	ED-106	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1*	ED-106	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
1*	ED-107	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1*	ED-107	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
1*	ED-108	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	1	INT/EXT	VIS
1*	ED-108	ESCAPE	DEVICE		CYLINDER	PLANT 8 NORTH	PLANT 8 CONTROL ROOM	60	SPECIAL	HYDROTEST
1*	EL-001	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	2ND FLOOR MENS RESTROOM	1	INT/EXT	VIS
1*	EL-002	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	MEN'S RESTROOM, ROOM 108	1	INT/EXT	VIS
1*	EL-003	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	WOMEN'S RESTROOM, ROOM 109	1	INT/EXT	VIS
1*	EL-005	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	2ND FLOOR WOMENS RESTROOM	1	INT/EXT	VIS
3*	EL-007	EMERGENCY	LIGHT			PLANT 9	SOUTH FIREWATER DIESEL	1	INT/EXT	VIS
1	EL-008	EMERGENCY	LIGHT			AREA 3/4 SUBOFFICE	WEST WALL	1	INT/EXT	VIS
1	EL-009	EMERGENCY	LIGHT			AREA 3/4 SUBOFFICE	NORTH WALL IN HALLWAY	1	INT/EXT	VIS
1*	EL-010	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MAIN HALLWAY - ABOVE SOUTH DOOR	1	INT/EXT	VIS
1*	EL-011	EMERGENCY	LIGHT			ANALYTICAL SERVICES	ALKYL LAB - ABOVE DOOR TO MAIN HALL	1	INT/EXT	VIS
1*	EL-012	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MAIN HALLWAY - AT DOORWAY TO ALKYL	1	INT/EXT	VIS
1*	EL-013	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MAIN HALLWAY - NORTH END	1	INT/EXT	VIS
1*	EL-014	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MAIN HALLWAY - CENTER	1	INT/EXT	VIS
1*	EL-015	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MAIN HALLWAY - SOUTH END	1	INT/EXT	VIS
1*	EL-016	EMERGENCY	LIGHT			ANALYTICAL SERVICES	ENVIRONMENTAL LAB - ABOVE DOOR TO	1	INT/EXT	VIS
1*	EL-017	EMERGENCY	LIGHT			ANALYTICAL SERVICES	'SAFER' COMPUTER ROOM	1	INT/EXT	VIS
1*	EL-018	EMERGENCY	LIGHT			ANALYTICAL SERVICES	HALLWAY BESIDE REST ROOMS	1	INT/EXT	VIS
1*	EL-019	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MEN'S REST ROOM	1	INT/EXT	VIS
1*	EL-020	EMERGENCY	LIGHT			ANALYTICAL SERVICES	WOMEN'S REST ROOM	1	INT/EXT	VIS
1*	EL-021	EMERGENCY	LIGHT			ANALYTICAL SERVICES	SPECIAL PROBLEMS LAB - ABOVE DOOR	1	INT/EXT	VIS
1*	EL-022	EMERGENCY	LIGHT			ANALYTICAL SERVICES	SPECIAL INSTRUMENTS LAB - ABOVE DOO	1	INT/EXT	VIS
1*	EL-023	EMERGENCY	LIGHT			ANALYTICAL SERVICES	PHARMACEUTICAL LAB - ABOVE DOOR TO	1	INT/EXT	VIS
1*	EL-024	EMERGENCY	LIGHT			ANALYTICAL SERVICES	VPC INSTRUMENT LAB - ABOVE DOOR TO	1	INT/EXT	VIS
1*	EL-025	EMERGENCY	LIGHT			ANALYTICAL SERVICES	STOCKROOM - ABOVE SOUTH DOOR	1	INT/EXT	VIS
1*	EL-026	EMERGENCY	LIGHT			ANALYTICAL SERVICES	HALLWAY BESIDE REST ROOMS (AT LAB	1	INT/EXT	VIS
1*	EL-027	EMERGENCY	LIGHT			ADMINISTRATION BUILDING	MEN'S REST ROOM BY EXECUTIVE CONFE	1	INT/EXT	VIS
1*	EL-028	EMERGENCY	LIGHT			ADMINISTRATION BUILDING	WOMEN'S REST ROOM BY EXECUTIVE CO	1	INT/EXT	VIS

1*	EL-030	EMERGENCY	LIGHT	PT LAB	MAIN HALLWAY	1	INT/EXT	VIS
1*	EL-031	EMERGENCY	LIGHT	PT LAB	ROOM 112 - SOUTH WALL	1	INT/EXT	VIS
1*	EL-032	EMERGENCY	LIGHT	PT LAB	ROOM 113 - EAST WALL	1	INT/EXT	VIS
1*	EL-033	EMERGENCY	LIGHT	PT LAB	ROOM 115 - WEST WALL	1	INT/EXT	VIS
1*	EL-034	EMERGENCY	LIGHT	PT LAB	ROOM 117 - WEST WALL	1	INT/EXT	VIS
1*	EL-035	EMERGENCY	LIGHT	PT LAB	MEN'S REST ROOM	1	INT/EXT	VIS
1*	EL-036	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	AREA 2 CONTROL ROOM	1	INT/EXT	VIS
1*	EL-037	EMERGENCY	LIGHT	PT LAB	ROOM 143 - WEST WALL	1	INT/EXT	VIS
1*	EL-038	EMERGENCY	LIGHT	PT LAB	ROOM 145 - EAST WALL	1	INT/EXT	VIS
1*	EL-039	EMERGENCY	LIGHT	PT LAB	ROOM 145 - WEST WALL	1	INT/EXT	VIS
1*	EL-040	EMERGENCY	LIGHT	NORTH CONFERENCE ROOM	NORTHEAST DOOR	1	INT/EXT	VIS
1*	EL-041	EMERGENCY	LIGHT	NORTH CONFERENCE ROOM	NORTHWEST DOOR	1	INT/EXT	VIS
1*	EL-042	EMERGENCY	LIGHT	EAST CONFERENCE ROOM	EAST DOOR	1	INT/EXT	VIS
1*	EL-043	EMERGENCY	LIGHT	WEST CONFERENCE ROOM	WEST DOOR	1	INT/EXT	VIS
1*	EL-44	EMERGENCY	LIGHT	PT Lab	Hallway west door	1	INT/EXT	VIS
1*	EL-45	EMERGENCY	LIGHT	PT Lab	Hallway by South Door	1	INT/EXT	VIS
3*	EL-040	EMERGENCY	LIGHT	PLANT 10	CONROL ROOM SOUTH WALL	1	INT/EXT	VIS
3*	EL-047	EMERGENCY	LIGHT	PLANT 14	CONTROL ROOM WEST WALL	1	INT/EXT	VIS
3*	EL-048	EMERGENCY	LIGHT	DEWATERING PLANT	POLYMER ROOM	1	INT/EXT	VIS
3*	EL-049	EMERGENCY	LIGHT	DEWATERING PLANT	2ND FLOOR CONTROL RM	1	INT/EXT	VIS
3*	EL-050	EMERGENCY	LIGHT	DEWATERING PLANT	2ND FLOOR EAST WALL	1	INT/EXT	VIS
3*	EL-051	EMERGENCY	LIGHT	DEWATERING PLANT	2ND FLOOR CONTROL RM	1	INT/EXT	VIS
3*	EL-052	EMERGENCY	LIGHT	DEWATERING PLANT	2ND FLOOR WEST DOOR	1	INT/EXT	VIS
3*	EL-054	EMERGENCY	LIGHT	AMBULANCE BUILDING	BAY AREA - NORTHEAST DOOR	1	INT/EXT	VIS
3*	EL-055	EMERGENCY	LIGHT	AMBULANCE BUILDING	BAY AREA - WEST (ROLL UP) DOOR	1	INT/EXT	VIS
3*	EL-056	EMERGENCY	LIGHT	#4 Boiler	Control Room	1	INT/EXT	VIS
3*	EL-057	EMERGENCY	LIGHT	#4 Boiler	HE-3600-1 House North Wall	1	INT/EXT	VIS
3*	EL-058	EMERGENCY	LIGHT	#4 Boiler	Control Room East Door	1	INT/EXT	VIS
3*	EL-059	EMERGENCY	LIGHT	#4 Boiler	Control Room West Door	1	INT/EXT	VIS
3*	EL-060	EMERGENCY	LIGHT	#4 Boiler	HE-3600-1 locker room	1	INT/EXT	VIS
5	EL-061	EMERGENCY	LIGHT	MAINTENANCE COMPLEX	SHOP - EAST WALL BY BAY DOOR	1	INT/EXT	VIS
3*	EL-079	EMERGENCY	LIGHT	MAINTENANCE COMPLEX	STOCK ROOM - BETWEEN AISLE AK & AJ	1	INT/EXT	VIS
3*	EL-080	EMERGENCY	LIGHT	PLANT 9	PDC-13-B WEST DOOR	1	INT/EXT	VIS
3*	EL-081	EMERGENCY	LIGHT	PLANT 9	PDC-13-B SOUTH DOOR	1	INT/EXT	VIS
3*	EL-082	EMERGENCY	LIGHT	PLANT9	PDC-14-A NORTH WALL	1	INT/EXT	VIS
3*	EL-084	EMERGENCY	LIGHT	PLANT9	PDC-14-A SOUTH WALL	1	INT/EXT	VIS
1*	EL-085	EMERGENCY	LIGHT	CAFETERIA	N Door	1	INT/EXT	VIS
3*	EL-086	EMERGENCY	LIGHT	CAFETERIA	BAY AREA - SOUTHEAST DOOR	1	INT/EXT	VIS
1*	EL-087	EMERGENCY	LIGHT	CAFETERIA	WEST DOOR	1	INT/EXT	VIS
1*	EL-088	EMERGENCY	LIGHT	CAFETERIA	KITCHEN EAST DOOR	1	INT/EXT	VIS
1*	EL-089	EMERGENCY	LIGHT	LADIES CHANGEHOUSE	WEST DOOR	1	INT/EXT	VIS
1*	EL-090	EMERGENCY	LIGHT	CHANGE HOUSE	SOUTH DOOR	1	INT/EXT	VIS
1*	EL-091	EMERGENCY	LIGHT	PT Lab	Room 103 South Door	1	INT/EXT	VIS
1*	EL-092	EMERGENCY	LIGHT	PT Lab	Room 138 south door	1	INT/EXT	VIS
1*	EL -093	EMERGENCY	LIGHT	PT Lab	Room 145	1	INT/EXT	VIS
1*	EL-094	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	East Door	1	INT/EXT	VIS
1*	EL-095	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	SOUTH DOOR	1	INT/EXT	VIS
1*	EL-096	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	SOUTH HALLWAY	1	INT/EXT	VIS
1*	EL-097	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	AREA 1 CONTROL ROOM	1	INT/EXT	VIS
1*	EL-098	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	AREA 1 CONTROL ROOM	1	INT/EXT	VIS
1*	EL-099	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	AREA 3 CONTROL ROOM	1	INT/EXT	VIS
1*	EL-100	EMERGENCY	LIGHT	CONSOLIDATED CONTROL ROOM	AREA 3 CONTROL ROOM	1	INT/EXT	VIS
1*	EL-101	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	PLANT MANAGER'S WING - EAST DOOR	1	INT/EXT	VIS
1*	EL-102	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	PLANT MANAGER'S WING @ EXECUTIVE C	1	INT/EXT	VIS
1*	EL-103	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	SHIPPING OFFICE WING - EAST DOOR	1	INT/EXT	VIS
1*	EL-104	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	SHIPPING OFFICE WING @ ADMIN CONFEI	1	INT/EXT	VIS
1*	EL-105	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	MAIN LOBBY	1	INT/EXT	VIS
1*	EL-106	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	SQERA WING - ABOVE MGR, SQERA OFFI(	1	INT/EXT	VIS
1*	EL-107	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	SQERA WING - EAST DOOR	1	INT/EXT	VIS
1*	EL-108	EMERGENCY	LIGHT	ADMINISTRATION BUILDING	PT WING - EAST DOOR	1	INT/EXT	VIS
1*	EL-109	EMERGENCY	LIGHT	ADMIN SERVICES BUILDING	1ST FLOOR - NORTH END	1	INT/EXT	VIS
1*	EL-110	EMERGENCY	LIGHT	ADMIN SERVICES BUILDING	1ST FLOOR - SOUTH END	1	INT/EXT	VIS
1*	EL-111	EMERGENCY	LIGHT	ADMIN SERVICES BUILDING	1ST FLOOR - EAST SIDE AT STAIRWELL	1	INT/EXT	VIS
1*	EL-112	EMERGENCY	LIGHT	ADMIN SERVICES BUILDING	1ST FLOOR - WEST ENTRANCE AT LOBBY	1	INT/EXT	VIS
1*	EL-113	EMERGENCY	LIGHT	ADMIN SERVICES BUILDING	1ST FLOOR - HALLWAY INTERSECTION AT	1	INT/EXT	VIS
1*	EL-114	EMERGENCY	LIGHT	ADMIN SERVICES BUILDING	2ND FLOOR - HALLWAY INTERSECTION	1	INT/EXT	VIS

1"	EL-115	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	2ND FLOOR - SOUTH END	1	INT/EXT	VIS
1"	EL-116	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	2ND FLOOR - WEST WING	1	INT/EXT	VIS
1"	EL-117	EMERGENCY	LIGHT			ADMIN SERVICES BUILDING	PLT MNGWING BY BREAK ROOM	1	INT/EXT	VIS
1"	EL-118	EMERGENCY	LIGHT			MENS CHANGEHOUSE	CENTER DOOR WAY	1	INT/EXT	VIS
1"	EL-119	EMERGENCY	LIGHT			MENS CHANGEHOUSE	CENTER DOOR WAY	1	INT/EXT	VIS
1"	EL-120	EMERGENCY	LIGHT			ANALYTICAL SERVICES	MAIN HALLWAY WEST DOOR SAFER	1	INT/EXT	VIS
1"	EL-121	EMERGENCY	LIGHT			PT Lab	Center hallway	1	INT/EXT	VIS
1"	EL-122	EMERGENCY	LIGHT			PT Lab	Restroom	1	INT/EXT	VIS
1"	EL-123	EMERGENCY	LIGHT			PT Lab	Main hallway East Door	1	INT/EXT	VIS
1"	EL-124	EMERGENCY	LIGHT			PT Lab	Hall way by break room	1	INT/EXT	VIS
1"	EL-125	EMERGENCY	LIGHT			PT Lab	Room 143	1	INT/EXT	VIS
1"	EL-126	EMERGENCY	LIGHT			PT Lab	Room 134 west wall	1	INT/EXT	VIS
1"	EL-127	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	AREA 2 CONTROL ROOM	1	INT/EXT	VIS
3"	EL-128	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	TOOL ROOM EAST DOOR	1	INT/EXT	VIS
3"	EL-129	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	TOOL ROOM WEST DOOR	1	INT/EXT	VIS
3"	EL-134	EMERGENCY	LIGHT			PLANT 9	PDC-13A WEST WALL	1	INT/EXT	VIS
3"	EL-135	EMERGENCY	LIGHT			PLANT 9	PDC-13-A NORTHWALL	1	INT/EXT	VIS
3"	EL-136	EMERGENCY	LIGHT			PLANT 9	PDC 13 A SOUTH WALLL	1	INT/EXT	VIS
1"	EL-185	EMERGENCY	LIGHT			CAFETERIA	NORTH DOOR	1	INT/EXT	VIS
1"	EL-186	EMERGENCY	LIGHT			CAFETERIA	SOUTH DOOR	1	INT/EXT	VIS
1"	EL-200	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	SOUTH HALLWAY	1	INT/EXT	VIS
1"	EL-201	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	NORTH HALLWAY	1	INT/EXT	VIS
1"	EL-202	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	NORTH HALLWAY	1	INT/EXT	VIS
1"	EL-203	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	FREEZER	1	INT/EXT	VIS
1"	EL-204	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	BREAKROOM N EXIT	1	INT/EXT	VIS
1"	EL-205	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	BREAKROOM S EXIT	1	INT/EXT	VIS
1"	EL-206	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	MENS RESTROOM	1	INT/EXT	VIS
1"	EL-207	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	EAST EXIT DOOR	1	INT/EXT	VIS
1"	EL-208	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	NORTH DOOR FORMANS OFFICE	1	INT/EXT	VIS
1"	EL-209	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	WEST EXIT FORMANS OFFICE	1	INT/EXT	VIS
1"	EL-210	EMERGENCY	LIGHT			CONSOLIDATED CONTROL ROOM	WOMENS RESTROOM	1	INT/EXT	VIS
1"	EL-211	EMERGENCY	LIGHT			ANALYTICAL SERVICES	ALKYL LAB DOOR TO MAIN HALL	1	INT/EXT	VIS
3"	EL-216	EMERGENCY	LIGHT			DR3 WAREHOUSE #2	WEST WALL	1	INT/EXT	VIS
3"	EL217	EMERGENCY	LIGHT			DR3 WAREHOUSE#2	EAST WALL	1	INT/EXT	VIS
3"	EL218	EMERGENCY	LIGHT			DR3 WAREHOUSE#3	WEST WALL	1	INT/EXT	VIS
3"	EL-219	EMERGENCY	LIGHT			DR3 WAREHOUSE#3	EAST WALL	1	INT/EXT	VIS
3"	EL-220	EMERGENCY	LIGHT			TRAINING BUILDING	HALLWAY- SOUTH DOOR	1	INT/EXT	VIS
3"	EL-221	EMERGENCY	LIGHT			TRAINING BUILDING	HALLWAY NORTH DOOR	1	INT/EXT	VIS
3"	EL-222	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	LOCKER ROOM - NORTH DOOR	1	INT/EXT	VIS
3"	EL-223	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	LLWAY BETWEEN LOCKER ROOM & OFFIC	1	INT/EXT	VIS
3"	EL-224	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	CUBICLE AREA NORTH DOOR	1	INT/EXT	VIS
3"	EL-225	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	NORTH ENTRANCE DOOR	1	INT/EXT	VIS
3"	EL-226	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	MAIN ENTRANCE - NORTH DOOR	1	INT/EXT	VIS
3"	EL-227	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	OFFICES WEST WALL	1	INT/EXT	VIS
3"	EL-228	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	OFFICES MENS RESTROOM	1	INT/EXT	VIS
3"	EL-229	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	BREAKROOM EAST WALL	1	INT/EXT	VIS
3"	EL-230	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	BREAKROOM EAST WALL	1	INT/EXT	VIS
3"	EL-231	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	SHOP- BY BAY DOOR	1	INT/EXT	VIS
3"	EL-232	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	SHOP- EAST EXIT	1	INT/EXT	VIS
3"	EL-233	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	SHOP-SOUTHWALL	1	INT/EXT	VIS
3"	EL-234	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	VALVE SHOP - SOUTH WALL	1	INT/EXT	VIS
3"	EL-235	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	NORTH EXIT FROM SHOP	1	INT/EXT	VIS
3"	EL-236	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	2ND FLOOR CONFERENCE	1	INT/EXT	VIS
3"	EL-237	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	2ND FLOOR CONFERENCE	1	INT/EXT	VIS
3"	EL-238	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	LADIES RESTROOM	1	INT/EXT	VIS
3"	EL-239	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	STOCKROOM MEZZANINE	1	INT/EXT	VIS
3"	EL-240	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	STOCKROOM DOOR TO OFFICES	1	INT/EXT	VIS
3"	EL-241	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	STOCKROOM SOUTHWEST DOOR	1	INT/EXT	VIS
3"	EL-242	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	STOCKROOM NORTH DOOR	1	INT/EXT	VIS
3"	EL-243	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	E&I SHOP SOUTHWALL	1	INT/EXT	VIS
3"	EL-244	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	2ND FLOOR WEST DOUBLE DOOR	1	INT/EXT	VIS
3"	EL-245	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	OFFICES SOUTH DOOR	1	INT/EXT	VIS
3"	EL-246	EMERGENCY	LIGHT			MAINTENANCE COMPLEX	OFFICES SOUTHWALL	1	INT/EXT	VIS
3"	EL-247	EMERGENCY	LIGHT			AMBULANCE BUILDING	HALLWAY- EAST DOOR	1	INT/EXT	VIS
3"	EL-248	EMERGENCY	LIGHT			AMBULANCE BUILDING	HALLWAY - WEST DOOR	1	INT/EXT	VIS

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1"	FB-001	FIRE	BLANKET		PLANT 7	CYLINDER LOAD AREA - SOUTH END	1	INT/EXT	VIS
1"	FB-003	FIRE	BLANKET		PT LAB	SOUTHWEST HALLWAY	1	INT/EXT	VIS
1"	FB-007	FIRE	BLANKET		PT LAB	NORTH WING - HALLWAY	1	INT/EXT	VIS
1"	FB-008	FIRE	BLANKET		PT LAB	SOUTH WING	1	INT/EXT	VIS
1"	FB-009	FIRE	BLANKET		PT LAB	EAST WING - HALLWAY	1	INT/EXT	VIS
1"	FB-010	FIRE	BLANKET		PT LAB	ROOM 143	1	INT/EXT	VIS
1"	FB-011	FIRE	BLANKET		PT LAB	ROOM 145	1	INT/EXT	VIS
1"	FB-012	FIRE	BLANKET		PT LAB	ROOM 134 - BREEZEWAY	1	INT/EXT	VIS
1"	FB-018	FIRE	BLANKET		PLANT 7	CYLINDER LOAD AREA W OF WALL	1	INT/EXT	VIS
1"	FB-019	FIRE	BLANKET		PLANT 7	CYLINDER AREA	1	INT/EXT	VIS
1"	FB-020	FIRE	BLANKET		ANALYTICAL SER	ALKYL LAB WEST WALL	1	INT/EXT	VIS
1"	FB-021	FIRE	BLANKET		ANALYTICAL SERVICES	WET LAB	1	INT/EXT	VIS
1"	FB-027	FIRE	BLANKET		CAFETERIA	KITCHEN	1	INT/EXT	VIS
5	FB-028	FIRE	BLANKET		PLANT 9	HCN BULK STORAGE - CONTROL ROOM	1	INT/EXT	VIS
2"	FE36-001	FIRE	EXTINGUISHER	CLEAN AGENT	Plant 12	PDC 21B	60	SPECIAL	HYDROTEST
2"	FE36-001	FIRE	EXTINGUISHER	CLEAN AGENT	Plant 12	PDC-21B	1	INT/EXT	VIS
1"	FE36-005	FIRE	EXTINGUISHER	CLEAN AGENT	ADMIN BUILDING	DOOR TO LOBBY	60	SPECIAL	HYDROTEST
1"	FE36-005	FIRE	EXTINGUISHER	CLEAN AGENT	ADMIN BUILDING	DOOR TO LOBBY	1	INT/EXT	VIS
2"	FE36-006	FIRE	EXTINGUISHER	CLEAN AGENT	Old plant 9 2nd floor	foremans office	60	SPECIAL	HYDROTEST
2"	FE36-006	FIRE	EXTINGUISHER	CLEAN AGENT	Old plant 9 2nd floor	foremans office	1	INT/EXT	VIS
1"	FE-36-007	FIRE	EXTINGUISHER	CLEAN AGENT	Plant 5	701 Control room	60	SPECIAL	HYDROTEST
1"	FE-36-007	FIRE	EXTINGUISHER	CLEAN AGENT	Plant 5	701 Control room	1	INT/EXT	VIS
3"	FE36-008	FIRE	EXTINGUISHER	CLEAN AGENT	MAINTENANCE COMPLEX	&C SHOP - SOUTHEAST CORNER - OUTSIL	60	SPECIAL	HYDROTEST
3"	FE36-008	FIRE	EXTINGUISHER	CLEAN AGENT	MAINTENANCE COMPLEX	&C SHOP - SOUTHEAST CORNER - OUTSID	1	INT/EXT	VIS
2"	FE36-016	FIRE	EXTINGUISHER	CLEAN AGENT	SHIPPING WAREHOUSE	MEZZINE	1	INT/EXT	VIS
1"	FH-001	FIRE	HYDRANT		CHANGE HOUSE	SOUTHWEST CORNER	1	INT/EXT	VIS
1"	FH-002	FIRE	HYDRANT		CHANGE HOUSE	SOUTH SIDE	1	INT/EXT	VIS
1"	FH-003	FIRE	HYDRANT		3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	FH-004	FIRE	HYDRANT		PLANT 8 CONTROL ROOM - NORTH SID	CYLINDER LOAD STATION	1	INT/EXT	VIS
1"	FH-005	FIRE	HYDRANT		AREA 2	2ND & "A" STREET DIKE @ T-100M-4	1	INT/EXT	VIS
1"	FH-006	FIRE	HYDRANT		TRAFFIC - LIQUID PACKAGING	WEST OF PLANT 7 @ RESTROOM	1	INT/EXT	VIS
2"	FH-007	FIRE	HYDRANT		RAW MATERIAL WAREHOUSE	5TH & "B" STREETS	1	INT/EXT	VIS
2"	FH-008	FIRE	HYDRANT		PLANT 9	DR-3 WAREHOUSE - NORTH END	1	INT/EXT	VIS
2"	FH-009	FIRE	HYDRANT		PLANT 15	WEST SIDE	1	INT/EXT	VIS
3	FH-010	FIRE	HYDRANT		PLANT 10	"D" & 6TH STREETS	1	INT/EXT	VIS
3"	FH-011	FIRE	HYDRANT		MAINTENANCE COMPLEX	NORTH SIDE @ 10TH STREET	1	INT/EXT	VIS
1	FH-012	FIRE	HYDRANT		RIVER ROAD	FIRE TRAINING GROUNDS	1	INT/EXT	VIS
3"	FH-013	FIRE	HYDRANT		PLANT 11	"D" & 9TH STREETS	1	INT/EXT	VIS
3"	FH-014	FIRE	HYDRANT		PLANT 9 SOUTH SIDE	"A" & 9TH STREETS	1	INT/EXT	VIS
1"	FH-015	FIRE	HYDRANT		PLANT 7	Entrance to Plt 7	1	INT/EXT	VIS
2"	FHB-001	FOAM	HOSE	BOX	PLANT 15	WEST SIDE	12	SPECIAL	HYDROTEST
2"	FHB-001	FOAM	HOSE	BOX	PLANT 15	WEST SIDE	1	INT/EXT	VIS
2"	FHB-002	FOAM	HOSE	BOX	PLANT 15	SOUTH SIDE	1	INT/EXT	VIS
2"	FHB-002	FOAM	HOSE	BOX	PLANT 15	SOUTH SIDE	12	SPECIAL	HYDROTEST
1"	HALON-001	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	HALLWAY AT PDC	60	SPECIAL	HYDROTEST
1"	HALON-001	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	HALLWAY AT PDC	1	INT/EXT	VIS
3"	HALON-002	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	E&I SHOP SOUTHWALL	60	SPECIAL	HYDROTEST
3"	HALON-002	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	E&I SHOP SOUTHWALL	1	INT/EXT	VIS
3"	HALON-005	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	COPIER MODULE IN OFFICE	60	SPECIAL	HYDROTEST
3"	HALON-005	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	COPIER MODULE IN OFFICE	1	INT/EXT	VIS
3"	HALON-006	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	SHOP - OUTSIDE SOUTH DOOR	1	INT/EXT	VIS
3"	HALON-008	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	SHOP - OUTSIDE SOUTH DOOR	60	SPECIAL	HYDROTEST
1	HALON-009	FIRE	EXTINGUISHER	HALON	PT LAB - OUTSIDE	BUG HOUSE - INSIDE	1	INT/EXT	VIS
1	HALON-009	FIRE	EXTINGUISHER	HALON	PT LAB - OUTSIDE	BUG HOUSE - INSIDE	144	SPECIAL	HYDROTEST
1	HALON-010	FIRE	EXTINGUISHER	HALON	PT LAB - OUTSIDE	BUG HOUSE - INSIDE	1	INT/EXT	VIS
1	HALON-010	FIRE	EXTINGUISHER	HALON	PT LAB - OUTSIDE	BUG HOUSE - INSIDE	144	SPECIAL	HYDROTEST
1"	HALON-011	FIRE	EXTINGUISHER	HALON	ANALYTICAL SERVICES - OUTSIDE	EAST SIDE - FIRE BOX	144	SPECIAL	HYDROTEST
1"	HALON-011	FIRE	EXTINGUISHER	HALON	ANALYTICAL SERVICES - OUTSIDE	EAST SIDE - FIRE BOX	1	INT/EXT	VIS
1"	HALON-012	FIRE	EXTINGUISHER	HALON	ADMIN BUILDING - SOUTH SIDE	By Executive Conference rm	1	INT/EXT	VIS
1"	HALON-012	FIRE	EXTINGUISHER	HALON	ADMIN BUILDING - SOUTH SIDE	By Executive Conference rm	144	SPECIAL	HYDROTEST
1	HALON-013	FIRE	EXTINGUISHER	HALON	PT LAB	ROOM 134 - INSTRUMENT LAB	1	INT/EXT	VIS
1	HALON-013	FIRE	EXTINGUISHER	HALON	PT LAB	ROOM 134 - INSTRUMENT LAB	144	SPECIAL	HYDROTEST

1	HALON-015	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES - OUTSIDE	EAST SIDE - FIRE BOX	1	INT/EXT	VIS
1	HALON-015	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES - OUTSIDE	EAST SIDE - FIRE BOX	144	SPECIAL	HYDROTEST
1	HALON-016	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES - OUTSIDE	EAST SIDE - FIRE BOX	144	SPECIAL	HYDROTEST
1	HALON-016	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES - OUTSIDE	EAST SIDE - FIRE BOX	1	INT/EXT	VIS
1*	HALON-017	FIRE	EXTINGUISHER	HALON		E&I NORTH SHOP	INSIDE SOUTH WALL	144	SPECIAL	HYDROTEST
1*	HALON-017	FIRE	EXTINGUISHER	HALON		E&I NORTH SHOP	INSIDE SOUTH WALL	1	INT/EXT	VIS
3*	HALON-018	FIRE	EXTINGUISHER	HALON		MAINTENANCE COMPLEX	2ND FLOOR E&I OFFICE	144	SPECIAL	HYDROTEST
3*	HALON-018	FIRE	EXTINGUISHER	HALON		MAINTENANCE COMPLEX	2ND FLOOR E&I OFFICE	1	INT/EXT	VIS
1*	HALON-019	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	COMPUTER ROOM	144	SPECIAL	HYDROTEST
1*	HALON-019	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	COMPUTER ROOM	1	INT/EXT	VIS
1	HALON-020	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	FLAMMABLE STORAGE ROOM	144	SPECIAL	HYDROTEST
1	HALON-020	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	FLAMMABLE STORAGE ROOM	1	INT/EXT	VIS
1	HALON-021	FIRE	EXTINGUISHER	HALON		PT LAB	ROOM 104 - SOUTHWEST WING	144	SPECIAL	HYDROTEST
1	HALON-021	FIRE	EXTINGUISHER	HALON		PT LAB	ROOM 104 - SOUTHWEST WING	1	INT/EXT	VIS
1*	HALON-022	FIRE	EXTINGUISHER	HALON		PT LAB	SOUTH WING	144	SPECIAL	HYDROTEST
1*	HALON-022	FIRE	EXTINGUISHER	HALON		PT LAB	SOUTH WING	1	INT/EXT	VIS
1*	HALON-023	FIRE	EXTINGUISHER	HALON		PLANT 5 2ND FLOOR	ROL ROOM - NORTH SIDE - NORTHEAST CO	144	SPECIAL	HYDROTEST
1*	HALON-023	FIRE	EXTINGUISHER	HALON		PLANT 5 2ND FLOOR	ROL ROOM - NORTH SIDE - NORTHEAST CO	1	INT/EXT	VIS
5	HALON-027	FIRE	EXTINGUISHER	HALON		SHAW CONSTRUCTORS COMPOUND	TRAILER #1	60	SPECIAL	HYDROTEST
5	HALON-027	FIRE	EXTINGUISHER	HALON		SHAW CONSTRUCTORS COMPOUND	TRAILER #1	1	INT/EXT	VIS
1	HALON-029	FIRE	EXTINGUISHER	HALON		3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
1	HALON-029	FIRE	EXTINGUISHER	HALON		3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
3*	HALON-030	FIRE	EXTINGUISHER	HALON		MAINTENANCE COMPLEX	2ND FLOOR E&I OFFICE	144	SPECIAL	HYDROTEST
3*	HALON-030	FIRE	EXTINGUISHER	HALON		MAINTENANCE COMPLEX	2ND FLOOR E&I OFFICE	1	INT/EXT	VIS
1*	HALON-031	FIRE	EXTINGUISHER	HALON		AREA 2 SUBOFFICE @ 4TH & "A"	HALLWAY	144	SPECIAL	HYDROTEST
1*	HALON-031	FIRE	EXTINGUISHER	HALON		AREA 2 SUBOFFICE @ 4TH & "A"	HALLWAY	1	INT/EXT	VIS
2*	HALON-033	FIRE	EXTINGUISHER	HALON		PLANT 9	LANT - CONTROL ROOM - NORTHEAST CO	60	SPECIAL	HYDROTEST
2*	HALON-033	FIRE	EXTINGUISHER	HALON		PLANT 9	LANT - CONTROL ROOM - NORTHEAST CO	1	INT/EXT	VIS
1	HALON-035	FIRE	EXTINGUISHER	HALON		3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1	HALON-035	FIRE	EXTINGUISHER	HALON		3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
3*	HALON-036	FIRE	EXTINGUISHER	HALON		TRAINING BUILDING	HALLWAY SOUTH END	1	INT/EXT	VIS
3*	HALON-036	FIRE	EXTINGUISHER	HALON		TRAINING BUILDING	HALLWAY SOUTH END	144	SPECIAL	HYDROTEST
1*	HALON-037	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	ENVIRONMENTAL LAB	1	INT/EXT	VIS
1*	HALON-037	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	ENVIRONMENTAL LAB	144	SPECIAL	HYDROTEST
1	HALON-039	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	ELECTRICAL/PHONE ROOM	1	INT/EXT	VIS
1	HALON-039	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	ELECTRICAL/PHONE ROOM	144	SPECIAL	HYDROTEST
1*	HALON-040	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SPECIAL PROBLEMS LAB	1	INT/EXT	VIS
1*	HALON-040	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SPECIAL PROBLEMS LAB	144	SPECIAL	HYDROTEST
1*	HALON-041	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SPECIAL INSTRUMENTS LAB	144	SPECIAL	HYDROTEST
1*	HALON-041	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SPECIAL INSTRUMENTS LAB	1	INT/EXT	VIS
1*	HALON-042	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	PHARMACEUTICAL LAB	144	SPECIAL	HYDROTEST
1*	HALON-042	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	PHARMACEUTICAL LAB	1	INT/EXT	VIS
1*	HALON-043	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	VPC LAB	1	INT/EXT	VIS
1*	HALON-043	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	VPC LAB	144	SPECIAL	HYDROTEST
1*	HALON-044	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SAMPLE INLET AREA	144	SPECIAL	HYDROTEST
1*	HALON-044	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SAMPLE INLET AREA	1	INT/EXT	VIS
1	HALON-045	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SOUTH END - HALLWAY	1	INT/EXT	VIS
1	HALON-045	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	SOUTH END - HALLWAY	144	SPECIAL	HYDROTEST
1*	HALON-046	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	NORTH WING	144	SPECIAL	HYDROTEST
1*	HALON-046	FIRE	EXTINGUISHER	HALON		ANALYTICAL SERVICES	NORTH WING	1	INT/EXT	VIS
2*	HALON-047	FIRE	EXTINGUISHER	HALON		AREA 3	SUBOFFICE - HALLWAY	144	SPECIAL	HYDROTEST
2*	HALON-047	FIRE	EXTINGUISHER	HALON		AREA 3	SUBOFFICE - HALLWAY	1	INT/EXT	VIS
2	HALON-048	FIRE	EXTINGUISHER	HALON		PLANT 5	701 CONTROL ROOM	1	INT/EXT	VIS
2	HALON-048	FIRE	EXTINGUISHER	HALON		PLANT 5	701 CONTROL ROOM	144	SPECIAL	HYDROTEST
1*	HALON-049	FIRE	EXTINGUISHER	HALON		PLANT 8 NORTH	PLANT 8 CONTROL ROOM - NORTH SIDE	60	SPECIAL	HYDROTEST
1*	HALON-049	FIRE	EXTINGUISHER	HALON		PLANT 8 NORTH	PLANT 8 CONTROL ROOM - NORTH SIDE	1	INT/EXT	VIS
3*	HALON-050	FIRE	EXTINGUISHER	HALON		TRAINING BUILDING	HALLWAY	60	SPECIAL	HYDROTEST
3*	HALON-050	FIRE	EXTINGUISHER	HALON		TRAINING BUILDING	HALLWAY	1	INT/EXT	VIS
1*	HALON-051	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	1ST FLOOR - H2O FOUNTAIN	144	SPECIAL	HYDROTEST
1*	HALON-051	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	1ST FLOOR - H2O FOUNTAIN	1	INT/EXT	VIS
1*	HALON-052	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	1ST FLOOR - WEST WING	144	SPECIAL	HYDROTEST
1*	HALON-052	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	1ST FLOOR - WEST WING	1	INT/EXT	VIS
1*	HALON-053	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	1ST FLOOT - SOUTH WING	144	SPECIAL	HYDROTEST
1*	HALON-053	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	1ST FLOOT - SOUTH WING	1	INT/EXT	VIS
1*	HALON-054	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	2ND FLOOR - H2O FOUNTAIN	144	SPECIAL	HYDROTEST
1*	HALON-054	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING	2ND FLOOR - H2O FOUNTAIN	1	INT/EXT	VIS
1*	HALON-055	FIRE	EXTINGUISHER	HALON		ADMIN SERVICES BUILDING				

1"	HALON-055	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	2ND FLOOR - SOUTH WING	1	INT/EXT	VIS
1"	HALON-057	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	1ST FLOOR - ROOM 145	144	SPECIAL	HYDROTEST
1"	HALON-057	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	1ST FLOOR - ROOM 145	1	INT/EXT	VIS
1"	HALON-058	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	2ND FLOOR - ROOM 201	1	INT/EXT	VIS
1"	HALON-058	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	2ND FLOOR - ROOM 201	144	SPECIAL	HYDROTEST
1"	HALON-059	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	2ND FLOOR WEST WING ROOM 223	1	INT/EXT	VIS
1"	HALON-059	FIRE	EXTINGUISHER	HALON	ADMIN SERVICES BUILDING	2ND FLOOR WEST WING ROOM 223	144	SPECIAL	HYDROTEST
1	HALON-062	FIRE	EXTINGUISHER	HALON	ANALYTICAL SERVICES	WET LAB	144	SPECIAL	HYDROTEST
1	HALON-062	FIRE	EXTINGUISHER	HALON	ANALYTICAL SERVICES	WET LAB	1	INT/EXT	VIS
1"	HALON-063	FIRE	EXTINGUISHER	HALON	PT lab	Room 145	1	INT/EXT	VIS
1"	HALON-063	FIRE	EXTINGUISHER	HALON	PT lab	Room 145	144	SPECIAL	HYDROTEST
1"	HALON-064	FIRE	EXTINGUISHER	HALON	PT lab	Room 134	1	INT/EXT	VIS
1"	HALON-064	FIRE	EXTINGUISHER	HALON	PT lab	Room 134	144	SPECIAL	HYDROTEST
1	HALON-065	FIRE	EXTINGUISHER	HALON	PT lab		1	INT/EXT	VIS
1	HALON-065	FIRE	EXTINGUISHER	HALON	PT lab		144	SPECIAL	HYDROTEST
4"	HALON-066	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	1	INT/EXT	VIS
4"	HALON-066	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	144	SPECIAL	HYDROTEST
1"	HALON-067	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	AREA 1 CONTROL ROOM	1	INT/EXT	VIS
1"	HALON-067	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	AREA 1 CONTROL ROOM	144	SPECIAL	HYDROTEST
1"	HALON-068	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	AREA 3 CONTROL ROOM	1	INT/EXT	VIS
1"	HALON-068	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	AREA 3 CONTROL ROOM	144	SPECIAL	HYDROTEST
1"	HALON-069	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	AREA 2 CONTROL ROOM	1	INT/EXT	VIS
1"	HALON-069	FIRE	EXTINGUISHER	HALON	CONSOLIDATED CONTROL ROOM	AREA 2 CONTROL ROOM	144	SPECIAL	HYDROTEST
1	HALON-070	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	1	INT/EXT	VIS
1	HALON-070	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	144	SPECIAL	HYDROTEST
1	HALON-071	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	1	INT/EXT	VIS
1	HALON-071	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	144	SPECIAL	HYDROTEST
4"	HALON-072	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	1	INT/EXT	VIS
4"	HALON-072	FIRE	EXTINGUISHER	HALON	PT lab	NORTH SIDE	144	SPECIAL	HYDROTEST
5	HALON-30	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	2ND FLOOR - E&I OFFICES	1	INT/EXT	VIS
5	HALON-30	FIRE	EXTINGUISHER	HALON	MAINTENANCE COMPLEX	2ND FLOOR - E&I OFFICES	60	SPECIAL	HYDROTEST
1"	HB-001	HOSE	BOX	1 1/2"	TRAFFIC - LIQUID PACKAGING	WEST OF PLANT 7	12	SPECIAL	HYDROTEST
1"	HB-001	HOSE	BOX	1 1/2"	TRAFFIC - LIQUID PACKAGING	WEST OF PLANT 7	1	INT/EXT	VIS
1"	HB-002	HOSE	BOX	1 1/2"	2ND &"B" STREET	BUILDING 18 - NORTH SIDE	1	INT/EXT	VIS
1"	HB-002	HOSE	BOX	1 1/2"	2ND &"B" STREET	BUILDING 18 - NORTH SIDE	12	SPECIAL	HYDROTEST
1"	HB-003	HOSE	BOX	1 1/2"	PLANT 8 CONTROL ROOM - NORTH SID	CYLINDER LOAD STATION	12	SPECIAL	HYDROTEST
1"	HB-003	HOSE	BOX	1 1/2"	PLANT 8 CONTROL ROOM - NORTH SID	CYLINDER LOAD STATION	1	INT/EXT	VIS
1"	HB-004	HOSE	BOX	1 1/2"	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	HB-004	HOSE	BOX	1 1/2"	3RD & "A" STREET	STORAGE SHED	12	SPECIAL	HYDROTEST
1"	HB-005	HOSE	BOX	1 1/2"	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM EAST OF SUBOFFICE	12	SPECIAL	HYDROTEST
1"	HB-005	HOSE	BOX	1 1/2"	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM EAST OF SUBOFFICE	1	INT/EXT	VIS
1"	HB-006	HOSE	BOX	1 1/2"	PLANT 5 MMT TANK FARM	4TH STREET	12	SPECIAL	HYDROTEST
1"	HB-006	HOSE	BOX	1 1/2"	PLANT 5 MMT TANK FARM	4TH STREET	1	INT/EXT	VIS
1"	HB-007	HOSE	BOX	1 1/2"	MAALOX AREA	D STREET @ TRAILER LOADING SPOT	1	INT/EXT	VIS
1"	HB-007	HOSE	BOX	1 1/2"	MAALOX AREA	D STREET @ TRAILER LOADING SPOT	12	SPECIAL	HYDROTEST
2"	HB-008	HOSE	BOX	1 1/2"	CHEMICAL WAREHOUSE	5TH STREET BESIDE LOADING RAMP	12	SPECIAL	HYDROTEST
2"	HB-008	HOSE	BOX	1 1/2"	CHEMICAL WAREHOUSE	5TH STREET BESIDE LOADING RAMP	1	INT/EXT	VIS
2"	HB-009	HOSE	BOX	1 1/2"	RAW MATERIAL WAREHOUSE	5TH & "B" STREETS	1	INT/EXT	VIS
2"	HB-009	HOSE	BOX	1 1/2"	RAW MATERIAL WAREHOUSE	5TH & "B" STREETS	12	SPECIAL	HYDROTEST
4	HB-010	HOSE	BOX	1 1/2"	PLANT 1	EAST SIDE	12	SPECIAL	HYDROTEST
4	HB-010	HOSE	BOX	1 1/2"	PLANT 1	EAST SIDE	1	INT/EXT	VIS
2"	HB-011	HOSE	BOX	1 1/2"	PLANT 15	SOUTH SIDE	12	SPECIAL	HYDROTEST
2"	HB-011	HOSE	BOX	1 1/2"	PLANT 15	SOUTH SIDE	1	INT/EXT	VIS
3"	HB-012	HOSE	BOX	1 1/2"	PLANT 9	SOUTHEAST CORNER - ACROSS 8TH STREE	12	SPECIAL	HYDROTEST
3"	HB-012	HOSE	BOX	1 1/2"	PLANT 9	SOUTHEAST CORNER - ACROSS 8TH STREE	1	INT/EXT	VIS
3"	HB-013	HOSE	BOX	1 1/2"	PLANT 10	WEST SIDE	12	SPECIAL	HYDROTEST
3"	HB-013	HOSE	BOX	1 1/2"	PLANT 10	WEST SIDE	1	INT/EXT	VIS
3"	HB-014	HOSE	BOX	1 1/2"	PLANT 14	SOUTH SIDE	1	INT/EXT	VIS
3"	HB-014	HOSE	BOX	1 1/2"	PLANT 14	SOUTH SIDE	12	SPECIAL	HYDROTEST
1"	HB-016	HOSE	BOX	1 1/2"	BUTENE TANK FARM	WEST SIDE	1	INT/EXT	VIS
1"	HB-016	HOSE	BOX	1 1/2"	BUTENE TANK FARM	WEST SIDE	1	INT/EXT	HYDROTEST
1"	HB-017	HOSE	BOX	1 1/2"	AREA 2	SOUTH SMOKE SHED	1	INT/EXT	VIS
1"	HB-017	HOSE	BOX	1 1/2"	AREA 2	SOUTH SMOKE SHED	12	SPECIAL	HYDROTEST
1"	HB-018	HOSE	BOX	1 1/2"	AREA 2	3RD STREET WEST OF RR	1	INT/EXT	VIS

1"	HB-016	HOSE	BOX	1 1/2"		AREA 2	3RD STREET WEST OF RR	12	SPECIAL	HYDROTEST
1"	HRACK-001	HOSE	RACK			PT LAB	NORTH WING - HALLWAY	1	INT/EXT	VIS
1"	HRACK-001	HOSE	RACK			PT LAB	NORTH WING - HALLWAY	12	SPECIAL	HYDROTEST
1"	HRACK-002	HOSE	RACK			PT LAB	WEST WING - HALLWAY	1	INT/EXT	VIS
1"	HRACK-002	HOSE	RACK			PT LAB	WEST WING - HALLWAY	12	SPECIAL	HYDROTEST
3"	HRACK-003	HOSE	RACK			MAINTENANCE COMPLEX	STOCK ROOM - NORTH DOOR	1	INT/EXT	VIS
3"	HRACK-003	HOSE	RACK			MAINTENANCE COMPLEX	STOCK ROOM - NORTH DOOR	12	SPECIAL	HYDROTEST
3"	HRACK-004	HOSE	RACK			MAINTENANCE COMPLEX	STOCK ROOM - WEST SIDE	12	SPECIAL	HYDROTEST
3"	HRACK-004	HOSE	RACK			MAINTENANCE COMPLEX	STOCK ROOM - WEST SIDE	1	INT/EXT	VIS
3"	HRACK-005	HOSE	RACK			MAINTENANCE COMPLEX	STOCK ROOM - CENTER	1	INT/EXT	VIS
3"	HRACK-005	HOSE	RACK			MAINTENANCE COMPLEX	STOCK ROOM - CENTER	12	SPECIAL	HYDROTEST
1"	HRACK-006	HOSE	RACK			ANALYTICAL SERVICES	NORTH WING	1	INT/EXT	VIS
1"	HRACK-006	HOSE	RACK			ANALYTICAL SERVICES	NORTH WING	12	SPECIAL	HYDROTEST
1"	HRACK-007	HOSE	RACK			ANALYTICAL SERVICES	SOUTH END - HALLWAY	1	INT/EXT	VIS
1"	HRACK-007	HOSE	RACK			ANALYTICAL SERVICES	SOUTH END - HALLWAY	12	SPECIAL	HYDROTEST
2	LIFEPAC-001					PLANT 5 WEST	CORNER 5TH & "B" STREET			VIS
2	LIFEPAC-002					PLANT 4	PDC SOUTH OF PLANT - EAST WALL	1	INT/EXT	VIS
1	M150-001	FIRE	EXTINGUISHER	METAL-X	30 LB	PLT 7	CYL FILL AREA	1	INT/EXT	VIS
1	M150-001	FIRE	EXTINGUISHER	METAL-X	30 LB	PLT 7	CYL FILL AREA	144	SPECIAL	HYROTEST
1	M30-001	FIRE	EXTINGUISHER	METAL-X	30 LB	TRAFFIC - LIQUID PACKAGING	SODIUM WAREHOUSE - SOUTH SIDE	144	SPECIAL	HYROTEST
1	M30-001	FIRE	EXTINGUISHER	METAL-X	30 LB	TRAFFIC - LIQUID PACKAGING	SODIUM WAREHOUSE - SOUTH SIDE	1	INT/EXT	VIS
1"	M30-002	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 4	CONTROL ROOM - 2ND FLOOR - NORTH EN	1	INT/EXT	VIS
1"	M30-002	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 4	CONTROL ROOM - 2ND FLOOR - NORTH EN	144	SPECIAL	HYDROTEST
1	M30-004	FIRE	EXTINGUISHER	METAL-X	30 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
1	M30-004	FIRE	EXTINGUISHER	METAL-X	30 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
2	M30-004	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 4	TOP LEVEL OF V1	144	SPECIAL	HYDROTEST
2	M30-004	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 4	TOP LEVEL OF V1	1	INT/EXT	VIS
1"	M30-006	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 1ST FLOOR	UNDER PLANT @ SCALES/CONVEYOR	144	SPECIAL	HYDROTEST
1"	M30-006	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 1ST FLOOR	UNDER PLANT @ SCALES/CONVEYOR	1	INT/EXT	VIS
1"	M30-007	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	144	SPECIAL	HYDROTEST
1"	M30-007	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	1	INT/EXT	VIS
1	M30-008	FIRE	EXTINGUISHER	METAL-X	30 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1	M30-008	FIRE	EXTINGUISHER	METAL-X	30 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYROTEST
1"	M30-009	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - WEST WALL @ DOOR	1	INT/EXT	VIS
1"	M30-009	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - WEST WALL @ DOOR	144	SPECIAL	HYROTEST
1"	M30-010	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 3RD FLOOR	SOUTH SIDE - EAST WALL	144	SPECIAL	HYROTEST
1"	M30-010	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 3RD FLOOR	SOUTH SIDE - EAST WALL	1	INT/EXT	VIS
1"	M30-011	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 4	SODIUM SHED, WEST PLATFORM	144	SPECIAL	HYROTEST
1"	M30-011	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 4	SODIUM SHED, WEST PLATFORM	1	INT/EXT	VIS
1"	M30-012	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - R7 PLATFORM	144	SPECIAL	HYROTEST
1"	M30-012	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 5 2ND FLOOR	SOUTH SIDE - R7 PLATFORM	1	INT/EXT	VIS
1	M30-013	FIRE	EXTINGUISHER	METAL-X	30 LB	LANT 8 CONTROL ROOM - NORTH SID	CYLINDER LOAD STATION	144	SPECIAL	HYDROTEST
1	M30-013	FIRE	EXTINGUISHER	METAL-X	30 LB	LANT 8 CONTROL ROOM - NORTH SID	CYLINDER LOAD STATION	1	INT/EXT	VIS
1"	M30-014	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 8 2ND FLOOR	AU-7M-1 - EAST SIDE	144	SPECIAL	HYROTEST
1"	M30-014	FIRE	EXTINGUISHER	METAL-X	30 LB	PLANT 8 2ND FLOOR	AU-7M-1 - EAST SIDE	1	INT/EXT	VIS
1"	M30-015	FIRE	EXTINGUISHER	METAL-X	30 LB	ANALYTICAL SERVICES	ALKYL LAB	144	SPECIAL	HYROTEST
1"	M30-015	FIRE	EXTINGUISHER	METAL-X	30 LB	ANALYTICAL SERVICES	ALKYL LAB	1	INT/EXT	VIS
1	M30-016	FIRE	EXTINGUISHER	METAL-X	30 LB	3RD & "A" STREET	STORAGE SHED	144	SPECIAL	HYDROTEST
1	M30-016	FIRE	EXTINGUISHER	METAL-X	30 LB	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1	M30-018	FIRE	EXTINGUISHER	METAL-X	30 LB	PT LAB - OUTSIDE	NORTH SIDE	144	SPECIAL	HYROTEST
1	M30-018	FIRE	EXTINGUISHER	METAL-X	30 LB	PT LAB - OUTSIDE	NORTH SIDE	1	INT/EXT	VIS
1	M30-019	FIRE	EXTINGUISHER	METAL-X	30 LB	PT LAB	ROOM 145	144	SPECIAL	HYDROTEST
1	M30-019	FIRE	EXTINGUISHER	METAL-X	30 LB	PT LAB	ROOM 145	1	INT/EXT	VIS
1"	M30-020	FIRE	EXTINGUISHER	METAL-X	30 LB	PT LAB	NORTH WING - HALLWAY	1	INT/EXT	VIS
1"	M30-020	FIRE	EXTINGUISHER	METAL-X	30 LB	PT LAB	NORTH WING - HALLWAY	144	SPECIAL	HYROTEST
1"	M30-022	FIRE	EXTINGUISHER	METAL-X	30 LB	SODIUM THAW HOUSE	PLANT 4	144	SPECIAL	HYROTEST
1"	M30-022	FIRE	EXTINGUISHER	METAL-X	30 LB	SODIUM THAW HOUSE	PLANT 4	1	INT/EXT	VIS
1"	M30-023	FIRE	EXTINGUISHER	METAL-X	30 LB	IDENIX	PLANT 15	144	SPECIAL	HYROTEST
1"	M30-023	FIRE	EXTINGUISHER	METAL-X	30 LB	IDENIX	PLANT 15	1	INT/EXT	VIS
1"	M30-024	FIRE	EXTINGUISHER	METAL-X	30 LB	IDENIX	PLANT 15	144	SPECIAL	HYROTEST
1"	M30-024	FIRE	EXTINGUISHER	METAL-X	30 LB	IDENIX	PLANT 15	1	INT/EXT	VIS
1"	NDL 2145	AIR	BOTTLE	DRAGER	10 MINUTE	AMBULANCE BUILDING	BREATHING AIR CABINET			HYDROTEST

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1"	P300-001	FIRE	EXTINGUISHER	ANSUL	300 LB	PLANT 9	7TH STREET	144	SPECIAL	HYDROTEST
1"	P300-001	FIRE	EXTINGUISHER	ANSUL	300 LB	PLANT 9	7TH STREET	1	INT/EXT	VIS
1"	P30-001	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 4	CONTROL ROOM - 2ND FLOOR -NORTH ENI	144	SPECIAL	HYROTEST
1"	P30-001	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 4	CONTROL ROOM - 2ND FLOOR -NORTH ENI	1	INT/EXT	VIS
2"	P30-002	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	2ND FLOOR - WEST SIDE - WEST WALL	1	INT/EXT	VIS
2"	P30-002	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	2ND FLOOR - WEST SIDE - WEST WALL	144	SPECIAL	HYDROTEST
2"	P30-003	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	1ST FLOOR - NORTH SIDE - OUTSIDE	1	INT/EXT	VIS
2"	P30-003	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	1ST FLOOR - NORTH SIDE - OUTSIDE	144	SPECIAL	HYDROTEST
2"	P30-004	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	1ST FLOOR - SOUTH WALL	144	SPECIAL	HYDROTEST
2"	P30-004	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	1ST FLOOR - SOUTH WALL	1	INT/EXT	VIS
1"	P30-005	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	1ST FLOOR - SOUTH WALL	144	SPECIAL	HYDROTEST
1"	P30-005	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	1ST FLOOR - SOUTH WALL	1	INT/EXT	VIS
2"	P30-006	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 1	STORAGE SHED	1	INT/EXT	VIS
2"	P30-006	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 1	EPTD CELL - 3RD FLOOR	144	SPECIAL	HYDROTEST
2"	P30-007	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 1	EPTD CELL - 2ND FLOOR	144	SPECIAL	HYDROTEST
2"	P30-007	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 1	EPTD CELL - 2ND FLOOR	1	INT/EXT	VIS
1"	P30-008	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 8	PLANT 8	1	INT/EXT	VIS
1"	P30-008	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 8	PLANT 8	144	SPECIAL	HYDROTEST
2"	P30-009	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	3RD FLOOR - NORTHWEST CORNER	144	SPECIAL	HYDROTEST
2"	P30-009	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 15	3RD FLOOR - NORTHWEST CORNER	1	INT/EXT	VIS
1"	P30-010	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 4	CONTROL ROOM - SOUTH END	144	SPECIAL	HYDROTEST
1"	P30-010	FIRE	EXTINGUISHER	PURPLE K	30 LB	PLANT 4	CONTROL ROOM - SOUTH END	1	INT/EXT	VIS
3"	PD-01	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-02	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-03	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-04	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-05	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-06	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-07	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-08	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-09	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-10	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-11	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-12	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-13	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-14	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-15	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-16	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-17	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-18	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-19	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
3"	PD-20	PASS DEVICE				ERT VAN	EMT SHED	1	INT/EXT	VIS
1"	PDU-001	DRAGER	PORTABLE	UNIT		ANALYTICAL SERVICES	ALKYL LAB	60	SPECIAL	HYDROTEST
1"	PDU-001	DRAGER	PORTABLE	UNIT		ANALYTICAL SERVICES	ALKYL LAB	1	INT/EXT	VIS
1"	PIV-001	POST	VALVE	INDICATOR		PT LAB - OUTSIDE	NORTHEAST CORNER	1	INT/EXT	VIS
1"	PIV-002	POST	VALVE	INDICATOR		PT LAB - OUTSIDE	NORTHEAST CORNER	1	INT/EXT	VIS
1"	PIV-003	POST	VALVE	INDICATOR		PT LAB - OUTSIDE	NORTHEAST CORNER	1	INT/EXT	VIS
1"	PIV-004	POST	INDICATOR	VALVE		PLANT 8 NORTH	SPRINKLER HOUSE 2 - NORTH SIDE	1	INT/EXT	VIS
1"	PIV-005	POST	INDICATOR	VALVE		PLANT 4	SOUTH SIDE OF PLANT @ 4TH STREET	1	INT/EXT	VIS
1"	PIV-006	POST	INDICATOR	VALVE		ISOBUTYLENE TANK FARM	SPRINKLER HOUSE 3 - SOUTHWEST SIDE	1	INT/EXT	VIS
1"	PIV-007	POST	VALVE	INDICATOR		PLANT 7	CYLINDER RESTORATION AREA	1	INT/EXT	VIS
1"	PIV-008	POST	VALVE	INDICATOR		AREA 2	DROP ZONE D ON 2ND ST	1	INT/EXT	VIS
1"	PIV-009	POST	INDICATOR	VALVE		RIVER ROAD	NORTH END - CLARIFIER #1	1	INT/EXT	VIS
1"	PIV-010	POST	INDICATOR	VALVE		RIVER ROAD	NORTH SIDE - COOLING TOWER #4	1	INT/EXT	VIS
1"	PIV-011	POST	INDICATOR	VALVE		PLANT 5 WEST	SPRINKLER HOUSE 4 - WEST SIDE	1	INT/EXT	VIS
1"	PIV-012	POST	INDICATOR	VALVE		CHEMICAL WAREHOUSE	5TH STREET UNDER LIGHT POLE	1	INT/EXT	VIS
2"	PIV-013	POST	INDICATOR	VALVE		CHEMICAL WAREHOUSE	5TH STREET BESIDE LOADING RAMP	1	INT/EXT	VIS
2"	PIV-014	POST	INDICATOR	VALVE		PLANT 15	NORTH SIDE	1	INT/EXT	VIS
2"	PIV-015	POST	INDICATOR	VALVE		PLANT 9	1ST FLOOR - SPRINKLER HOUSE 19	1	INT/EXT	VIS
3"	PIV-016	POST	VALVE	INDICATOR		PLANT 9	EAST OF EMERGENCY GENERATOR	1	INT/EXT	VIS
3"	PIV-017	POST	VALVE	INDICATOR		PLANT 9	EAST OF EMERGENCY GENERATOR	1	INT/EXT	VIS
3"	PIV-018	POST	VALVE	INDICATOR		PLANT 9	EAST OF EMERGENCY GENERATOR	1	INT/EXT	VIS
2"	PIV-019	POST	INDICATOR	VALVE		PLANT 9	1ST FLOOR - NORTH SIDE @ R113	1	INT/EXT	VIS
2"	PIV-020	POST	INDICATOR	VALVE		PLANT 9	1ST FLOOR - NORTH SIDE @ R113	1	INT/EXT	VIS

1"	PIV-02[illegible]	POST	INDICATOR	VALVE	RIVER ROAD	NORTH SIDE @ D STREET	1	INT/EXT	VIS
1"	PIV-023	POST	INDICATOR	VALVE	PLANT 4	SOUTH SIDE OF PLANT @ 4TH STREET	1	INT/EXT	VIS
1"	PIV-024	POST	INDICATOR	VALVE	ISOBUTYLENE TANK FARM	SPRINKLER HOUSE 3 - EAST SIDE	1	INT/EXT	VIS
3"	PIV-025	POST	INDICATOR	VALVE	PLANT 11	SOUTHWEST - SPRNKVH-022	1	INT/EXT	VIS
3"	PIV-026	POST	INDICATOR	VALVE	PLANT 11	EAST SIDE - T-1135	1	INT/EXT	VIS
3"	PIV-027	POST	INDICATOR	VALVE	PLANT 14	NORTH SIDE - T-15M-44	1	INT/EXT	VIS
3"	PIV-028	POST	INDICATOR	VALVE	PLANT 9	SOUTH SIDE - D-446	1	INT/EXT	VIS
1"	PIV-029	POST	INDICATOR	VALVE	PLANT 10	WEST SIDE	1	INT/EXT	VIS
1"	PIV-030	POST	INDICATOR	VALVE	PLANT 10	NORTHEAST - AREA 3 CLEANING PAD	1	INT/EXT	VIS
3"	PIV-031	POST	INDICATOR	VALVE	#4 BOILER	NORTHEAST - HE-3800-1	1	INT/EXT	VIS
3"	PIV-032	POST	INDICATOR	VALVE	PLANT 14	EAST SIDE OF K-4M-19	1	INT/EXT	VIS
3"	PIV-033	POST	VALVE	INDICATOR	PLANT 9	EAST OF EMERGENCY GENERATOR	1	INT/EXT	VIS
3"	PIV-034	POST	INDICATOR	VALVE	PLANT 10	WEST SIDE - SPRNKVH-014	1	INT/EXT	VIS
3"	PIV-035	POST	INDICATOR	VALVE	#4 BOILER	NORTH SIDE - HE-3800-1 ON 10TH STREET	1	INT/EXT	VIS
3"	PIV-036	POST	INDICATOR	VALVE	PLANT 11	NORTHEAST - SPRNKVH-023	1	INT/EXT	VIS
3"	PIV-037	POST	INDICATOR	VALVE	PLANT 11	NORTH SIDE - COOLING TOWER #15	1	INT/EXT	VIS
1"	PIV-038	POST	VALVE	INDICATOR	NORTH E&I SHOP	SOUTHWEST SIDE	1	INT/EXT	VIS
3"	PIV-039	POST	INDICATOR	VALVE	PLANT 11	"D" & 8TH STREETS	1	INT/EXT	VIS
3"	PIV-040	POST	INDICATOR	VALVE	PLANT 11	NORTHEAST - COOLING TOWER #12	1	INT/EXT	VIS
3"	PIV-041	POST	INDICATOR	VALVE	PLANT 11	WEST SIDE - SPRNKVH-022 [DI](S)]	1	INT/EXT	VIS
3"	PIV-042	POST	INDICATOR	VALVE	PLANT 11	"D" & 8TH STREETS	1	INT/EXT	VIS
3"	PIV-043	POST	INDICATOR	VALVE	PLANT 14	SOUTH SIDE - SPRINKLER HOUSE	1	INT/EXT	VIS
3"	PIV-044	POST	INDICATOR	VALVE	PLANT 9	NORTH SIDE ON 9TH STREET	1	INT/EXT	VIS
3	PIV-045	POST	INDICATOR	VALVE	PLANT 9	9TH STREET - SOUTH SIDE	1	INT/EXT	VIS
3"	PIV-046	POST	INDICATOR	VALVE	PLANT 11	SOUTH SIDE - T-1197	1	INT/EXT	VIS
3"	PIV-047	POST	INDICATOR	VALVE	PLANT 11	NORTHEAST - SPRNKVH-023	1	INT/EXT	VIS
3"	PIV-048	POST	INDICATOR	VALVE	PLANT 11	SOUTHWEST CORNER	1	INT/EXT	VIS
3"	PIV-049	POST	INDICATOR	VALVE	PLANT 11	C-1172 - EAST SIDE	1	INT/EXT	VIS
3"	PIV-050	POST	INDICATOR	VALVE	PLANT 11	EAST OF PLANT - SOUTH OF T-1197	1	INT/EXT	VIS
3"	PIV-051	POST	INDICATOR	VALVE	PLANT 11	NORTHEAST SIDE - SPRNKVH-023	1	INT/EXT	VIS
2"	PIV-052	POST	INDICATOR	VALVE	PLANT 15	NORTH SIDE	1	INT/EXT	VIS
2"	PIV-053	POST	INDICATOR	VALVE	PLANT 15	NORTH SIDE	1	INT/EXT	VIS
3"	PIV-054	POST	INDICATOR	VALVE	PLANT 11	NORTH SIDE	1	INT/EXT	VIS
1"	PIV-055	POST	INDICATOR	VALVE	RIVER ROAD	NORTH SIDE - COOLING TOWER #4	1	INT/EXT	VIS
3"	PIV-056	POST	INDICATOR	VALVE	PLANT 11	SOUTH SIDE -C-1172	1	INT/EXT	VIS
1"	PIV-057	POST	INDICATOR	VALVE	PLANT 5 WEST	SPRINKLER HOUSE 25 - NORTH SIDE	1	INT/EXT	VIS
1"	PIV-058	POST	INDICATOR	VALVE	PLANT 5 WEST	SPRINKLER HOUSE 25 - NORTH SIDE	1	INT/EXT	VIS
2"	PIV-059	POST	INDICATOR	VALVE	PLANT 1	1T FLOOR - SOUTH OF SPRINKLER HOUSE	1	INT/EXT	VIS
3"	PIV-060	POST	INDICATOR	VALVE	PLANT 11	NORTH SIDE - COOLING TOWER #12	1	INT/EXT	VIS
3"	PIV-061	POST	INDICATOR	VALVE	PLANT 9	NORTH SIDE - HCN BULK AREA	1	INT/EXT	VIS
2"	PIV-062	POST	INDICATOR	VALVE	PLANT 9	B" & 8TH STREETS	1	INT/EXT	VIS
2"	PIV-063	POST	INDICATOR	VALVE	6th street at drum pad	south west	1	INT/EXT	VIS
3"	PIV-66	POST	INDICATOR	VALVE	PLANT 14	NORTH SIDE BY 8th STREET	1	INT/EXT	VIS
3"	PIV-67	POST	INDICATOR	VALVE	PLANT 11	CORNER OF D & 9th STREET	1	INT/EXT	VIS
3"	PIV-68	POST	INDICATOR	VALVE	PLANT 9	CORNER OF A & 9th STREET	1	INT/EXT	VIS
3"	PIV-69	POST	INDICATOR	VALVE	PLANT 9	EAST SIDE D STR-NORTH PT>11	1	INT/EXT	VIS
1"	PIV-70	POST	INDICATOR	VALVE	PLANT 7	North side of SVH -3	1	INT/EXT	VIS
1"	PIV-71	POST	INDICATOR	VALVE	PLANT 7	NW of cleaning shed	1	INT/EXT	VIS
1"	PIV-72	POST	INDICATOR	VALVE	PLANT 7	East of Cylinder fill	1	INT/EXT	VIS
1"	PTN-001	PORTABLE	TURRET	NOZZLE	PLANT 7	BEHIND WALL	1	INT/EXT	VIS
1"	PTN-002	PORTABLE	TURRET	NOZZLE	PLANT 4	4TH STREET SHED - PORTABLE	1	INT/EXT	VIS
1"	PTN-003	PORTABLE	TURRET	NOZZLE	AMBULANCE BUILDING	BEHIND BUILDING	1	INT/EXT	VIS
1"	SPW-002	FIRE	EXTINGUISHER	PRESS. WATER	A & 3 RD	A & 3 RD	60	SPECIAL	HYDROTEST
1"	SPW-002	FIRE	EXTINGUISHER	PRESS. WATER	A & 3 RD	A & 3 RD	1	INT/EXT	VIS
1"	SPW-003	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	NORTH BREAK ROOM	1	INT/EXT	VIS
1"	SPW-003	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	NORTH BREAK ROOM	60	SPECIAL	HYDROTEST
1"	PW-004	FIRE	EXTINGUISHER	PRESS. WATER	CAFETERIA	ATLAS BREAK AREA	1	INT/EXT	VIS
1"	PW-004	FIRE	EXTINGUISHER	PRESS. WATER	CAFETERIA	ATLAS BREAK AREA	60	SPECIAL	HYDROTEST
1"	PW-005	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - SOUTH SIDE	SOUTHEAST WING	1	INT/EXT	VIS
1"	PW-005	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - SOUTH SIDE	SOUTHEAST WING	60	SPECIAL	HYDROTEST
1"	SPW-006	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-006	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS

1"	PW-007	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - SOUTH SIDE	SOUTHWEST WING	1	INT/EXT	VIS
1"	PW-007	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - SOUTH SIDE	SOUTHWEST WING	60	SPECIAL	HYDROTEST
1"	PW-008	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - SOUTH SIDE	SOUTHEAST WING	60	SPECIAL	HYDROTEST
1"	PW-008	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - SOUTH SIDE	SOUTHEAST WING	1	INT/EXT	VIS
1"	SPW-009	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-009	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	SPW-011	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-011	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
3"	PW-012	FIRE	EXTINGUISHER	PRESS. WATER	PLANT 9	HCN WAREHOUSE	60	SPECIAL	HYDROTEST
3"	PW-012	FIRE	EXTINGUISHER	PRESS. WATER	PLANT 9	HCN WAREHOUSE	1	INT/EXT	VIS
1"	PW-013	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - NORTH SIDE	NORTH WING	60	SPECIAL	HYDROTEST
1"	PW-013	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - NORTH SIDE	NORTH WING	1	INT/EXT	VIS
1"	PW-014	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - NORTH SIDE	SOUTHEAST WING	60	SPECIAL	HYDROTEST
1"	PW-014	FIRE	EXTINGUISHER	PRESS. WATER	ADMIN BUILDING - NORTH SIDE	SOUTHEAST WING	1	INT/EXT	VIS
1"	PW-015	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	LADIES ROOM	60	SPECIAL	HYDROTEST
1"	PW-015	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	LADIES ROOM	1	INT/EXT	VIS
1"	PW-016	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	SOUTHWEST CORNER	1	INT/EXT	VIS
1"	PW-016	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	SOUTHWEST CORNER	60	SPECIAL	HYDROTEST
1"	PW-017	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	CENTER	1	INT/EXT	VIS
1"	PW-017	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	CENTER	60	SPECIAL	HYDROTEST
1"	PW-018	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	NORTH OF CENTER	60	SPECIAL	HYDROTEST
1"	PW-018	FIRE	EXTINGUISHER	PRESS. WATER	CHANGE HOUSE	NORTH OF CENTER	1	INT/EXT	VIS
1"	PW-019	FIRE	EXTINGUISHER	PRESS. WATER	CONFERENCE ROOMS	CONFERENCE ROOM	60	SPECIAL	HYDROTEST
1"	PW-019	FIRE	EXTINGUISHER	PRESS. WATER	CONFERENCE ROOMS	CONFERENCE ROOM	1	INT/EXT	VIS
1"	SPW-020	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-020	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	SPW-021	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-021	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	PW-022	FIRE	EXTINGUISHER	PRESS. WATER	CONFERENCE ROOMS	CONFERENCE ROOM	1	INT/EXT	VIS
1"	PW-022	FIRE	EXTINGUISHER	PRESS. WATER	CONFERENCE ROOMS	CONFERENCE ROOM	60	SPECIAL	HYDROTEST
1"	PW-023	FIRE	EXTINGUISHER	PRESS. WATER	AREA 2 SUBOFFICE @ 4TH & "A"	OLD FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
1"	PW-023	FIRE	EXTINGUISHER	PRESS. WATER	AREA 2 SUBOFFICE @ 4TH & "A"	OLD FOREMAN'S OFFICE	1	INT/EXT	VIS
1"	PW-024	FIRE	EXTINGUISHER	PRESS. WATER	AREA 2 SUBOFFICE	EAST DOOR	60	SPECIAL	HYDROTEST
1"	PW-024	FIRE	EXTINGUISHER	PRESS. WATER	AREA 2 SUBOFFICE	EAST DOOR	1	INT/EXT	VIS
1"	PW-028	FIRE	EXTINGUISHER	PRESS. WATER	AREA 1 SUBOFFICE	INSIDE BUILDING	60	SPECIAL	HYDROTEST
1"	PW-028	FIRE	EXTINGUISHER	PRESS. WATER	AREA 1 SUBOFFICE	INSIDE BUILDING	1	INT/EXT	VIS
1"	SPW-030	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-030	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	SPW-31	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-31	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	PW-032	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	PW-032	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
1"	SPW-033	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	60	SPECIAL	HYDROTEST
1"	SPW-033	FIRE	EXTINGUISHER	PRESS. WATER	3RD & "A" STREET	STORAGE SHED	1	INT/EXT	VIS
3"	PW-036	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	UPSTAIRS	60	SPECIAL	HYDROTEST
3"	PW-036	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	UPSTAIRS	1	INT/EXT	VIS
3"	PW-037	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	OFFICES - PARTITION WALL	60	SPECIAL	HYDROTEST
3"	PW-037	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	OFFICES - PARTITION WALL	1	INT/EXT	VIS
3"	PW-038	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	OFFICES - EAST WALL	60	SPECIAL	HYDROTEST
3"	PW-038	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	OFFICES - EAST WALL	1	INT/EXT	VIS
3"	PW-039	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	NEW STOCK ROOM - NORTHWEST BEAM	60	SPECIAL	HYDROTEST
3"	PW-039	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	NEW STOCK ROOM - NORTHWEST BEAM	1	INT/EXT	VIS
3"	PW-040	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	NEW STOCK ROOM - SOUTHWEST BEAM	1	INT/EXT	VIS
3"	PW-040	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	NEW STOCK ROOM - SOUTHWEST BEAM	60	SPECIAL	HYDROTEST
3"	PW-041	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	NEW STOCK ROOM - SOUTH WALL	60	SPECIAL	HYDROTEST
3"	PW-041	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	NEW STOCK ROOM - SOUTH WALL	1	INT/EXT	VIS
3"	PW-042	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	V STOCK ROOM - SOUTH END - CENTER BI	1	INT/EXT	VIS
3"	PW-042	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	V STOCK ROOM - SOUTH END - CENTER BI	60	SPECIAL	HYDROTEST
3"	PW-043	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	W STOCK ROOM - SOUTH END - EAST WA	60	SPECIAL	HYDROTEST
3"	PW-043	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	W STOCK ROOM - SOUTH END - EAST WA	1	INT/EXT	VIS
3"	PW-044	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	E&I OFFICES - UPSTAIRS - EAST WING	1	INT/EXT	VIS
3"	PW-044	FIRE	EXTINGUISHER	PRESS. WATER	MAINTENANCE COMPLEX	E&I OFFICES - UPSTAIRS - EAST WING	60	SPECIAL	HYDROTEST
1"	PW-045	FIRE	EXTINGUISHER	PRESS. WATER	PLANT 9	OSI PLANT - FOREMAN'S OFFICE	60	SPECIAL	HYDROTEST
1"	PW-045	FIRE	EXTINGUISHER	PRESS. WATER	PLANT 9	OSI PLANT - FOREMAN'S OFFICE	1	INT/EXT	VIS
3"	PW-046	FIRE	EXTINGUISHER	PRESS. WATER	PLANT 9	HCN #2 SOUTHWALL	60	SPECIAL	HYDROTEST
3"	PW-046	FIRE	EXTINGUISHER	PRESS. WATER	PLANT 9	HCN #2 SOUTHWALL	1	INT/EXT	VIS
1"	PW-047	FIRE	EXTINGUISHER	PRESS. WATER	CHANGEHOUSE	NORTH BREAK ROOM @ S DOOR	60	SPECIAL	HYDROTEST

1"	PW-0[illegible]	FIRE	EXTINGUISHER	PRESS. WATER	CHAN[illegible]HOUSE	NORTH BREAK ROOM @ S DOOR	1	INT/E[illegible]	VIS		
1"	PW-048	FIRE	EXTINGUISHER	PRESS. WATER	CHANGEHOUSE	SE ENTRANCE DOOR	60	SPECIAL	HYDROTEST		
1"	PW-048	FIRE	EXTINGUISHER	PRESS. WATER	CHANGEHOUSE	SE ENTRANCE DOOR	1	INT/EXT	VIS		
2"	PW-051	FIRE	EXTINGUISHER	PRESS. WATER	AREA 3	ZONE STORES	60	SPECIAL	HYDROTEST		
2"	PW-051	FIRE	EXTINGUISHER	PRESS. WATER	AREA 3	ZONE STORES	1	INT/EXT	VIS		
1"	PW-052	FIRE	EXTINGUISHER	PRESS. WATER	CONSOLIDATED CONTROL ROOM	HALLWAY	60	SPECIAL	HYDROTEST		
1"	PW-052	FIRE	EXTINGUISHER	PRESS. WATER	CONSOLIDATED CONTROL ROOM	HALLWAY	1	INT/EXT	VIS		
1"	PW-053	FIRE	EXTINGUISHER	PRESS. WATER	CONSOLIDATED CONTROL ROOM	HALLWAY	60	SPECIAL	HYDROTEST		
1"	PW-053	FIRE	EXTINGUISHER	PRESS. WATER	CONSOLIDATED CONTROL ROOM	HALLWAY	1	INT/EXT	VIS		
1"	PW-054	FIRE	EXTINGUISHER	PRESS. WATER	CONSOLIDATED CONTROL ROOM	HALLWAY	60	SPECIAL	HYDROTEST		
1"	PW-054	FIRE	EXTINGUISHER	PRESS. WATER	CONSOLIDATED CONTROL ROOM	HALLWAY	1	INT/EXT	VIS		
3"	RD-001	RETRIEVAL	DEVICE		AMBULANCE BUILDING	SPARE (S/N 79994)			CERTIFICATION		
3"	RD-001	RETRIEVAL	DEVICE		AMBULANCE BUILDING	SPARE (S/N 79994)			VIS		
3"	RD-002	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 11605D)			CERTIFICATION		
3"	RD-002	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 11605D)			VIS		
3"	RD-003	RETRIEVAL	DEVICE		AMBULANCE BUILDING	SPARE (S/N 79992V)			VIS		
3"	RD-003	RETRIEVAL	DEVICE		AMBULANCE BUILDING	SPARE (S/N 79992V)			CERTIFICATION		
3"	RD-004	RETRIEVAL	DEVICE		SAFETY BUILDING	ROOM 120 (S/N 20658D)			CERTIFICATION		
3"	RD-004	RETRIEVAL	DEVICE		SAFETY BUILDING	ROOM 120 (S/N 20658D)			VIS		
3"	RD-005	RETRIEVAL	DEVICE		AREA 1 MAINTENANCE SHOP	CSE CART (S/N 79995V)			VIS		
3"	RD-005	RETRIEVAL	DEVICE		AREA 1 MAINTENANCE SHOP	CSE CART (S/N 79995V)			CERTIFICATION		
3"	RD-006	RETRIEVAL	DEVICE		AREA 1 MAINTENANCE SHOP	CSE CART (S/N 69429V)			VIS		
3"	RD-006	RETRIEVAL	DEVICE		AREA 1 MAINTENANCE SHOP	CSE CART (S/N 69429V)			CERTIFICATION		
3"	RD-007	RETRIEVAL	DEVICE		AREA 2 MAINTENANCE SHOP	CSE CART (S/N 21407D)			VIS		
3"	RD-007	RETRIEVAL	DEVICE		AREA 2 MAINTENANCE SHOP	CSE CART (S/N 21407D)			CERTIFICATION		
3"	RD-008	RETRIEVAL	DEVICE		AREA 2 MAINTENANCE SHOP	CSE CART (S/N 79993V)			VIS		
3"	RD-008	RETRIEVAL	DEVICE		AREA 2 MAINTENANCE SHOP	CSE CART (S/N 79993V)			CERTIFICATION		
3"	RD-009	RETRIEVAL	DEVICE		AREA 2 MAINTENANCE SHOP	CSE CART (S/N 73594V)			VIS		
3"	RD-009	RETRIEVAL	DEVICE		AREA 2 MAINTENANCE SHOP	CSE CART (S/N 73594V)			CERTIFICATION		
3"	RD-010	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 18758D)			CERTIFICATION		
3"	RD-010	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 18758D)			VIS		
3"	RD-011	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 59895V)			VIS		
3"	RD-011	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 59895V)			CERTIFICATION		
3"	RD-012	RETRIEVAL	DEVICE		Plant 7	Railcar cleaning pad (S/N 18293D)			VIS		
3"	RD-012	RETRIEVAL	DEVICE		TRAFFIC	FOREMAN'S OFFICE (S/N 18302D)			CERTIFICATION		
3"	RD-013	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 59897V)			VIS		
3"	RD-013	RETRIEVAL	DEVICE		AREA 3 MAINTENANCE SHOP	CSE CART (S/N 59897V)			CERTIFICATION		
3"	RD-014	RETRIEVAL	DEVICE		TRAFFIC	FOREMANS OFFICE S/N 18293D			VIS		
3"	RD-014	RETRIEVAL	DEVICE		TRAFFIC	FOREMANS OFFICE S/N 18293D			CERTIFICATION		
3"	RD-015	RETRIEVAL	DEVICE		TRAFFIC	FOREMANS OFFICE S/N 118302D			VIS		
3"	RD-015	RETRIEVAL	DEVICE		TRAFFIC	FOREMANS OFFICE S/N 118302D			CERTIFICATION		
2"	RES-006	RESUSCITATOR			CYLINDER	PLANT 3 OSI	2ND FLOOR CONTROL ROOM	1	INT/EXT	VIS	
2"	RES-006	RESUSCITATOR			CYLINDER	PLANT 3 OSI	2ND FLOOR CONTROL ROOM	60	SPECIAL	HYDROTEST	
1"	RES-012	RESUSCITATOR			CYLINDER	ADMIN SERVICES BUILDING	1ST FLOOR - MEDICAL OFFICE	60	SPECIAL	HYDROTEST	
1"	RES-012	RESUSCITATOR			CYLINDER	ADMIN SERVICES BUILDING	1ST FLOOR - MEDICAL OFFICE	1	INT/EXT	VIS	
1"	RES-013	RESUSCITATOR			CYLINDER	PT PILOT PLANT	EAST SIDE - ROCKET CONTROL ROOM	60	SPECIAL	HYDROTEST	
1"	RES-013	RESUSCITATOR			CYLINDER	PT PILOT PLANT	EAST SIDE - ROCKET CONTROL ROOM	1	INT/EXT	VIS	
1"	RES-014	RESUSCITATOR			CYLINDER	PLANT 9	HCN WAREHOUSE	1	INT/EXT	VIS	
1"	RES-014	RESUSCITATOR			CYLINDER	PLANT 9	HCN WAREHOUSE	60	SPECIAL	HYDROTEST	
1"	RES-014	RESUSCITATOR			CYLINDER	PLANT 9	HCN WAREHOUSE	60	SPECIAL	HYDROTEST	
1"	RES-017	RESUSCITATOR			CYLINDER	PLANT 8 TANK FARM	FIRST AID BOX @ 4TH & "B"	1	INT/EXT	VIS	
1"	RES-017	RESUSCITATOR			CYLINDER	PLANT 8 TANK FARM	FIRST AID BOX @ 4TH & "B"	60	SPECIAL	HYDROTEST	
1"	RES-018	RESUSCITATOR			CYLINDER	AREA 2	CO STORAGE AREA	1	INT/EXT	VIS	
1"	RES-018	RESUSCITATOR			CYLINDER	AREA 2	CO STORAGE AREA	60	SPECIAL	HYDROTEST	
1"	RES-018	RESUSCITATOR			CYLINDER	AREA 2	CO STORAGE AREA	60	SPECIAL	HYDROTEST	
1"	RES-020	RESUSCITATOR			CYLINDER	AREA 1 SUBOFFICE	SOUTH OF BUILDING	60	SPECIAL	HYDROTEST	
1"	RES-020	RESUSCITATOR			CYLINDER	AREA 1 SUBOFFICE	SOUTH OF BUILDING	1	INT/EXT	VIS	
1"	RES-021	RESUSCITATOR			CYLINDER	PLANT 9	HCN WAREHOUSE - NORTH SIDE	60	SPECIAL	HYDROTEST	
1"	RES-021	RESUSCITATOR			CYLINDER	PLANT 9	HCN WAREHOUSE - NORTH SIDE	1	INT/EXT	VIS	
1"	RES-021	RESUSCITATOR			CYLINDER	PLANT 9	HCN WAREHOUSE - NORTH SIDE	60	SPECIAL	HYDROTEST	
2"	RES-022	RESUSCITATOR			CYLINDER	PLANT 9	2ND FLOOR - SOUTH PORCH	1	INT/EXT	VIS	
2"	RES-022	RESUSCITATOR			CYLINDER	PLANT 9	2ND FLOOR - SOUTH PORCH	60	SPECIAL	HYDROTEST	
1"	RES-024	RESUSCITATOR			CYLINDER	#4 BOILER	NORTH SIDE	1	INT/EXT	VIS	

1"	RES-031	RESUSCITATOR			CYLINDER	PLANT 9	HCN BULK STORAGE - CONTROL ROOM	60	SPECIAL	HYDROTEST
1"	RES-031	RESUSCITATOR			CYLINDER	PLANT 9	HCN BULK STORAGE - CONTROL ROOM	1	INT/EXT	VIS
3"	RES-035	RESUSCITATOR			CYLINDER	MAINTENANCE COMPLEX	East wall carpenter shop	60	SPECIAL	HYDROTEST
3"	RES-035	RESUSCITATOR			CYLINDER	MAINTENANCE COMPLEX	East wall carpenter shop	1	INT/EXT	VIS
1"	RES-036	RESUSCITATOR			CYLINDER	PLANT 9	OSI PLANT - 2ND FLOOR - CONTROL ROOM	60	SPECIAL	HYDROTEST
1"	RES-036	RESUSCITATOR			CYLINDER	PLANT 9	OSI PLANT - 2ND FLOOR - CONTROL ROOM	1	INT/EXT	VIS
1"	RES-037	RESUSCITATOR			CYLINDER	ANALYTICAL SERVICES	ALKYL LAB	1	INT/EXT	VIS
1"	RES-037	RESUSCITATOR			CYLINDER	ANALYTICAL SERVICES	ALKYL LAB	60	SPECIAL	HYDROTEST
1"	RES-039	RESUSCITATOR			CYLINDER	PLANT 9	PLANT 15 SOUTHSIDE OF FIELD LAB	60	SPECIAL	HYDROTEST
1"	RES-039	RESUSCITATOR			CYLINDER	PLANT 9	Plant 15 Southside of field lab	1	INT/EXT	VIS
1"	RES-6	RESUSCITATOR			CYLINDER	PLANT 9	OSI PLANT - 2ND FLOOR - CONTROL ROOM	1	INT/EXT	VIS
1"	RES-6	RESUSCITATOR			CYLINDER	PLANT 9	OSI PLANT - 2ND FLOOR - CONTROL ROOM	60	SPECIAL	HYDROTEST
1"	SB-003	PEG	BOX			D STREET @ RR TRACKS	NORTH OF THE PHENO UNLOAD	1	INT/EXT	VIS
1"	SB-005	PEG	BOX			AREA 2 SUBOFFICE	SUBOFFICE HALLWAY	1	INT/EXT	VIS
2"	SB-034	PEG	BOX			PLANT 1	ELL - 2ND FLOOR - CONTROL ROOM - WES	1	INT/EXT	VIS
2"	SB-036	SAFETY	BOX			PLANT 1	EPTD Cell south of k-4m-5	1	INT/EXT	VIS
2"	SB-037	PEG	BOX			PLANT 15	1ST FLOOR - EAST WALL	1	INT/EXT	VIS
2"	SB-038	PEG	BOX			PLANT 15	2ND FLOOR - OUTSIDE	1	INT/EXT	VIS
2"	SB-045	PEG	BOX			PLANT 15	3RD FLOOR - WEST WALL	1	INT/EXT	VIS
2"	SB-053	SAFETY	BOX			OLD PLANT 9	2ND FLOOR @ R-171	1	INT/EXT	VIS
2"	SB-054	SAFETY	BOX			OLD PLANT 9	2ND FLOOR R-131 CELL	1	INT/EXT	VIS
2"	SB-055	SAFETY	BOX			OLD PLANT 9	3RD FLOOR OUTSIDE ALCL ROOM	1	INT/EXT	VIS
1"	SB-076	PEG	BOX			PLANT 8	CENTER STAIRS SW CORNER	1	INT/EXT	VIS
2"	SB-097	SAFETY	BOX			PLANT 11	NORTH SIDE @T-6M-1 - INSIDE DIKE	1	INT/EXT	VIS
2"	SB-100	SAFETY	BOX			D Street	River Pump House	1	INT/EXT	VIS
2"	SB-103	SAFETY	BOX			PLANT 9 OSI	HCN PLANT 2ND FLOOR	1	INT/EXT	VIS
2"	SB-104	SAFETY	BOX			PLANT 9 OSI	HCN PLANT 1ST FLOOR	1	INT/EXT	VIS
2"	SB-108	SAFETY	BOX			PLANT 9 OSI	R1122 CELL 3RD FLOOR	1	INT/EXT	VIS
2"	SB-109	PEG	BOX			AS LAB	VPC EAST SIDE	1	INT/EXT	VIS
2"	SB-110	PEG	BOX			AS LAB	WEST SIDE	1	INT/EXT	VIS
2"	SB-113	PEG	BOX			PLANT 1	1ST FLOOR - SOUTH OF K-4M-6	1	INT/EXT	VIS
2"	SB-114	SAFETY	BOX			PLANT 11	IT ACID LOADING SPOT - NORTHWEST COI	1	INT/EXT	VIS
2"	SB-118	PEG	BOX			AREA 2 SUBOFFICE	SOUTHWEST OF SUBOFFICE	1	INT/EXT	VIS
2"	SH 26B	SPRINKLER	SYSTEM	DRY PIPE		PLANT 15	SOUTHEAST CORNER	12	SPECIAL	FULL TRIP /LINE CHECK
1"	SH-01	SPRINKLER	SYSTEM	DRY PIPE		PT LAB - OUTSIDE	EAST SIDE	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-02A	SPRINKLER	SYSTEM	REACTION DELUGE		PLANT 8	1ST FLOOR	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-02B	SPRINKLER	SYSTEM	DELUGE		PLANT 8	2ND FLOOR	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-02C	SPRINKLER	SYSTEM	DELUGE		PLANT 8	3ND FLOOR	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-02D	SPRINKLER	SYSTEM	WET		PLANT 8	T/FARM	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-03A	SPRINKLER	SYSTEM	REACTION DELUGE		OLEFIN TANK FARM	NORTH END	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-03B	SPRINKLER	SYSTEM	REACTION DELUGE		OLEFIN TANK FARM (SOUTH)	SOUTH END	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-03C	SPRINKLER	SYSTEM	REACTION DELUGE		OLEFIN TANK FARM	CENTER	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-03D	SPRINKLER	SYSTEM	REACTION DELUGE		RAIL CAR SPOTTING AREA	NORTH TURRET	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-03E	SPRINKLER	SYSTEM	REACTION DELUGE		RAIL CAR SPOTTING AREA	SOUTH TURRET	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-03F	SPRINKLER	SYSTEM	REACTION DELUGE		RAIL CAR SPOTTING AREA	CENTER TURRET (EAST OF RAIL SPUR)	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-04	SPRINKLER	SYSTEM	REACTION DELUGE		PLANT 5	1ST FLOOR	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-05A	SPRINKLER	SYSTEM	DELUGE		PLANT 5	MMT	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-05B	SPRINKLER	SYSTEM	DELUGE		PLANT 5	MMT AUX	12	SPECIAL	FULL TRIP / LINE CHECK

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2"	SH-06	SPRINKLER	SYSTEM	DRY PIPE	PLANT 12	702 WAREHOUSE	12	SPECIAL	FULL TRIP /LINE CHECK
2"	SH-07	SPRINKLER	SYSTEM	DRY PIPE	TRAFFIC	SHIPPING WAREHOUSE	12	SPECIAL	FULL TRIP / LINE CHECK
2"	SH-08	SPRINKLER	SYSTEM	DRY PIPE	PLANT 12		12	SPECIAL	FULL TRIP / LINE CHECK
2"	SH-09A	SPRINKLER	SYSTEM	REACTION DELUGE	PLANT 15 / PLANT 1		12	SPECIAL	FULL TRIP / LINE CHECK
2"	SH-09B	SPRINKLER	SYSTEM	REACTION DELUGE	PLANT 15 / PLANT 1		12	SPECIAL	FULL TRIP / LINE CHECK
2"	SH-10	SPRINKLER	SYSTEM	REACTION DELUGE	PLANT 9	OSI PLANT	74.6	20; 0 LBS AIR; 10	FULL TRIP/LINE CHECK
2"	SH-11A	SPRINKLER	SYSTEM	REACTION DELUGE	PLANT 9	DR3	PSI H2O; 5 LBS AIR (DISCHARGE)		FULL TRIP/LINE CHECK
2"	SH-11B	SPRINKLER	SYSTEM	DELUGE	PLANT 9	R-121 CELL	PSI H2O; 5 LBS AIR (DISCHARGE)		FULL TRIP/LINE CHECK
3"	SH-12	SPRINKLER	SYSTEM	DRY PIPE	PLANT 9	DR3 WAREHOUSES 1 & 2	99	PSI H2O; 37 LBS	FULL TRIP/LINE CHECK
3"	SH-14A	SPRINKLER	SYSTEM	REACTION DELUGE	PLANT 10 (OLD VALVE)	1ST & 2ND FLOOR, STACKUP, WAREHOUSI	12	SPECIAL	FULL TRIP /LINE CHECK
3"	SH-14B	SPRINKLER	SYSTEM	DELUGE	PLANT 10 (NEW VALVE)	TANK FARM	12	SPECIAL	FULL TRIP /LINE CHECK
3"	SH-14C	SPRINKLER	SYSTEM	DELUGE	PLANT 14	BULK PACKAGING WAREHOUSE	12	SPECIAL	FULL TRIP /LINE CHECK
3"	SH-15	SPRINKLER	SYSTEM	REACTION DELUGE	PLANT 14		12	SPECIAL	FULL TRIP / LINE CHECK
3"	SH-16	SPRINKLER	SYSTEM	WET	MAINTENANCE COMPLEX	STORES WAREHOUSE	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-17	SPRINKLER	SYSTEM	DRY PIPE	ANALYTICAL SERVICES	INSIDE BUILDING	12	SPECIAL	FULL TRIP / LINE CHECK
3"	SH-18	SPRINKLER	SYSTEM	DRY PIPE	PLANT 9	DR3 WAREHOUSE #3	96	PSI H2O; 30 LBS	FULL TRIP/LINE CHECK
2"	SH-19A	SPRINKLER	SYSTEM	DRY PIPE	PLANT 9	DRUM WAREHOUSE, PACKAGING WAREHOUSE	95 PSI H2O; 45 PSI AIR; 20		FULL TRIP/LINE CHECK
2"	SH-19B	SPRINKLER	SYSTEM	DELUGE	PLANT 9	NSU / NSU TANK FARM	80	O; 36 PSI AIR; 20	FULL TRIP/LINE CHECK
2"	SH-19C	SPRINKLER	SYSTEM	DRY PIPE	PLANT 9	R1161 / R1131 CELLS / HCN CELL	100	O; 38 PSI AIR; 20	FULL TRIP/LINE CHECK
2"	SV-19D	FOAM	SYSTEM	DELUGE	PLANT 9	NSU TANK FARM			
2"	SV-19E	FOAM	SYSTEM	DELUGE	PLANT 9	NSU TANK FARM			
2"	SH-24	SPRINKLER	SYSTEM	DELUGE	PLANT 9	DIP PACKAGING SHED	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-25A	SPRINKLER	SYSTEM	DELUGE	PLANT 5	2ND / 3RD FLOOR	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-25B	SPRINKLER	SYSTEM	DELUGE	PLANT 5	728 TANK FARM	12	SPECIAL	FULL TRIP / LINE CHECK
2"	SH-26A	SPRINKLER	SYSTEM	DELUGE	PLANT 1	NGENDX PLANT	12	SPECIAL	FULL TRIP /LINE CHECK
3"	SH-27	SPRINKLER	SYSTEM	WET	PLANT 9	A & 9TH STREET / DIBL TANK FARM	12	SPECIAL	FULL TRIP / LINE CHECK
1"	SH-28	SPRINKLER	SYSTEM	DELUGE	PLANT 4	SOUTHSIDE PT.4 BY 4TH STREET	12	SPECIAL	FULL TRIP / LINE CHECK
4"	SH29A	SPRINKLER	SYSTEM	DELUGE	PO TANK	EAST OF D AND 8TH ST	12	SPECIAL	FULL TRIP / LINE CHECK
4"	SH29B	SPINKLER	SYSTEM	DELUGE	PO RAILCAR	8TH AND D STREET	12	SPECIAL	FULLTRIP / LINE
2"	SH30A	SPINKLER	SYSTEM	DELUGE	PLANT 9	6TH STREET 4716	12	SPECIAL	FULLTRIP / LINE
2"	SH30B	SPINKLER	SYSTEM	DELUGE	PLANT 9	6TH STREET 4716	12	SPECIAL	FULLTRIP / LINE

2"	SH30C	SPRINKLER	SYSTEM	DELUGE	PLANT 9	6TH STREET 4716	12	SPECIAL	FULLTRIP / LIN	
3"	SIP-01	SHELTER	IN	PLACE KIT	MAINTENANCE COMPLEX	E&I Shop under desk	1	INT/EXT	VIS	
	SIP-02	SHELTER	IN	PLACE KIT	Contractor breakroom					
1"	SIP-03	SHELTER	IN	PLACE KIT	NORTH CONF ROOM	WEST DOOR ON FREEZER	1	INT/EXT	VIS	
1"	SIP-04	SHELTER	IN	PLACE KIT	ADMIN SERVICES	COMPUTER ROOM 102	1	INT/EXT	VIS	
1"	SIP-05	SHELTER	IN	PLACE KIT	CCR	AREA 3 CONTROL ROOM	1	INT/EXT	VIS	
	SK-1	SPILL	KIT				1	INT/EXT	VIS	
1"	SK-10	SPILL	KIT			Traffic Drumming Shed	1	INT/EXT	VIS	
	SK-2	SPILL	KIT			Fire Truck	1	INT/EXT	VIS	
1"	SK-3	SPILL	KIT		PLANT 4	BESIDE RR TRACK 3RD AND D	1	INT/EXT	VIS	
	SK-4	SPILL	KIT			90 Day pad	1	INT/EXT	VIS	
	SK-5	SPILL	KIT			Boiler # 4 - SAA	1	INT/EXT	VIS	
1"	SK-6	SPILL	KIT		PLANT 8 1ST FLOOR	EAST OF IC4 COMPRESSOR ON B ST	1	INT/EXT	VIS	
	SK-7	SPILL	KIT			Area II-SAA	1	INT/EXT	VIS	
1"	SK-8	SPILL	KIT			Area III-SAA	1	INT/EXT	VIS	
	SK-9	SPILL	KIT			North Traffic Area -SAA	1	INT/EXT	VIS	
3"	SS-001	SAFETY	SHOWER		PLANT 1	EPTD CLEANING PAD	2	INT/EXT	VIS	
1"	SS-003	SAFETY	SHOWER		PLANT 5 MMT TANK FARM	MMT CONTROL ROOM - EAST SIDE	1	INT/EXT	VIS	
3"	SS-004	SAFETY	SHOWER		PLANT 9	HCN BUILDING	1	INT/EXT	VIS	
2"	SS-005	SAFETY	SHOWER		PLANT 1	NAPROXEN - SOUTHWEST SIDE	1	INT/EXT	VIS	
2"	SS-006	SAFETY	SHOWER		PLANT 1	NAPROXEN - SOUTH SIDE	1	INT/EXT	VIS	
2"	SS-007	SAFETY	SHOWER		PLANT 1	1ST FLOOR - SOUTH OF K-4M-8	1	INT/EXT	VIS	
2"	SS-008	SAFETY	SHOWER		PLANT 15	1ST FLOOR	1	INT/EXT	VIS	
2"	SS-009	SAFETY	SHOWER		PLANT 15	TANK FARM - NORTH SIDE	1	INT/EXT	VIS	
2"	SS-010	SAFETY	SHOWER		PLANT 1	TANK FARM - NORTH SIDE	1	INT/EXT	VIS	
2"	SS-011	SAFETY	SHOWER		PLANT 15	1ST FLOOR	1	INT/EXT	VIS	
2"	SS-012	SAFETY	SHOWER		PLANT 15	2ND FLOOR - WEST SIDE	1	INT/EXT	VIS	
2"	SS-013	SAFETY	SHOWER		PLANT 15	2ND FLOOR - WEST SIDE	1	INT/EXT	VIS	
2"	SS-014	SAFETY	SHOWER		PLANT 15	2ND FLOOR - WEST SIDE	1	INT/EXT	VIS	
2"	SS-015	SAFETY	SHOWER		PLANT 15	2ND FLOOR - NORTHEAST CORNER ROOM	1	INT/EXT	VIS	
2"	SS-016	SAFETY	SHOWER		PLANT 15	3RD FLOOR	1	INT/EXT	VIS	
2"	SS-017	SAFETY	SHOWER		PLANT 15	3RD FLOOR	1	INT/EXT	VIS	
2"	SS-018	SAFETY	SHOWER		PLANT 15	3RD FLOOR	1	INT/EXT	VIS	
2"	SS-019	SAFETY	SHOWER		PLANT 1	EPTD CELL - 2ND FLOOR	1	INT/EXT	VIS	
2"	SS-020	SAFETY	SHOWER		PLANT 9	NSU - TANK FARM	1	INT/EXT	VIS	
2"	SS-021	SAFETY	SHOWER		PLANT 9	NSU - 2ND FLOOR	1	INT/EXT	VIS	
2"	SS-022	SAFETY	SHOWER		PLANT 9	NSU - 3RD FLOOR	1	INT/EXT	VIS	
2"	SS-023	SAFETY	SHOWER		PLANT 9	NSU - 4TH FLOOR	1	INT/EXT	VIS	
2"	SS-024	SAFETY	SHOWER		PLANT 1	3RD FLOOR	1	INT/EXT	VIS	
2"	SS-025	SAFETY	SHOWER		SOUTH DRUMMING SHED	SOUTHEAST CORNER OF SHED - OUTSIDE	1	INT/EXT	VIS	
2"	SS-026	SAFETY	SHOWER		SOUTH DRUMMING SHED	NORTH WALL UNDER SHED	1	INT/EXT	VIS	
2"	SS-027	SAFETY	SHOWER		CHEMICAL WAREHOUSE	AST END - ROOM ON SOUTHWEST CORNE	1	INT/EXT	VIS	
2"	SS-028	SAFETY	SHOWER		CHEMICAL WAREHOUSE	NORTH SIDE @ WEST DOOR	1	INT/EXT	VIS	
2"	SS-029	SAFETY	SHOWER		CHEMICAL WAREHOUSE	SOUTHEAST CORNER	1	INT/EXT	VIS	
2"	SS-030	SAFETY	SHOWER		D STREET @ RR TRACKS	EAST OF RR TRACKS	1	INT/EXT	VIS	
3"	SS-031	SAFETY	SHOWER		PLANT 1	NORTH SIDE - T-15M-13	1	INT/EXT	VIS	
1"	SS-032	SAFETY	SHOWER		AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM EAST OF SUBOFFICE	1	INT/EXT	VIS	
1"	SS-033	SAFETY	SHOWER		AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT	VIS	
1"	SS-034	SAFETY	SHOWER		PLANT 5 1ST FLOOR	ELEVATOR - "B" STREET SIDE	1	INT/EXT	VIS	
1"	SS-035	SAFETY	SHOWER		PLANT 5 2ND FLOOR	CENTER STAIR WELL	1	INT/EXT	VIS	
1"	SS-036	SAFETY	SHOWER		PLANT 5 3RD FLOOR	NORTH SIDE - NORTH WALL	1	INT/EXT	VIS	
1"	SS-037	SAFETY	SHOWER		PLANT 5 3RD FLOOR	NORTH SIDE - NORTH WALL	1	INT/EXT	VIS	
1"	SS-038	SAFETY	SHOWER		PLANT 5 MMT TANK FARM	T-6M-14 - EAST SIDE	1	INT/EXT	VIS	
1"	SS-039	SAFETY	SHOWER		PLANT 5 1ST FLOOR	M-12 - NORTHWEST SIDE EAST OF A350-1	1	INT/EXT	VIS	
1"	SS-040	SAFETY	SHOWER		PLANT 5 MMT TANK FARM	PDC-20-B - WEST SIDE INSIDE	1	INT/EXT	VIS	
1"	SS-041	SAFETY	SHOWER		PLANT 5 MMT TANK FARM	MT COLUMN CONTROL ROOM - SOUTH SIL	1	INT/EXT	VIS	
1"	SS-042	SAFETY	SHOWER		PLANT 5 MMT TANK FARM	T-6M-5/6 - NORTH SIDE	1	INT/EXT	VIS	
1"	SS-043	SAFETY	SHOWER		PLANT 5 MMT TANK FARM	T-8300-1 - NORTH SIDE @ 5TH STREET	1	INT/EXT	VIS	
1"	SS-044	SAFETY	SHOWER		D STREET @ RR TRACKS	N OF PHENOL PLATFORM	1	INT/EXT	VIS	
1"	SS-045	SAFETY	SHOWER		MAALOX AREA	-250M-2 - DIKE @ D STREET & RIVER ROAI	1	INT/EXT	VIS	
1"	SS-046	SAFETY	SHOWER		RIVER ROAD	T-250M-2 DIKE - SOUTH SIDE	1	INT/EXT	VIS	
1"	SS-047	SAFETY	SHOWER		MAALOX AREA	T-15M-61 - SOUTH SIDE	1	INT/EXT	VIS	
1"	SS-048	SAFETY	SHOWER		PLANT 4	BOTTOM OF SODIUM TANK	1	INT/EXT	VIS	

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1"	SS-04[illegible]	SAFETY	SHOWER		PL[illegible]4	SOUTHWEST SIDE	1	INT/E[illegible]	VIS
1"	SS-050	SAFETY	SHOWER		PLANT 4	WEST SIDE TOWARD STREET	1	INT/EXT	VIS
1"	SS-051	SAFETY	SHOWER		PLANT 8 1ST FLOOR	CENTER STAIRS - EAST SIDE	1	INT/EXT	VIS
1"	SS-052	SAFETY	SHOWER		PLANT 8 TANK FARM	SOUTH OF PLANT 8	1	INT/EXT	VIS
1"	SS-053	SAFETY	SHOWER		PLANT 8 2ND FLOOR	CENTER STAIRS - EAST SIDE	1	INT/EXT	VIS
1"	SS-054	SAFETY	SHOWER		PLANT 8 3RD FLOOR	NTER STAIRS - WEST SIDE HEAD OF STAI	1	INT/EXT	VIS
1"	SS-055	SAFETY	SHOWER		PLANT 8 TANK FARM	LANT 8 COLUMN CONTROL ROOM - WEST	1	INT/EXT	VIS
1"	SS-056	SAFETY	SHOWER		PLANT 8 TANK FARM	T-30M-45 SOUTHWEST OF DIKE	1	INT/EXT	VIS
1"	SS-057	SAFETY	SHOWER		PLANT 8 TANK FARM	T-15M-20 - SOUTH ALLEY UNLOADING SPO	1	INT/EXT	VIS
1	SS-058	SAFETY	SHOWER		PT LAB STORAGE BUILDING	INSIDE	1	INT/EXT	VIS
1"	SS-059	SAFETY	SHOWER		T&V SHOP	OUTSIDE EAST DOOR	1	INT/EXT	VIS
1"	SS-060	SAFETY	SHOWER		PLANT 8 CONTROL ROOM - NORTH SID	CYLINDER LOAD STATION	1	INT/EXT	VIS
1"	SS-061	SAFETY	SHOWER		AREA 2	SATELLITE SHOP	1	INT/EXT	VIS
1"	SS-062	SAFETY	SHOWER		AREA2	3RD ST WEST OF RR TRACK	1	INT/EXT	VIS
1"	SS-063	SAFETY	SHOWER		PLANT 7	RR TRACKS SW OF PLANT 7	1	INT/EXT	VIS
1"	SS-064	SAFETY	SHOWER		PLANT 7	RR TRACKS SW OF PLANT 7	1	INT/EXT	VIS
1"	SS-065	SAFETY	SHOWER		PLANT 7	CYLINDER READY AREA - SAMPLE SHED	1	INT/EXT	VIS
1"	SS-066	SAFETY	SHOWER		PLANT 7	CYLINDER LOAD AREA - WEST SIDE	1	INT/EXT	VIS
1"	SS-067	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	NORTHEAST SIDE @ T-12M-4	1	INT/EXT	VIS
1"	SS-068	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	ODIUM WAREHOUSE - EAST SIDE @ T-6M-	1	INT/EXT	VIS
1"	SS-069	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	ODIUM WAREHOUSE - EAST SIDE @ T-15M	1	INT/EXT	VIS
1"	SS-070	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	ODIUM WAREHOUSE - EAST SIDE @ T-8M-	1	INT/EXT	VIS
1"	SS-071	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	ODIUM WAREHOUSE - EAST SIDE @ T-14M	1	INT/EXT	VIS
1"	SS-072	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	ODIUM WAREHOUSE - EAST SIDE @ T-16M	1	INT/EXT	VIS
1"	SS-073	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	SODIUM WAREHOUSE - SOUTH SIDE	1	INT/EXT	VIS
1"	SS-074	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	T-14M-1	1	INT/EXT	VIS
1"	SS-075	SAFETY	SHOWER		T/T TURN-AROUND	STEAM ENTRANCE	1	INT/EXT	VIS
2"	SS-076	SAFETY	SHOWER		PLANT 1	1ST FLOOR - NORTH OF D-165	1	INT/EXT	VIS
1"	SS-077	SAFETY	SHOWER		PLANT 5 1ST FLOOR	CENTER STAIRS - NORTHWEST SIDE	1	INT/EXT	VIS
1"	SS-078	SAFETY	SHOWER		M/C WELDING SHOP	OUTSIDE - EAST END	1	INT/EXT	VIS
3"	SS-079	SAFETY	SHOWER		PLANT 9	WEST SIDE - D-446	1	INT/EXT	VIS
1"	SS-080	SAFETY	SHOWER		PLANT 7	CLEANING PAD - W/ SCALES	1	INT/EXT	VIS
2"	SS-081	SAFETY	SHOWER		PLANT 9	OSI TANK FARM - NORTH OF T-720-B	1	INT/EXT	VIS
3	SS-082	SAFETY	SHOWER		RIVER ROAD	CLARIFIER #1	1	INT/EXT	VIS
2"	SS-083	SAFETY	SHOWER		PLANT 1	TD CELL - 3RD FLOOR - N/E CORNER OF K	1	INT/EXT	VIS
2"	SS-084	SAFETY	SHOWER		PLANT 1	EPTD LOADING DOCK	1	INT/EXT	VIS
2"	SS-085	SAFETY	SHOWER		PLANT 15	)XEN CRUDE STACKUP - T/F - SOUTH SIDE	1	INT/EXT	VIS
2"	SS-086	SAFETY	SHOWER		PLANT 15	VAPROXEN CRUDE STACKUP - 2ND FLOOF	1	INT/EXT	VIS
2"	SS-087	SAFETY	SHOWER		PLANT 1	EPTD CELL - 2ND FLOOR	1	INT/EXT	VIS
1"	SS-088	SAFETY	SHOWER		NORTH BOILER AREA - EAST SIDE	SOUTHWEST OF T-250M-3	1	INT/EXT	VIS
2"	SS-089	SAFETY	SHOWER		PLANT 1	1ST FLOOR - STAIRS	1	INT/EXT	VIS
3"	SS-090	SAFETY	SHOWER		PLANT 14	WEST OF PCL3 STORAGE SHED @ E-135	1	INT/EXT	VIS
3"	SS-091	SAFETY	SHOWER		PLANT 14	SIDE OF PCL3 STORAGE SHED @ HCL VAF	1	INT/EXT	VIS
2"	SS-092	SAFETY	SHOWER		PLANT 9	EAST TANK FARM - CENTER DIKE WALL	1	INT/EXT	VIS
2"	SS-093	SAFETY	SHOWER		PLANT 9	NORTH TANK FARM - NORTH SIDE	1	INT/EXT	VIS
2"	SS-094	SAFETY	SHOWER		PLANT 9	NORTH TANK FARM - NORTH SIDE	1	INT/EXT	VIS
2"	SS-095	SAFETY	SHOWER		PLANT 9	1ST FLOOR - NORTH SIDE	1	INT/EXT	VIS
2"	SS-096	SAFETY	SHOWER		PLANT 9	1ST FLOOR - WEST SIDE	1	INT/EXT	VIS
2"	SS-097	SAFETY	SHOWER		PLANT 9	1ST FLOOR - CENTER HALLWAY	1	INT/EXT	VIS
2"	SS-098	SAFETY	SHOWER		PLANT 9	1ST FLOOR - EAST SIDE	1	INT/EXT	VIS
2"	SS-099	SAFETY	SHOWER		PLANT 9	2ND FLOOR - SOUTH SIDE	1	INT/EXT	VIS
2"	SS-100	SAFETY	SHOWER		PLANT 9	2ND FLOOR - NORTH SIDE	1	INT/EXT	VIS
2"	SS-101	SAFETY	SHOWER		PLANT 9	3RD FLOOR - NORTH SIDE	1	INT/EXT	VIS
2"	SS-102	SAFETY	SHOWER		PLANT 9	3RD FLOOR - SOUTH SIDE	1	INT/EXT	VIS
3"	SS-103	SAFETY	SHOWER		PLANT 9	SOUTH TANK FARM - NORTH SIDE	1	INT/EXT	VIS
3"	SS-104	SAFETY	SHOWER		PLANT 9	SOUTH TANK FARM - NORTHWEST CORNEI	1	INT/EXT	VIS
3"	SS-105	SAFETY	SHOWER		PLANT 9	NORTH OF COOLING TOWERS	1	INT/EXT	VIS
3"	SS-106	SAFETY	SHOWER		PLANT 9	SOUTH TANK FARM - SOUTH SIDE	1	INT/EXT	VIS
3"	SS-107	SAFETY	SHOWER		PLANT 9	HCN BUILDING - WEST SIDE	1	INT/EXT	VIS
4	SS-108	SAFETY	SHOWER		PLANT 9	HCN BUILDING - EAST SIDE	1	INT/EXT	VIS
3"	SS-109	SAFETY	SHOWER		PLANT 9	HCN BUILDING 2 - EAST SIDE	1	INT/EXT	VIS
3"	SS-110	SAFETY	SHOWER		PLANT 9	TANK FARM T9259A	1	INT/EXT	VIS
1"	SS-111	SAFETY	SHOWER		PLANT 5 2ND FLOOR	SOUTH SIDE - R7 PLATFORM	1	INT/EXT	VIS
1"	SS-112	SAFETY	SHOWER		PLANT 5 2ND FLOOR	UTH SIDE - SOUTHWEST OF CONTROL RO	1	INT/EXT	VIS
1"	SS-113	SAFETY	SHOWER		PLANT 5 3RD FLOOR	SOUTH SIDE - WEST SIDE @ DOOR	1	INT/EXT	VIS
3"	SS-114	SAFETY	SHOWER		PLANT 11	EAST SIDE - SPENT ACID LOADING SPOT	1	INT/EXT	VIS

3"	SS-116	SAFETY	SHOWER	PLANT 11	EAST SIDE - T-60M-1	1	INT/EXT	VIS
3"	SS-117	SAFETY	SHOWER	PLANT 11	EAST SIDE - T-1153	1	INT/EXT	VIS
3"	SS-118	SAFETY	SHOWER	PLANT 11	NORTH SIDE - T-1191	1	INT/EXT	VIS
3"	SS-119	SAFETY	SHOWER	PLANT 11	NORTH SIDE - D-1106B	1	INT/EXT	VIS
3"	SS-120	SAFETY	SHOWER	PLANT 11	SOUTHWEST - T-1152	1	INT/EXT	VIS
1"	SS-121	SAFETY	SHOWER	NORTH BOILER AREA - EAST SIDE	SOUTHWEST OF T-250M-3	1	INT/EXT	VIS
1"	SS-122	SAFETY	SHOWER	NORTH BOILER AREA - EAST SIDE	HE-2290-1 @ T-50M-4	1	INT/EXT	VIS
1"	SS-123	SAFETY	SHOWER	NORTH BOILER AREA - EAST SIDE	NORTH OF T-30M-19	1	INT/EXT	VIS
1"	SS-124	SAFETY	SHOWER	NORTH BOILER AREA - EAST SIDE	T-15M-3	1	INT/EXT	VIS
1"	SS-125	SAFETY	SHOWER	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT	VIS
1"	SS-126	SAFETY	SHOWER	AREA 2	2ND & "A" STREET DIKE @ T-100M-4	1	INT/EXT	VIS
1"	SS-127	SAFETY	SHOWER	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	1	INT/EXT	VIS
1"	SS-128	SAFETY	SHOWER	TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	1	INT/EXT	VIS
1"	SS-129	SAFETY	SHOWER	PLANT 7	LINDER LOAD AREA - LOAD RAMP TOP/STA	1	INT/EXT	VIS
1"	SS-130	SAFETY	SHOWER	PLANT 7	YLINDER RESTORATION AREA - ENTRANC	1	INT/EXT	VIS
1"	SS-131	SAFETY	SHOWER	PLANT 7	CYLINDER RESTORATION AREA	1	INT/EXT	VIS
1	SS-132	SAFETY	SHOWER	PLANT 7	CYLINDER RESTORATION AREA	1	INT/EXT	VIS
1"	SS-133	SAFETY	SHOWER	PLANT 8 TANK FARM	T-30M-45 INSIDE DIKE	1	INT/EXT	VIS
1"	SS-134	SAFETY	SHOWER	AREA 2 SUBOFFICE @ 4TH & "A"	TANK FARM EAST OF SUBOFFICE	1	INT/EXT	VIS
2"	SS-135	SAFETY	SHOWER	RAW MATERIAL WAREHOUSE	NORTH LOADING DOCK	1	INT/EXT	VIS
1"	SS-136	SAFETY	SHOWER	MAALOX AREA	T-250M-2 DIKE - NORTH OF RIVER ROAD	1	INT/EXT	VIS
1"	SS-137	SAFETY	SHOWER	PLANT 7	SW OF BLAST WALL	1	INT/EXT	VIS
2"	SS-138	SAFETY	SHOWER	PLANT 1	TANK FARM - NORTH SIDE	1	INT/EXT	VIS
2"	SS-139	SAFETY	SHOWER	PLANT 1	EPTD TANK CAR	1	INT/EXT	VIS
3"	SS-140	SAFETY	SHOWER	#4 BOILER	HE-3800-1 - EAST SIDE	1	INT/EXT	VIS
3"	SS-141	SAFETY	SHOWER	#4 BOILER	TANK FARM - NORTH SIDE	1	INT/EXT	VIS
3"	SS-142	SAFETY	SHOWER	EDWIN COOPER	ORTH - T-1030-A (AKA T-30M-24) - INSIDE DI	1	INT/EXT	VIS
3"	SS-143	SAFETY	SHOWER	EDWIN COOPER	SOUTH - T-4M-17 (INSIDE DIKE)	1	INT/EXT	VIS
3"	SS-144	SAFETY	SHOWER	PLANT 10	1ST FLOOR - EAST - CONTROL ROOM	1	INT/EXT	VIS
3"	SS-145	SAFETY	SHOWER	PLANT 10	330 DRUM WAREHOUSE - WEST WALL	1	INT/EXT	VIS
3"	SS-146	SAFETY	SHOWER	PLANT 10	D FLOOR - WEST WALL BETWEEN T-500-4	1	INT/EXT	VIS
3"	SS-147	SAFETY	SHOWER	RIVER ROAD	TERING PLANT - BOTTOM FLOOR - NORTH	1	INT/EXT	VIS
3"	SS-148	SAFETY	SHOWER	RIVER ROAD	G PLANT - 2ND FLOOR SOUTHEAST - CON	1	INT/EXT	VIS
1"	SS-149	SAFETY	SHOWER	PT LAB	ROOM 145	1	INT/EXT	VIS
1"	SS-150	SAFETY	SHOWER	PT LAB	NORTH WING - HALLWAY	1	INT/EXT	VIS
1"	SS-151	SAFETY	SHOWER	PT LAB	ROOM 134 - BREEZEWAY	1	INT/EXT	VIS
1"	SS-152	SAFETY	SHOWER	PT LAB	ROOM 113 - CHEMICAL LAB	1	INT/EXT	VIS
1"	SS-153	SAFETY	SHOWER	PT LAB	ROOM 112 - GENERAL LAB	1	INT/EXT	VIS
1"	SS-154	SAFETY	SHOWER	PT LAB	ROOM 143	1	INT/EXT	VIS
1"	SS-155	SAFETY	SHOWER	PLANT 7	CYLINDER LOAD AREA - OUTSIDE FENCE	1	INT/EXT	VIS
2"	SS-156	SAFETY	SHOWER	PLANT 9	EAST TANK FARM @ T-20M-2	1	INT/EXT	VIS
1"	SS-157	SAFETY	SHOWER	NORTH BOILER AREA	WEST SIDE	1	INT/EXT	VIS
2"	SS-158	SAFETY	SHOWER	PLANT 1	TANK FARM @ T-18M-1	1	INT/EXT	VIS
2"	SS-159	SAFETY	SHOWER	PLANT 1	TANK FARM @ T-20M-3	1	INT/EXT	VIS
1"	SS-160	SAFETY	SHOWER	WELD SHOP	SOUTHWEST OF IPA TANK (T-18M-2)	1	INT/EXT	VIS
2"	SS-161	SAFETY	SHOWER	PLANT 9	HCN PLANT - 1ST FLOOR	1	INT/EXT	VIS
2"	SS-162	SAFETY	SHOWER	PLANT 9	HCN PLANT - 2ND FLOOR	1	INT/EXT	VIS
2"	SS-164	SAFETY	SHOWER	PLANT 12	UNDER PLANT @ STAIRS	1	INT/EXT	VIS
2"	SS-165	SAFETY	SHOWER	PLANT 12		1	INT/EXT	VIS
2"	SS-166	SAFETY	SHOWER	PLANT 12	T-8M-18 (FORMALDEHYDE TANK)	1	INT/EXT	VIS
2"	SS-167	SAFETY	SHOWER	PLANT 12	BETWEEM T-5700-1 AND T-8M-19	1	INT/EXT	VIS
2"	SS-168	SAFETY	SHOWER	PLANT 9	4TH FLOOR - SOUTH WALL	1	INT/EXT	VIS
1"	SS-169	SAFETY	SHOWER	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT	VIS
1"	SS-170	SAFETY	SHOWER	MAALOX AREA	T-30M-52 DIKE	1	INT/EXT	VIS
3"	SS-171	SAFETY	SHOWER	PLANT 14	1ST FLOOR - NORTHEAST - K-5M-1	1	INT/EXT	VIS
3"	SS-172	SAFETY	SHOWER	PLANT 14	1ST FLOOR - SOUTHWEST - T-3M-15	1	INT/EXT	VIS
3"	SS-173	SAFETY	SHOWER	PLANT 14	1ST FLOOR - NORTHWEST - SPRNKVH #15	1	INT/EXT	VIS
3"	SS-174	SAFETY	SHOWER	PLANT 14	2ND FLOOR - NORTH WALL	1	INT/EXT	VIS
3"	SS-175	SAFETY	SHOWER	PLANT 14	3RD FLOOR - NORTH WALL	1	INT/EXT	VIS
3"	SS-176	SAFETY	SHOWER	PLANT 14	1ST FLOOR - NORTHWEST - T-1437	1	INT/EXT	VIS
3"	SS-177	SAFETY	SHOWER	PLANT 14	NORTHEAST - T-11M-6	1	INT/EXT	VIS
3"	SS-178	SAFETY	SHOWER	PLANT 11	NORTHEAST - T-1107-A	1	INT/EXT	VIS
2"	SS-179	SAFETY	SHOWER	AREA 1 MAINTENANCE SHED	SOUTH WALL - OUTSIDE OF BUILDING	1	INT/EXT	VIS
3"	SS-180	SAFETY	SHOWER	AREA 1	SATELLITE SHOP - EAST SIDE	1	INT/EXT	VIS
1"	SS-181	SAFETY	SHOWER	PLANT 8 NORTH	NT 8 CONTROL ROOM - SOUTHEAST CORI	1	INT/EXT	VIS
3"	SS-182	SAFETY	SHOWER	MAINTENANCE COMPLEX	OUTSIDE - EAST WALL CARPENTER SHOP	1	INT/EXT	VIS
3"	SS-183	SAFETY	SHOWER	MAINTENANCE COMPLEX	OUTSIDE - EAST WALL CARPENTER SHOP	1	INT/EXT	VIS

2"	SS-[illegible]	SAFETY	SHOWER			PLANT 9	EAST TANK FARM - SOUTHWEST CORNER	1	INT/EXT	VIS
2"	SS-185	SAFETY	SHOWER			PLANT 9	EAST TANK FARM - SOUTHWEST CORNER	1	INT/EXT	VIS
1"	SS-186	SAFETY	SHOWER			PLANT 4	PC AREA W OF SODIUM TANK	1	INT/EXT	VIS
1"	SS-187	SAFETY	SHOWER			PT LAB	ROOM 122 - MENS ROOM	1	INT/EXT	VIS
1	SS-188	SAFETY	SHOWER			PT LAB	ROOM 123 - LADIES ROOM	1	INT/EXT	VIS
3"	SS-189	SAFETY	SHOWER			PLANT 14	NORTH - T-8M-20	1	INT/EXT	VIS
3"	SS-190	SAFETY	SHOWER			PLANT 14	EAST SIDE - SOUTH OF K-4M-19	1	INT/EXT	VIS
1	SS-191	SAFETY	SHOWER			PT LAB STORAGE BUILDING	INSIDE	1	INT/EXT	VIS
3"	SS-192	SAFETY	SHOWER			PLANT 14	NORTHWEST - T-8138-A	1	INT/EXT	VIS
3"	SS-193	SAFETY	SHOWER			PLANT 14	NORTHWEST - T-30M-53	1	INT/EXT	VIS
3"	SS-194	SAFETY	SHOWER			PLANT 9	I STREET - ACCL TANK FARM - ON DIKE W.	1	INT/EXT	VIS
3"	SS-195	SAFETY	SHOWER			PLANT 9	I STREET - ACCL TANK FARM - ON DIKE W.	1	INT/EXT	VIS
2"	SS-196	SAFETY	SHOWER			PLANT 9	TANK FARM - EAST OF OSI	1	INT/EXT	VIS
1"	SS-197	SAFETY	SHOWER			NORTH BOILER AREA	NORTHEAST CORNER	1	INT/EXT	VIS
1"	SS-198	SAFETY	SHOWER			NORTH BOILER AREA	NORTHEAST CORNER	1	INT/EXT	VIS
1"	SS-199	SAFETY	SHOWER			NORTH BOILER AREA	BOILER #3 - SOUTHEAST CORNER	1	INT/EXT	VIS
1"	SS-200	SAFETY	SHOWER			NORTH BOILER AREA	BOILER #3 - SOUTHEAST CORNER	1	INT/EXT	VIS
2"	SS-201	SAFETY	SHOWER			CHEMICAL WAREHOUSE	EAST END OF BUILDING - NORTH ROOM	1	INT/EXT	VIS
3"	SS-202	SAFETY	SHOWER			#4 BOILER	HE 9800-1 - SOUTHEAST CORNER	1	INT/EXT	VIS
1"	SS-203	SAFETY	SHOWER			MAALOX AREA	T-50M-3 DIKE	1	INT/EXT	VIS
3"	SS-204	SAFETY	SHOWER			EDWIN COOPER	T-1030B (AKA T-30M-25) - OUTSIDE DIKE	1	INT/EXT	VIS
4	SS-205	SAFETY	SHOWER			PLANT 9	RR TRACKS @ TANK CAR	1	INT/EXT	VIS
2"	SS-207	SAFETY	SHOWER			PLANT 9	EAST TANK FARM - NORTH OF T-30M-23	1	INT/EXT	VIS
1"	SS-208	SAFETY	SHOWER			PLANT 8 TANK FARM	T-5M-12 TANK FARM -SOUTHEAST	1	INT/EXT	VIS
2"	SS-209	SAFETY	SHOWER			PLANT 9	TANK FARM - EAST OF OLD PLANT 9	1	INT/EXT	VIS
3"	SS-210	SAFETY	SHOWER			PLANT 9	SOUTH SIDE - AREA 3 CLEANING PAD	1	INT/EXT	VIS
3"	SS-211	SAFETY	SHOWER			PLANT 9	ITH SIDE - D-447 (MPBACH BLOWDOWN DF	1	INT/EXT	VIS
2"	SS-212	SAFETY	SHOWER			PLANT 9	HCN PLANT - 2ND FLOOR - INSIDE	1	INT/EXT	VIS
2"	SS-213	SAFETY	SHOWER			PLANT 9	HCN PLANT - 2ND FLOOR - OUTSIDE	1	INT/EXT	VIS
2"	SS-214	SAFETY	SHOWER			PLANT 9	HCN PLANT - 1ST FLOOR - EAST SIDE	1	INT/EXT	VIS
2"	SS-215	SAFETY	SHOWER			PLANT 9	HCN PLANT - 1ST FLOOR - EAST SIDE	1	INT/EXT	VIS
3"	SS-217	SAFETY	SHOWER			PLANT 9	SOUTH TANK FARM - SOUTH OF T-7M-9	1	INT/EXT	VIS
2"	SS-218	SAFETY	SHOWER			PLANT 15	WEST SIDE	1	INT/EXT	VIS
3"	SS-219	SAFETY	SHOWER			#4 BOILER	9800-1 - UNLOADING AREA - SOUTH DIKE W	1	INT/EXT	VIS
3"	SS-220	SAFETY	SHOWER			PLANT 9	INCINERATOR TANK FARM	1	INT/EXT	VIS
2"	SS-221	SAFETY	SHOWER			PLANT 9	1125 CELL NORTH SIDE	1	INT/EXT	VIS
2"	SS-222	SAFETY	SHOWER			PLANT 9	OSI PLANT - COLUMNS	1	INT/EXT	VIS
2"	SS-223	SAFETY	SHOWER			PLANT 9	J - NORTH OF PACKAGING ROOM (EYEWA	1	INT/EXT	VIS
1"	SS-225	SAFETY	SHOWER			RIVER ROAD	PC CAUSTIC TANK - EAST SIDE	1	INT/EXT	VIS
2"	SS-226	SAFETY	SHOWER			PLANT 9	WEST SIDE	1	INT/EXT	VIS
2"	SS-227	SAFETY	SHOWER			PLANT 15	DIP PACKAGING ROOM	1	INT/EXT	VIS
2"	SS-228	SAFETY	SHOWER			PLANT 9	OSI PLANT - 1ST FLOOR	1	INT/EXT	VIS
2"	SS-229	SAFETY	SHOWER			PLANT 9	OSI PLANT - 2ND FLOOR	1	INT/EXT	VIS
2"	SS-230	SAFETY	SHOWER			PLANT 9	OSI PLANT - ROOF	1	INT/EXT	VIS
3"	SS-231	SAFETY	SHOWER			PLANT 9	OF INCINERATOR - WEST OF AMBULANCE	1	INT/EXT	VIS
3"	SS-232	SAFETY	SHOWER			PLANT 11	WEST SIDE - T-1139	1	INT/EXT	VIS
3"	SS-233	SAFETY	SHOWER			PLANT 11	DE - SPENT ACID TANK PLATFORM - GROUI	1	INT/EXT	VIS
3"	SS-234	SAFETY	SHOWER			PLANT 11	DE - SPENT ACID TANK PLATFORM - UPPE	1	INT/EXT	VIS
2"	SS-235	SAFETY	SHOWER			PLANT 12	BETWEEN T-500-50 AND K-500-15	1	INT/EXT	VIS
1"	SS-236	SAFETY	SHOWER			ANALYTICAL SERVICES	SPECIAL PROBLEMS LAB	1	INT/EXT	VIS
1"	SS-237	SAFETY	SHOWER			ANALYTICAL SERVICES	SPECIAL INSTRUMENTS LAB	1	INT/EXT	VIS
1"	SS-238	SAFETY	SHOWER			ANALYTICAL SERVICES	PHARMACEUTICAL LAB	1	INT/EXT	VIS
1"	SS-239	SAFETY	SHOWER			ANALYTICAL SERVICES	ENVIRONMENTAL LAB	1	INT/EXT	VIS
1"	SS-240	SAFETY	SHOWER			ANALYTICAL SERVICES	ALKYL LAB	1	INT/EXT	VIS
1"	SS-241	SAFETY	SHOWER			ANALYTICAL SERVICES	WET LAB	1	INT/EXT	VIS
1"	SS-242	SAFETY	SHOWER			ANALYTICAL SERVICES	VPC LAB	1	INT/EXT	VIS
1"	SS-243	SAFETY	SHOWER			PLANT 7	IER LOAD AREA - NORTH END - EAST RR T	1	INT/EXT	VIS
1"	SS-244	SAFETY	SHOWER			PLANT 5 MMT TANK FARM	T-15M-51 - NORTH SIDE	1	INT/EXT	VIS
2"	SS-245	SAFETY	SHOWER			PLANT 9	EAST TANK FARM - CENTER DIKE WALL	1	INT/EXT	VIS
1"	SS-246	SAFETY	SHOWER			RIVER ROAD	PC CAUSTIC TANK DIKE	1	INT/EXT	VIS
1"	SS-247	SAFETY	SHOWER			RIVER ROAD	PC SPENT ACID TANK DIKE	1	INT/EXT	VIS
3"	SS-248	SAFETY	SHOWER			PLANT 9	OF INCINERATOR - WEST OF AMBULANCE	1	INT/EXT	VIS
1"	SS-249	SAFETY	SHOWER			PLANT 8 TANK FARM	H STREET - EAST OF ETHYLENE LOAD SP	1	INT/EXT	VIS
3"	SS-250	SAFETY	SHOWER			MAINTENANCE COMPLEX	STOCK ROOM	1	INT/EXT	VIS
2"	SS-251	SAFETY	SHOWER			PLANT 9	EAST TANK FARM - EAST OF T-1313	1	INT/EXT	VIS
3"	SS-252	SAFETY	SHOWER			MAINTENANCE COMPLEX	VALVE SHOP - SOUTH WALL	1	INT/EXT	VIS
[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1"	SS-254	SAFETY	SHOWER		PT LAB	ROOM 117	1	INT/EXT	VIS
1"	SS-255	SAFETY	SHOWER		PT LAB	ROOM 104 - SOUTHWEST WING	1	INT/EXT	VIS
1"	SS-259	SAFETY	SHOWER		PT LAB	ROOM 110 - TOXIC LAB	1	INT/EXT	VIS
1"	SS-260	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	SODIUM WAREHOUSE - EAST SIDE	1	INT/EXT	VIS
1"	SS-261	SAFETY	SHOWER		PT LAB - OUTSIDE	BUG HOUSE - SOUTHSIDE	1	INT/EXT	VIS
4	SS-262	SAFETY	SHOWER		D & 6TH STREET	UNLOAD STATION	1	INT/EXT	VIS
4	SS-263	SAFETY	SHOWER		PLANT 9	A & 6TH STREET UNLOAD	1	INT/EXT	VIS
1	SS-263	SAFETY	SHOWER		T/T TURN AROUND	EAST OF RR TRACKS	1	INT/EXT	VIS
3"	SS-264	SAFETY	SHOWER		PLANT 9	ING TOWER 7&8 CHEMICAL SHED - WEST	1	INT/EXT	VIS
3"	SS-265	SAFETY	SHOWER		PLANT 9	COOLING TOWER #11	1	INT/EXT	VIS
3"	SS-266	SAFETY	SHOWER		PLANT 14	SIDE - COOLING TOWER #6 CHEMICAL DRU	1	INT/EXT	VIS
3"	SS-267	SAFETY	SHOWER		PLANT 14	SIDE - COOLING TOWER #9 CHEMICAL DRU	1	INT/EXT	VIS
3"	SS-268	SAFETY	SHOWER		PLANT 11	SIDE - COOLING TOWER #12 CHEMICAL DR	1	INT/EXT	VIS
3	SS-269	SAFETY	SHOWER		PLANT 14	COOLING TOWER #4 & #10	1	INT/EXT	VIS
1"	SS-270	SAFETY	SHOWER		3RD & "A" STREET		1	INT/EXT	VIS
1"	SS-271	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	T-14M-1	1	INT/EXT	VIS
3"	SS-273	SAFETY	SHOWER		PLANT 9	ACID UNLOAD SPOT	1	INT/EXT	VIS
2"	SS-274	SAFETY	SHOWER		PLANT 9	OSI PLANT - 1ST FLOOR - NORTH	1	INT/EXT	VIS
2"	SS-275	SAFETY	SHOWER		PLANT 9	TANK FARM - EAST OF OSI	1	INT/EXT	VIS
2"	SS-276	SAFETY	SHOWER		PLANT 9	TANK FARM - EAST OF OSI	1	INT/EXT	VIS
2"	SS-277	SAFETY	SHOWER		PLANT 9	PLANT - 2ND FLOOR - NORTHWEST CORN	1	INT/EXT	VIS
2"	SS-278	SAFETY	SHOWER		PLANT 9	OSI PLANT - MEZZANINE	1	INT/EXT	VIS
2"	SS-279	SAFETY	SHOWER		PLANT 9	OSI PLANT - MEZZANINE	1	INT/EXT	VIS
3"	SS-280	SAFETY	SHOWER		AREA 4	LE TANK FARM - 9TH STREET WEST OF T	1	INT/EXT	VIS
3"	SS-281	SAFETY	SHOWER		AREA 4	LE TANK FARM - 9TH STREET WEST OF T	1	INT/EXT	VIS
2"	SS-282	SAFETY	SHOWER		PLANT 9	EAST TANK FARM - NORTH OF T-80M-12	1	INT/EXT	VIS
2"	SS-283	SAFETY	SHOWER		PLANT 9	EAST TANK FARM - NORTH OF T-80M-10	1	INT/EXT	VIS
2"	SS-284	SAFETY	SHOWER		PLANT 9	EAST TANK FARM - NORHT OF T-20M-15	1	INT/EXT	VIS
2"	SS-285	SAFETY	SHOWER		PLANT 9	2ND FLOOR	1	INT/EXT	VIS
2"	SS-286	SAFETY	SHOWER		PLANT 9	EAST TANK FARM SOUTH OF T-10M-11	1	INT/EXT	VIS
3	SS-287	SAFETY	SHOWER		PLANT 11	SOUTH OF SWITCH HOUSE	1	INT/EXT	VIS
3	SS-288	SAFETY	SHOWER		PLANT 14	COOLING TOWER #15 - WEST SIDE	1	INT/EXT	VIS
3	SS-289	SAFETY	SHOWER		PLANT 11	NORTH SIDE - R-1101	1	INT/EXT	VIS
3	SS-291	SAFETY	SHOWER		PLANT 11	NORTH SIDE - R-1111	1	INT/EXT	VIS
3	SS-292	SAFETY	SHOWER		PLANT 11	EAST SIDE - E-1129	1	INT/EXT	VIS
3"	SS-293	SAFETY	SHOWER		PLANT 11	NORTH SIDE - S-1124	1	INT/EXT	VIS
3"	SS-294	SAFETY	SHOWER		PLANT 11	2nd floor east side			
3"	SS-295	SAFETY	SHOWER		PLANT 11	T115DA east side			
1"	SS-296	SAFETY	SHOWER		PLANT 4	T-40M-4 DIKE EAST OF RR TRACK	1	INT/EXT	VIS
1"	SS-297	SAFETY	SHOWER		PLANT 4	T-40M-4 DIKE EAST OF RR TRACK	1	INT/EXT	VIS
1"	SS-298	SAFETY	SHOWER		PLANT 4	T-40M-4 DIKE EAST OF RR TRACK	1	INT/EXT	VIS
1"	SS-299	SAFETY	SHOWER		ANALYTICAL SERVICES - OUTSIDE	EAST SIDE	1	INT/EXT	VIS
3	SS-300	SAFETY	SHOWER		PLANT 11	SOUTH SIDE - T-1197	1	INT/EXT	VIS
1"	SS-301	SAFETY	SHOWER		D STREET @ RR TRACKS	BETWEEN 3RD AND 4TH STREETS	1	INT/EXT	VIS
2"	SS-302	SAFETY	SHOWER		PLANT 15	T-1539 - SOUTH SIDE	1	INT/EXT	VIS
2"	SS-303	SAFETY	SHOWER		PLANT 15	1ST FLOOR	1	INT/EXT	VIS
2"	SS-304	SAFETY	SHOWER		PLANT 15	1ST FLOOR	1	INT/EXT	VIS
2"	SS-305	SAFETY	SHOWER		PLANT 15	DIP PACKAGING ROOM	1	INT/EXT	VIS
2"	SS-306	SAFETY	SHOWER		PLANT 12	NAPROXEN/DIP WAREHOUSE 4	1	INT/EXT	VIS
2"	SS-307	SAFETY	SHOWER		PLANT 15	SOUTH SIDE - WEST OF T-9M-4	1	INT/EXT	VIS
4	SS-308	SAFETY	SHOWER		PLANT 15	SOUTHWEST CORNER - WEST OF T-20M-1(	1	INT/EXT	VIS
3"	SS-309	SAFETY	SHOWER		PLANT 9	BULK STORAGE - NORTH SIDE - 10TH STR	1	INT/EXT	VIS
3"	SS-310	SAFETY	SHOWER		PLANT 9	K STORAGE - TANK CAR PLATFORM - NOF	1	INT/EXT	VIS
3"	SS-311	SAFETY	SHOWER		PLANT 9	ILK STORAGE - TANK CAR PLATFORM - EA	1	INT/EXT	VIS
1"	SS-312	SAFETY	SHOWER		D STREET	PHENOL PLATFORM @4TH AND D	1	INT/EXT	VIS
2"	SS-313	SAFETY	SHOWER		PLANT 9	NSU TANK FARM	1	INT/EXT	VIS
1"	SS-314	SAFETY	SHOWER		RIVER ROAD	CLARIFIER #2	1	INT/EXT	VIS
1"	SS-315	SAFETY	SHOWER		TRAFFIC - LIQUID PACKAGING	DIUM WAREHOUSE - EAST SIDE - LOAD SI	1	INT/EXT	VIS
2	SS-316	SAFETY	SHOWER		"D" STREET	PHENOL PLATFORM	1	INT/EXT	VIS
2"	SS-317	SAFETY	SHOWER		PLANT 9	NSU TANK FARM	1	INT/EXT	VIS
2"	SS-318	SAFETY	SHOWER		PLANT 15	SPRINKLER HOUSE - NORTH SIDE	1	INT/EXT	VIS
2"	SS-319	SAFETY	SHOWER		PLANT 15	SOUTHWEST CORNER	1	INT/EXT	VIS
2"	SS-320	SAFETY	SHOWER		PLANT 15	NAPROXEN CRUDE STACKUP - 3RD FLOOR	1	INT/EXT	VIS
2"	SS-321	SAFETY	SHOWER		PLANT 15	OXEN CRUDE STACKUP - 2ND FLOOR - EAS	1	INT/EXT	VIS
2"	SS-322	SAFETY	SHOWER		PLANT 15	XEN CRUDE STACKUP - 2ND FLOOR - WES	1	INT/EXT	VIS
2"	SS-323	SAFETY	SHOWER		PLANT 15	NAPROXEN UNLOAD AREA	1	INT/EXT	VIS

2"	SS-32	SAFETY	SHOWER	PLA 5	XEN GRUDE STACKUP - 1ST FLOOR - WES	1	INT/EX		VIS
1"	SS-325	SAFETY	SHOWER	PLANT 4	NORTH SIDE ON 3RD STREET	1	INT/EXT		VIS
1"	SS-327	SAFETY	SHOWER	PLANT 8 3RD FLOOR	EAST SIDE - NORTH WALL @ DOOR	1	INT/EXT		VIS
1"	SS-328	SAFETY	SHOWER	Plant 8 Control room - NORTH SIDE	LANT 8 CYLINDER FILL SHED - NORTH SID	1	INT/EXT		VIS
2"	SS-329	SAFETY	SHOWER	PLANT	3RD FLOOR - NORTHEASE OF K123	1	INT/EXT		VIS
1"	SS-330	SAFETY	SHOWER	PLANT 8 TANK FARM	4th & A STREET - EAST OF T-15M-42	1	INT/EXT		VIS
2"	SS-331	SAFETY	SHOWER	PLANT 1	LOOR - NORTHEASE OF SPRINKLER HOU	1	INT/EXT		VIS
2"	SS-332	SAFETY	SHOWER	PLANT 1	ROOF - EAST SIDE	1	INT/EXT		VIS
2"	SS-333	SAFETY	SHOWER	PLANT 9	ID LEVEL PLATFORM - NORTH SIDE OF R1	1	INT/EXT		VIS
3"	SS-334	SAFETY	SHOWER	PLANT 10	330 BULK PACKAGING	1	INT/EXT		VIS
2"	SS-335	SAFETY	SHOWER	PLANT 9	HCN PROCESSING PLANT - MEZZANINE	1	INT/EXT		VIS
3"	SS-336	SAFETY	SHOWER	CONTRACTOR COMPOUND	WELD SHED - SOUTH SIDE BESIDE DIESE	1	INT/EXT		VIS
3"	SS-338	SAFETY	SHOWER	PLANT 14	NORTHWEST OF T-11M-6 (OUTSIDE DIKE)	1	INT/EXT		VIS
1"	SS-339	SAFETY	SHOWER	PLANT 4	TOP OF V1 PLATFORM	1	INT/EXT		VIS
1"	SS-340	SAFETY	SHOWER	PLANT 4	TOP OF D12 PLATFORM	1	INT/EXT		VIS
1"	SS-341	SAFETY	SHOWER	PLANT 4	BOTTOM OF D12 PLATFORM	1	INT/EXT		VIS
1"	SS-342	SAFETY	SHOWER	PLANT 4	TOP OF V2 PLATFORM	1	INT/EXT		VIS
2"	SS-344	SAFETY	SHOWER	PLANT 9	2ND FLOOR UPSTAIR PLATFORM OVR R14	1	INT/EXT		VIS
3"	SS-345	SAFETY	SHOWER	PLANT 9	HCN WAREHOUSE #1 - NORTH END	1	INT/EXT		VIS
2"	SS-346	SAFETY	SHOWER	PLANT 9	SPRINKLER HOUSE 1# - WEST SIDE	1	INT/EXT		VIS
2"	SS-347	SAFETY	SHOWER	PLANT 9	OLD PLANT - 3RD FLOOR - SOUTH WALL	1	INT/EXT		VIS
2"	SS-348	SAFETY	SHOWER	PLANT 9	OLD PLANT - 3RD FLOOR - H111	1	INT/EXT		VIS
2"	SS-349	SAFETY	SHOWER	PLANT 9	LIME SLAKER - WEST SIDE IN T9240 DIKE	1	INT/EXT		VIS
3"	SS-350	SAFETY	SHOWER	PLANT 9	HCN BULK STORAGE - HCN FLARE	1	INT/EXT		VIS
2"	SS-351	SAFETY	SHOWER	PLANT 9	OSI CARBON HOUSE	1	INT/EXT		VIS
2"	SS-352	SAFETY	SHOWER	PLANT 15	GROUND LEVEL BY D-1518	1	INT/EXT		VIS
1"	SS-353	SAFETY	SHOWER	RIVER ROAD	AERATION BASIN	1	INT/EXT		VIS
3"	SS-354	SAFETY	SHOWER	PLANT 14	NORTH - T-8M-20	1	INT/EXT		VIS
2"	SS-355	SAFETY	SHOWER	PLANT 9	ROOF OVER R 811 HCN CELL	1	INT/EXT		VIS
2"	SS-356	SAFETY	SHOWER	PLANT 15	1ST FLOOR CLEAN ROOM	1	INT/EXT		VIS
2"	SS-357	SAFETY	SHOWER	PLANT 15	S TANK FARM	1	INT/EXT		VIS
2"	SS-358	SAFETY	SHOWER	PLANT 15	N.W SIDE GROUND LEVEL	1	INT/EXT		VIS
2"	SS-359	SAFETY	SHOWER	PLANT 15	2ND FLOOR CLEAN ROOM	1	INT/EXT		VIS
2"	SS-360	SAFETY	SHOWER	PLANT 12	1ST FLOOR SW SIDE	1	INT/EXT		VIS
3"	SS-361	SAFETY	SHOWER	#4 BOILER	TANK FARM	1	INT/EXT		VIS
3"	SS-362	SAFETY	SHOWER	#4 BOILER	TANK FARM	1	INT/EXT		VIS
2"	SS-363	SAFETY	SHOWER	PLANT 15	1ST CLEAN ROOM	1	INT/EXT		VIS
5	SS-364	SAFETY	SHOWER	PLANT 15	1ST CLEAN ROOM	1	INT/EXT		VIS
3"	SS-368	SAFETY	SHOWER	AREA 4	LE TANK FARM - 9TH STREET WEST OF T	1	INT/EXT		VIS
2"	SS-369	SAFETY	SHOWER	PLANT 9	OLD PLANT 4th FLOOR WALKWAY	1	INT/EXT		VIS
2"	SS-370	SAFETY	SHOWER	PLANT 15	N/EAST CORNER TRAILER UNLOAD PAD	1	INT/EXT		VIS
3"	SS-371	SAFETY	SHOWER	PLANT 14	NORTH EAST OF V-1407	1	INT/EXT		VIS
3"	SS-372	SAFETY	SHOWER	Maintanace complex	South wall by parts washer	1	INT/EXT		VIS
3"	SS-373	SAFETY	SHOWER	HCL Railcar	On Platform	1	INT/EXT		VIS
1"	TN-001	TURRET	NOZZLE	TRAFFIC - LIQUID PACKAGING	2ND & "A" STREET	1	INT/EXT		VIS
1"	TN-002	TURRET	NOZZLE	T/T TURN AROUND	1ST STREET - NORTH SIDE	1	INT/EXT		VIS
1"	TN-003	TURRET	NOZZLE	AREA 2	DROP ZONE D ON 2ND STREET	1	INT/EXT		VIS
1"	TN-004	TURRET	NOZZLE	PLANT 7	CYLINDER RESTORATION AREA	1	INT/EXT		VIS
1"	TN-005	TURRET	NOZZLE	PLANT 8	T-10M-11 - SOUTHEAST SIDE	1	INT/EXT		VIS
1"	TN-006	TURRET	NOZZLE	PLANT 8 TANK FARM	T-5M-12 DIKE - NORTH OF DIKE	1	INT/EXT		VIS
1"	TN-007	TURRET	NOZZLE	PLANT 9	EAST OF EMERGENCY GENERATOR	1	INT/EXT		VIS
1"	TN-008	TURRET	NOZZLE	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM SOUTH OF SUBOFFICE	1	INT/EXT		VIS
1"	TN-009	TURRET	NOZZLE	AREA 2 SUBOFFICE @ 4TH & "B"	TANK FARM EAST OF SUBOFFICE	1	INT/EXT		VIS
1"	TN-010	TURRET	NOZZLE	PLANT 5 MMT TANK FARM	4TH STREET	1	INT/EXT		VIS
1"	TN-011	TURRET	NOZZLE	PLANT 5 MMT TANK FARM	MMT CONTROL ROOM - SOUTHWEST SIDE	1	INT/EXT		VIS
1"	TN-012	TURRET	NOZZLE	MAALOX AREA	D STREET @ T-30M-14	1	INT/EXT		VIS
2"	TN-013	TURRET	NOZZLE	RIVER ROAD	NORTH - PRIMARY CLARIFIER	1	INT/EXT		VIS
2"	TN-014	TURRET	NOZZLE	CHEMICAL WAREHOUSE	5TH STREET BESIDE LOADING RAMP	1	INT/EXT		VIS
1"	TN-015	TURRET	NOZZLE	PLANT 5 MMT TANK FARM	INKLER HOUSE 5 - SOUTH SIDE @ 5TH STF	1	INT/EXT		VIS
2"	TN-016	TURRET	NOZZLE	PLANT 15	WEST SIDE	1	INT/EXT		VIS
2"	TN-017	TURRET	NOZZLE	PLANT 15	NORTH SIDE	1	INT/EXT		VIS
2"	TN-018	TURRET	NOZZLE	PLANT 15	EAST SIDE	1	INT/EXT		VIS

2"	TN-019	TURRET	NOZZLE	PLANT 9	LIME SILO	1	INT/EXT	VIS
2"	TN-020	TURRET	NOZZLE	PLANT 15	SOUTH SIDE	1	INT/EXT	VIS
2"	TN-021	TURRET	NOZZLE	PLANT 9	SOUTH OF OST COLUMN	1	INT/EXT	VIS
3"	TN-022	TURRET	NOZZLE	PLANT 9	"A" STREET - WEST SIDE	1	INT/EXT	VIS
3"	TN-023	TURRET	NOZZLE	PLANT 9	SOUTHEAST CORNER	1	INT/EXT	VIS
3"	TN-024	TURRET	NOZZLE	PLANT 9	HCN BUILDING - NORTH END	1	INT/EXT	VIS
3"	TN-025	TURRET	NOZZLE	PLANT 10	SOUTH SIDE - T-370-6 OR D-446	1	INT/EXT	VIS
3"	TN-026	TURRET	NOZZLE	PLANT 10	SOUTHWEST CORNER	1	INT/EXT	VIS
3"	TN-027	TURRET	NOZZLE	PLANT 14	NORTH SIDE - T-15M-44 (FUEL OIL TANK)	1	INT/EXT	VIS
3"	TN-028	TURRET	NOZZLE	#4 BOILER	HE-3800-1 - NORTH SIDE	1	INT/EXT	VIS
3"	TN-029	TURRET	NOZZLE	#4 BOILER	HE-3800-1 - NORTHWEST CORNER	1	INT/EXT	VIS
3"	TN-030	TURRET	NOZZLE	PLANT 14	NORTHEAST CORNER	1	INT/EXT	VIS
3"	TN-31	TURRET	NOZZLE	Plant 11	South side SVH 22	1	INT/EXT	VIS
3"	TN-032	TURRET	NOZZLE	PLANT 11	EAST SIDE - T-1136	1	INT/EXT	VIS
3"	TN-034	TURRET	NOZZLE	PLANT 11	NORTHEAST - SPRNKVH-023	1	INT/EXT	VIS
3"	TN-035	TURRET	NOZZLE	PLANT 11	NORTH SIDE - COOLING TOWER #15	1	INT/EXT	VIS
1"	TN-036	TURRET	NOZZLE	NORTH E&I SHOP	SOUTHWEST SIDE	1	INT/EXT	VIS
3"	TN-040	TURRET	NOZZLE	PLANT 11	NORTH SIDE - COOLING TOWER #12	1	INT/EXT	VIS
3"	TN-041	TURRET	NOZZLE	PLANT 11	"D" & 6TH STREET	1	INT/EXT	VIS
3"	TN-042	TURRET	NOZZLE	PLANT 11	"D" & 8TH STREET	1	INT/EXT	VIS
3"	TN-043	TURRET	NOZZLE	PLANT 9	9TH STREET - NORTH SIDE	1	INT/EXT	VIS
3"	TN-044	TURRET	NOZZLE	PLANT 9	SOUTH SIDE - T-30M-74	1	INT/EXT	VIS
3"	TN-045	TURRET	NOZZLE	PLANT 11	SCRUBBER C-1172 - EAST SIDE	1	INT/EXT	VIS
3"	TN-046	TURRET	NOZZLE	PLANT 11	New Control Room	1	INT/EXT	VIS
2"	TN-047	TURRET	NOZZLE	PLANT 15	NORTHWEST CORNER	1	INT/EXT	VIS
3"	TN-048	TURRET	NOZZLE	PLANT 9	BULK HCN FACILITY - NORTH SIDE	1	INT/EXT	VIS
2"	TN-049	TURRET	NOZZLE	PLANT 9	"B" & 6TH STREETS	1	INT/EXT	VIS
2"	TN-050	TURRET	NOZZLE	DRUMMING SHED	SOUTHWEST	1	INT/EXT	VIS
1"	TN-051	TURRET	NOZZLE	ISOBUTYLENE TANK FARM	RAILCAR UNLOAD SPOT NW SIDE	1	INT/EXT	VIS
1"	TN-052	TURRET	NOZZLE	ISOBUTYLENE TANK FARM	RAILCAR UNLOAD SPOT EAST SIDE	1	INT/EXT	VIS
1"	TN-053	TURRET	NOZZLE	ISOBUTYLENE TANK FARM	RAILCAR UNLOAD SW SIDE	1	INT/EXT	VIS
1"	TN-054	TURRET	NOZZLE	PLANT 7	ENTRANCE TO PLANT 7	1	INT/EXT	VIS
1"	TN-055	TURRET	NOZZLE	PLANT 7	EAST OF CYLINDER CLEANING PAD	1	INT/EXT	VIS
1"	TN-056	TURRET	NOZZLE	PLANT 7	EAST OF CYLINDER FILL STATION	1	INT/EXT	VIS

Appendix C – Coordination Agreements

Appendix C – Coordination Agreements

SI Group
The Substance Inside

PO Box 1028
725 Cannon Bridge Road
Orangeburg, SC 29116-1028
T. +1.803.534.5781
www.siigroup.com

January 15, 2018

Mr. Billy Staley
Emergency Services Director
Orangeburg County Emergency Preparedness Office
PO Drawer 9000
Orangeburg, SC 29116-9000

CERTIFIED MAIL/RETURN RECEIPT: 7016 0600 0001 1947 1276

RE: Emergency Assistance Confirmation

Dear Mr. Staley:

As you are aware, SI Group has been a valued neighbor in the Orangeburg community for years. We are proud to be an important part of Orangeburg's positive history and welcome future successes.

As you may already know, our site is a large quantity generator of hazardous waste. Both federal and state regulations require that the site maintain a contingency plan that outlines the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned released of hazardous waste. Copies of this plan (termed the RCRA Contingency Plan) are submitted to local emergency response personnel whenever there is an update to the plan. Additionally, these same regulations require the site to obtain verification from responding emergency response agencies that requests for emergency assistance will be provided when needed.

To acknowledge that you will provide such services, please have a representative of your agency date and sign the appropriate spaces provided below. A return envelope has been included for your convenience.

Should you require additional information, please contact me at 803-539-5490.

Sincerely,

Lisa Luna
Manager, Environmental Compliance

Enclosure

The County of Orangeburg will respond to any SI Group requests for emergency assistance.

Date: 2/6/18

Signed: Harold M. Y...

Title: County Administrator

7016 0600 0001 1947 1498

SI Group
The Substance Inside

Made 2/7/18

PO Box 1028
725 Cannon Bridge Road
Orangeburg, SC 29116-1028
T. +1.803.534.5781
www.siigroup.com

February 7, 2018

Col. CN Williamson
South Carolina Highway Patrol Commander
PO Box 1993
Blythewood, SC 29016

CERTIFIED MAIL/RETURN RECEIPT: 7016 0600 0001 1947 1498

RE: Emergency Assistance Confirmation

Dear Col. Lancaster:

As you are aware, SI Group has been a valued neighbor in the Orangeburg community for years. We are proud to be an important part of Orangeburg's positive history and welcome future successes.

As you may already know, our site is a large quantity generator of hazardous waste. Both federal and state regulations require that the site maintain a contingency plan that outlines the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned released of hazardous waste. Copies of this plan (termed the RCRA Contingency Plan) are submitted to local emergency response personnel whenever there is an update to the plan. Additionally, these same regulations require the site to obtain verification from responding emergency response agencies that requests for emergency assistance will be provided when needed.

To acknowledge that you will provide such services, please have a representative of your agency date and sign the appropriate spaces provided below. A return envelope has been included for your convenience.

Should you require additional information, please contact me at 803-539-5490.

Sincerely,

Lisa Luna
Manager, Environmental Compliance

Enclosure

The _____ will respond to any SI Group requests for emergency assistance as appropriate within their jurisdiction. Type and/or amount of emergency assistance is at the agency's discretion and within their typical responsibilities.

Date: _____ Signed: _____

Title: _____

7016 0600 0001 1947 1252

SI Group
The Substance Inside

Received 1/16/18

PO Box 1028
725 Cannon Bridge Road
Orangeburg, SC 29116-1028
T. +1.803.534.5781
www.siigroup.com

January 15, 2018

Mr. Mike Adams
Dept. of Public Safety
City of Orangeburg
1320 Middleton Street
Orangeburg, SC 29115

CERTIFIED MAIL/RETURN RECEIPT: 7016 0600 0001 1947 1252

RE: Emergency Assistance Confirmation

Dear Mr. Adams:

As you are aware, SI Group has been a valued neighbor in the Orangeburg community for years. We are proud to be an important part of Orangeburg's positive history and welcome future successes.

As you may already know, our site is a large quantity generator of hazardous waste. Both federal and state regulations require that the site maintain a contingency plan that outlines the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned released of hazardous waste. Copies of this plan (termed the RCRA Contingency Plan) are submitted to local emergency response personnel whenever there is an update to the plan. Additionally, these same regulations require the site to obtain verification from responding emergency response agencies that requests for emergency assistance will be provided when needed.

To acknowledge that you will provide such services, please have a representative of your agency date and sign the appropriate spaces provided below. A return envelope has been included for your convenience.

Should you require additional information, please contact me at 803-539-5490.

Sincerely,

Lisa Luna
Manager, Environmental Compliance

Enclosure

The _____ will respond to any SI Group requests for emergency assistance.

Date: _____ Signed: _____

Title: _____

7016 0600 0001 1947 1306

SI Group
The Substance Inside

Mailed 1/16/18

PO Box 1028
725 Cannon Bridge Road
Orangeburg, SC 29116-1028
T. +1.803.534.5781
www.siigroup.com

January 15, 2018

Mr. Leroy Ravenell
Orangeburg County Sheriff Department
PO Drawer 9000
Orangeburg, SC 29116-9000

CERTIFIED MAIL/RETURN RECEIPT: 7016 0600 0001 1947 1306

RE: Emergency Assistance Confirmation

Dear Mr. Ravenall:

As you are aware, SI Group has been a valued neighbor in the Orangeburg community for years. We are proud to be an important part of Orangeburg's positive history and welcome future successes.

As you may already know, our site is a large quantity generator of hazardous waste. Both federal and state regulations require that the site maintain a contingency plan that outlines the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned released of hazardous waste. Copies of this plan (termed the RCRA Contingency Plan) are submitted to local emergency response personnel whenever there is an update to the plan. Additionally, these same regulations require the site to obtain verification from responding emergency response agencies that requests for emergency assistance will be provided when needed.

To acknowledge that you will provide such services, please have a representative of your agency date and sign the appropriate spaces provided below. A return envelope has been included for your convenience.

Should you require additional information, please contact me at 803-539-5490.

Sincerely,

Lisa Luna
Manager, Environmental Compliance

Enclosure

The _____ will respond to any SI Group requests for emergency assistance.

Date: _____ Signed: _____

Title: _____

7016 0600 0001 1947 1269

SI Group
The Substance Inside

7/16/18 11/16/18

PO Box 1028
725 Cannon Bridge Road
Orangeburg, SC 29116-1028
T. +1.803.534.5781
www.siigroup.com

January 15, 2018

Ms. Thelma Williams
The Regional Medical Center
3000 St. Matthew Road
Orangeburg, SC 29118

CERTIFIED MAIL/RETURN RECEIPT: 7016 0600 0001 1947 1269

RE: Emergency Assistance Confirmation

Dear Ms. Williams:

As you are aware, SI Group has been a valued neighbor in the Orangeburg community for years. We are proud to be an important part of Orangeburg's positive history and welcome future successes.

As you may already know, our site is a large quantity generator of hazardous waste. Both federal and state regulations require that the site maintain a contingency plan that outlines the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned released of hazardous waste. Copies of this plan (termed the RCRA Contingency Plan) are submitted to local emergency response personnel whenever there is an update to the plan. Additionally, these same regulations require the site to obtain verification from responding emergency response agencies that requests for emergency assistance will be provided when needed.

To acknowledge that you will provide such services, please have a representative of your agency date and sign the appropriate spaces provided below. A return envelope has been included for your convenience.

Should you require additional information, please contact me at 803-539-5490.

Sincerely,

Lisa Luna
Manager, Environmental Compliance

Enclosure

The _____ will respond to any SI Group requests for emergency assistance.

Date: _____ Signed: _____

Title: _____

SI Group
The Substance Inside

Mailed 1/16/18

PO Box 1028
725 Cannon Bridge Road
Orangeburg, SC 29116-1028
T. +1.803.534.5781
www.siigroup.com

January 15, 2018

Mr. Danny Rivers
Orangeburg County Emergency Medical Services
PO Drawer 9000
Orangeburg, SC 29116-9000

CERTIFIED MAIL/RETURN RECEIPT: 7016 0600 0001 1947 1283

RE: Emergency Assistance Confirmation

Dear Mr. Rivers:

As you are aware, SI Group has been a valued neighbor in the Orangeburg community for years. We are proud to be an important part of Orangeburg's positive history and welcome future successes.

As you may already know, our site is a large quantity generator of hazardous waste. Both federal and state regulations require that the site maintain a contingency plan that outlines the actions that will be taken to minimize hazards to human health or the environment from fires, explosions, and any unplanned released of hazardous waste. Copies of this plan (termed the RCRA Contingency Plan) are submitted to local emergency response personnel whenever there is an update to the plan. Additionally, these same regulations require the site to obtain verification from responding emergency response agencies that requests for emergency assistance will be provided when needed.

To acknowledge that you will provide such services, please have a representative of your agency date and sign the appropriate spaces provided below. A return envelope has been included for your convenience.

Should you require additional information, please contact me at 803-539-5490.

Sincerely,

Lisa Luna
Manager, Environmental Compliance

Enclosure

The _____ will respond to any SI Group requests for emergency assistance.

Date: _____ Signed: _____

Title: _____

Appendix D – Decontamination Procedures

Introduction

It is the intent of this procedure to provide a pre-planned guide for handling the decontamination of contaminates from the workers and/equipment used during an emergency. Decontamination is the removing or neutralizing of the contaminates. Decontamination is to prevent the spread of the contaminates to other areas.

DECONTAMINATION PROCEDURES

1. DECONTAMINATION PLAN

A. A decontamination plan should be initialized by the Incident Commander, Safety Officer or Operations Chief before any personnel or equipment are allowed to exit areas where the potential for exposure to hazardous substances exists.

The use of safety showers is an acceptable decontamination method for the majority of the materials on site. For all other materials that require additional decontamination a decontamination plan as suggested below should be used. NOTE - Decontamination is based on the contaminate (see MSDS for reference).

The decontamination plan should:

a. Determine the number and layout of decontamination stations;
b. Determine the decontamination equipment needed;
c. Determine appropriate decontamination methods;
d. Establish procedures to prevent contamination of clean areas;
e. Establish methods and procedures to minimize wearer contact with contaminants during removal of personal protective clothing; and
f. Establish methods for disposing of clothing and equipment that are not completely decontaminated.

B. The plan should be revised whenever the type of personal protective clothing or equipment changes, the use conditions change, or the chemical hazards are reassessed based on new information.

C. The decontamination process should consist of a series of procedures performed in a specific sequence. For chemical protective ensembles, outer, more heavily contaminated items (e.g., outer boots and gloves) should be decontaminated and removed first, followed by decontamination and removal of inner, less contaminated items (e.g. jackets and pants).

D. Stations should be separated physically to prevent cross contamination and should be arranged in order of decreasing contamination, preferably in a straight line. Separate flow patterns and stations should be provided to isolate workers from different contamination zones containing incompatible wastes. Entry and exit points to exposed areas should be conspicuously marked. Dressing stations for entry to the decontamination area should be separate from redressing areas for exit from the decontamination area. Personnel who wish to enter clean areas of the decontamination facility, such as locker rooms, should be completely decontaminated.

E. All equipment used for decontamination must be decontaminated and/or disposed of properly. Buckets, brushes, clothing, tools, and other contaminated equipment should be collected, placed in containers, and labeled. Also, all spent solutions and wash water should be collected and disposed of properly. Clothing that is not completely decontaminated should be placed in plastic bags, pending further decontamination and/or disposal.

F. Decontamination of workers who initially come in contact with personnel and equipment leaving exposure or contamination areas will require more protection from contaminants than decontamination workers who are assigned to the last station in the decontamination line. In some cases, decontamination personnel should wear the same levels of protective clothing as workers in the exposure or contaminated areas. In other cases, decontamination personnel may be sufficiently protected by wearing one level lower protection (e.g., wearing Level B protection while decontaminating workers who are wearing Level A).

2. PREVENTION OF CONTAMINATION

In all cases, where possible, work practices and control methods will be used to prevent or minimize contamination, included but not limited to:

A. Minimizing contact with hazardous substances (e.g. do not walk through areas of obvious contamination, do not directly touch potentially hazardous substances).

B. Use remote sampling, handling, and container-opening techniques (e.g. drum grapples, pneumatic impact wrenches).

C. Protect monitoring and sampling instruments by bagging. Make openings in the bags for sample ports and sensors that must contact site materials.

D. Wear disposable outer garments and use disposable equipment where appropriate.

E. Cover equipment and tools with a strippable coating that can be removed during decontamination.

F. Encase the source of contaminants, e.g., with plastic sheeting or overpacks.

G. Ensure all closures and ensemble component interfaces are completely secured and that no open pockets that could serve to collect contaminant are present.

H. Minimizing contact time with contaminated materials.

I. Diluting contaminants, if possible and feasible.

J. Cooling contaminants prior to handling.

K. Solidify, or thicken liquid contaminants to reduce permeability through PPE; or adjust physical state to improve handling characteristics.

3. DECONTAMINATION METHODS

A. Decontamination methods will be employed to**:**

a. Physically remove contaminants,
b. Inactivate contaminants by chemical neutralization,
c. Disinfect/sterilize, or
d. Remove contaminants by a combination of physical and chemical means.

B In general, gross decontamination will be accomplished using detergents (surfactants) in water combined with a physical scrubbing action (where contaminants are compatible with water). This process will remove most forms of surface contamination including dusts, many inorganic chemicals, and some organic chemicals.

C. Where soapy water scrubbing of protective suits is not effective in removing oily or tacky organic substances (e.g., transformer oil) organic solvents such as petroleum distillates may allow easier removal of heavy organic contamination**.** Solvents used for decontamination may result in other problems**,** which must be controlled, including:

a. Permeation into clothing components, pulling the contaminant with it;
b. Spreading localized contaminant into other areas of the clothing; and
c. Generating large volumes of contaminated solvents that require disposal.

D. PPE and equipment that cannot be decontaminated effectively, without resulting in further exposure or secondary contamination, must be discarded (in accordance with waste disposal regulations).

4. DECONTAMINATION FOR PROTECTIVE CLOTHING REUSE

Due to the difficulty in assessing contamination levels in chemical protective clothing before and after exposure, the responsible supervisor or safety professional must determine if the respective clothing can be reused. This decision involves considerable risk in determining clothing to be contaminant-free. Reuse can be considered if, in the estimate of the supervisor:

A. No "significant" exposures have occurred.

B. Decontamination methods have been successful in reducing contamination levels to safe or acceptable concentrations, based on testing and analysis of decontaminated materials/PPE.

C. Contamination by known or suspected carcinogens should warrant automatic disposal. Use of disposable suits is highly recommended when extensive contamination is expected.

5. EMERGENCY DECONTAMINATION

A. In addition to routine decontamination procedures, emergency decontamination procedures must be established. In an emergency, the primary concern is to prevent the loss of life or severe injury to personnel. If immediate medical treatment is required to save a life, decontamination shall be completed prior to receiving medical treatment. If decontamination can be performed without interfering with essential life-saving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life, decontamination should be continued.

B. If an emergency due to a heat-related illness develops, protective clothing should be removed from the victim as soon as possible to reduce the heat stress. During an emergency, provisions must also be made for protecting medical personnel and disposing of contaminated clothing and equipment.

6. EMERGENCY DECONTAMINATION FOR CATEGORY 3 MATERIALS

A. Decontamination procedures for emergency decontamination when there is a suspected exposure to a Category 3 material will be those outlined above. If the MSDS for a particular material provides alternate methods for decontamination, it will be followed. As is practical, first decontamination will be conducted in the category 3 containment room.**

Date:	Description of Change
08/20/07	Update to reflect additions for Category 3 handling. ****6. EMERGENCY DECONTAMINATION FOR CATEGORY 3 MATERIALS** A. Decontamination procedures for emergency decontamination when there is a suspected exposure to a Category 3 material will be those outlined above. If the MSDS for a particular material provides alternate methods for decontamination, it will be followed. As is practical, first decontamination will be conducted in the category 3 containment room.**
10/6/09	Biennial review. No changes.
02/29/12	Changed wording in section 5. Emergency Decontamination.
03/10/14	Biennial review. No revisions required.
09/26/16	Corrected tabbing throughout document.
02/13/17	Revised to capture correct number sequence.
02/04/20	Biennial review. No changes.

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SECTION H
PERSONNEL TRAINING
[40 CFR 264.16; 270.14(b)(12); SCR.61-79.264.16; and SC R.61-79.270.14 (t)]

Information in this section details the training program instituted by SI Group for personnel involved in hazardous waste management activities at the Orangeburg Plant. The personnel training program is directed by the Manager of Health, Safety, & Security. The Senior Training Specialist & Assistant Training Coordinator are responsible for coordinating and directing onsite training.

The training program is structured to ensure that personnel assigned to the hazardous waste boiler and associated storage tanks are in compliance with the technical and administrative standards established under U.S. EPA, RCRA, and OSHA requirements. The training program instructs personnel in proper transfer procedures and operations during normal and emergency operations at these areas. A training matrix for the facility is in Appendix H-1. The matrix identifies the following information:

- Job title/position
- Job description as it is related to RCRA compliance
- Training that each position receives

H.1 Outline of Introductory Training Programs

The Health, Safety, and Security Department conducts mandated OSHA training that includes but is not limited to, the following areas: alarm systems, evacuation procedures, PPE, respiratory protection, emergency response, hazard communication, and fire extinguishers.

New employees at the facility are required to complete an orientation program presented by the Safety Department. The New Employee Orientation program includes the following safety topics: the alarm system, evacuation procedures, reporting of emergencies, hearing conservation, safety policies and procedures, safety awards program, review of past statistics, fire extinguisher use, respiratory protection, back safety, general hazard communications (HazCom) standards, and confined space entry. An overview of the new employee orientation is in Appendix H-2. Area specific HazCom training is also provided to new employees. No worker is allowed to work unsupervised or independent until he has completed job-specific training.

H.2 Continuing Training

Ongoing safety training is conducted via Computer Based Training (CBTs) using the site's Learning Information Management System software. The software system tracks completion of all CBTs, associated test results, and also provides reminders to management of those individuals who have not completed required training.

H.2.1 Safety Modules

Annual Safety CBTs include the following training modules:

• Asbestos and Mastic	• Cellphone Policy
• Asphyxiation	• Bloodborne Pathogens
• Cardinal Safety Rules	• Confined Space Entry
• Dust Explosions	• Fall Protection
• Fire Safety	• Hazard Communication
• HCN Awareness	• Hot Work
• Lead Awareness	• Ladder Safety
• Phenol Safety	• Plant Wide Evacuation Procedure
• PPE	• PSM – Area Specific
• PSM – Environmental and Utilities	• Security
• PSM/RMP Overview	• PSM – Traffic
• Shelter in Place	• Respirator Fit Test

H.2.2 Emergency Preparedness:

The annual CBT covers the following topics:

• RCRA Contingency Plan	• Plant Alarm System
• How to Activate the Plant Alarm System	• Pull Station Alarms
• Emergency Phone Number	• Plant Radios
• Plant Evacuation Alarm	• HCN Alarm
• Local Area Evacuation	• Community Warning Siren
• Personnel Accounting	• Emergency Centers
• Emergency Response Team	• Incident Commander/EMTs
• WISER System	• Small Fires/Spills

H.2.3 Resource Conservation and Recovery Act Training:

The Environmental Department is responsible for RCRA training. Annual RCRA training is conducted via CBT and includes hazardous waste, universal waste, spill control/emergency response, storage, labeling, inspections, and recordkeeping.

Additionally, annual classroom RCRA training is conducted by the Manager — Environmental Compliance or the Environmental Engineer and includes the following topics for the 1.5 hour classroom hours:

• Waste Determination	• Types of Hazardous Waste
• Listed Waste	• Speculative Accumulation
• Storage of Hazardous Waste	• SAAs/< 90 Day Storage/ < 90 Day Trailer Pad
• No. 4 Boiler and Associated Waste Tanks	
• Empty Containers	• Hazardous Waste Piping
• Proper Sampling	• Contingency Plan
• Waste Tanks	• Universal Waste
• Waste Minimization	• Reportable Quantity/Spill Reporting
• Non Hazardous Waste Storage	• Spills

H.2.4 Department of Transportation HM-126-F Training

General DOT Awareness training is provided to all employees via CBT on an annual basis. Logistic employees receive new employee training classroom training and recurring training every three years.

Per 49 CFR 172.704 HM126F, employees who load, unload, or handle hazardous materials in a matter that interfaces with the transportation system are considered Hazardous Materials (HazMat) employees. Training for newly hired HazMat employees includes General Awareness and Familiarization instruction on the DOT regulations and then follows with much more detailed function-specific instruction involving the actual application of these regulations to the daily job related functions performed by facility personnel. Newly assigned HazMat employees will be given this training within 90 days of the date of the assignment and before being considered qualified for unsupervised work in a HazMat function.

Recurrent training will be conducted every three years, at a minimum. International Air Transport Association training is provided as needed to those HazMat employees who may engage in shipments of hazardous materials via air transportation.

H.2.5 Leak Detection and Repair Training

Leak Detection and Repair (LDAR) Training is provided to all employees, except office personnel, via CBT on an annual basis. There are two different sessions and quizzes are taken at the completion of each session. A summary of each session is below.

Leak Detection and Repair — Session I

- What is LDAR
- What Defines a Leak
- What are Fugitive Emissions
- Equipment that falls under LDAR Regulations
- LDAR Regulations that apply to the facility
- LDAR Tagging System
- How can a Leak be Detected
- What to do when I Detect a "Potential Leak"
- What to do when a LDAR Pressure Relief Device Unseats
- What to do when LDAR Flange Seal Breaks
- Changes to Equipment/Procedures under LDAR
- Requirements for Internal Documentation for spills under LDAR (work order creation and incident report follow-up)

Leak Detection and Repair — Session II "What is Your Role"

- Your Role under LDAR
- Tags (what are tags used for, when to remove tags, replacing tags)
- Leaks (work order notifications)
- Maintenance Department Role (timeframe to make first attempt, when it must be repaired/delay of repair)
- Follow-up (notify LDAR group so they can verify the leak has been repaired)

H.2.6 Boiler Operator Technician Training

Boiler/Utility Technicians are trained on the following through on the job training:

- Feed Systems for Boilers
- Water Softener Systems

- Purpose of Deaerator Systems
- Startup and Shutdowns on the Boilers (how to start up on gas, fuel oil, and waste [for Boiler No.4]; emergency shutdowns; startup from emergency shutdown, and power failure)
- Equipment
- Water Treatment
- Process Hazards and Risks (hazards present; required PPE; administrative and engineering controls; lockout-tagout)
- Fire Water Systems (startup/shutdown for water pumps; emergency procedures)
- Environmental Responsibilities (recordkeeping for Boiler No. 4; RCRA requirements for waste delivered to trailer pad; loading/unloading trailers; procedures for handling hazardous waste; operation of waste fuel tanks)
- Miscellaneous Training (basic boiler principles; boiler combustion, water and steam)

H.3 Job Titles and Duties

SI Group maintains records of the job titles, names of employees, and job descriptions via Human Resource personnel records. Key personnel job descriptions are described in the following sections. Note that one person may hold more than one described position.

Manager — Environmental Compliance

Job Description

The Manager — Environmental Compliance is responsible for keeping the facility and its personnel operating in compliance with federal, state, and local environmental regulations. The Manager — Environmental Compliance reports to the Sr. Director — Southeast Operations.

Duties

- Manage the environmental program.
- Coordinate sampling and testing of any affected lands and waterways to monitor the extent and degree of pollution caused by the incident, including periodic sampling of onsite waterways for background information.

- Ensure that all reports and notifications required by state and federal regulators are accurate and filed in a timely and efficient manner.
- Assess possible hazards to human health and the environment.
- Assist in the supervision and coordination of post-emergency response actions.
- Determine the adequacy of any response efforts, and advise the Emergency Response Coordinator of the scope of any additional cleanup required.
- Ensure proper containerization and labeling of all hazardous waste.
- Maintain official records documenting the extent of spills and all containment, cleanup, and recovery actions taken and procedures used where appropriate.
- Review all site incidents reported.
- Coordinate all activities related to hazardous waste management.
- Obtain all necessary permits, licenses, and act as a liaison with federal, state, and local environmental regulatory agencies.
- Initiate purchase of waste handling equipment and spill kits (as needed).
- Maintain the Contingency Plan and any upgrades or modifications required and review the Contingency Plan after each incident.
- Prepare or oversee the proper preparation of manifests and hazardous waste reports.
- Reviews Management of Change requests and assist with Incident Investigation reviews.

Training

- 8-Hour HAZWOPER refresher/annual
- U.S. DOT HM-181/232 Training
- RCRA Training (24 hours)

Required Education

The Manager — Environmental Compliance must have a four-year Bachelor of Science degree in the field of environmental, safety and health, or other related field; or equivalent experience in lieu of a degree.

EMERGENCY RESPONSE COORDINATOR

Job Description

The Emergency Response Coordinator is responsible for coordinating with state and local emergency response personnel, in the event of emergency incidents for personnel associated with hazardous waste at the facility.

Duties

- Direct and coordinate all on-scene emergency response actions.
- Director of Emergency Medical Services onsite.
- Activate, or authorize the activation, of all or part of the Emergency Response Team (ERT) as required during an incident response.
- Coordinate all required assistance from federal, state, and local response organizations and private contractors for hazardous waste incidents.
- Protect the scene by limiting access.
- Investigate spills and fires to determine causes and prevent reoccurrences.
- Conduct Confined Space Rescue Training/High Angle Rescue Training for the ERT
- Conduct in house HazMat Training to the Technician level
- Maintain continued development for the ERT
- Manage yearly inspections of Fire Extinguishers, SCBA's, Fire Hoses, and all ER Fire and Rescue equipment
- Coordinate all fire training for all fire team members.
- Supervise the in service training for plant EMT/Safety Technician.

- Periodically observe hazardous waste treatment operations in order to ensure activities are properly addressed in facility plans and/or procedures.

- Maintain, troubleshoot, test and repair all fixed fire suppression CO2, Halon, and sprinkler systems.

Training Courses

- Fire Instructor Training
- First Aid/CPR Trainer
- Certified HazMat Instructor (Tech Level)
- U.S. DOT HM-232 Training for Hazmat Employees (4 hours)
- Advanced Rescue/Confined Space Training

Periodically observe hazardous waste treatment operations in order to ensure activities are properly addressed in facility plans and/or procedures.

Required Education

No specific education, aside from a high school diploma or General Education Degree, is required for this position.

Health, Safety, and Security Manager

Job Description

The Health, Safety, and Security Manager is responsible for ensuring that the facility maintains a safe working environment compliant with OSHA and South Carolina OSHA regulations.

Duties

- Manages the safety program, including Safety Policy & Procedures, Emergency Procedures, Emergency Services, Orangeburg Plant Wide Procedures — Environmental & Safety sections, Security policies, HAZCOM, IH & WHAT IF databases as well as Management of Change, Incident Investigations, Action Item Closure. Performs audits, and Safety Reviews

- Manages the onsite Security group.

- Manages Industrial Hygiene Program; performing monitoring and exposure assessments.

- Assess possible hazards to human health and the environment and advise the Emergency Response Coordinator if evacuation procedures should be initiated.

Training Courses

Classroom

- First Aid (4 hours every 3 years)
- CPR (4 hours every year)
- HAZWOPER 3-day Course or equivalent
- First Aid/CPR (included in First Responder Refresher Training) (every three years)

On-the-Job

- Perform safety walk- throughs of the site including hazardous waste treatment operations.

Required Education

The Health, Safety, and Security Manage must have a four-year Bachelor of Science degree in the field of environmental, safety and health, or other related field; minimum of 5 years of experience.

H.4 Description of How Training will be Designed to Meet Actual Job Tasks

SI Group's training program is reviewed annually to ensure that it is relevant to the training needs of the staff that works in the RCRA units and other hazardous waste management areas at the facility. The training is conducted or monitored by the Senior Training Specialist. The qualifications of the training director are discussed in Section H.4.1.

Training is designed to meet the requirements of the staff involved with the hazardous waste facility. Specific training, which includes on-the-job training, is given to the maintenance mechanics and chemical operators. Employees that work in the RCRA units are given training specific to their needs. All employees in the plant are given awareness and emergency response training that includes the RCRA units. Appendix H-3 includes an example Chemical Operator II Training manual that details the knowledge and training that must be completed before promotion.

H.4.1 Training Coordinator

The facility's Environmental, Health, Safety, and Sustainability Training Representative includes a Senior Training Representative and an Assistant Training Coordinator. Their duties include:

- Ensuring that employees meet regulatory and safety training requirements
- Monitoring and tracking employee's completion of required training
- Administering the progression system

- Providing training consulting expertise to managers and employees to assist them in developing quality training programs

- Coordinating training classes/sessions

H.4.2 Training for Emergency Response

Emergency response training is conducted for employees that work in the production facility. The site has a dedicated Emergency Response Coordinator who conducts Emergency Response training. The training discusses the RCRA units, each operating unit, and hydrogen cyanide storage tanks. The training includes emergency procedures, use of emergency equipment, and emergency systems. Emergency response training occurs on an annual basis and includes a training drill.

The site's Emergency Response Team receives specialized training as follows:

- HazMat Training (24 hour initial/8 hour annual refresher)
- Fire School: Interior Structures (8 hours/year) (conducted offsite or onsite)
- Fire School: External Structures (1 week/18 months) (conducted offsite)
- Quarterly ERT Classroom training (topics vary)

H.5 Maintenance of Training Records/Copy of Personnel Training Documents

The following records are maintained for all employees involved in hazardous waste management activities:

- The job title for each position, and the name of the employee in the position.

- A written job description, including required skills, level of education, previous experience, certifications and/or qualifications, and the duties assigned for each position.

- Documentation of compliance with the training and experience requirements established for each position.

Training records for current employees will be maintained until closure of the RCRA facility. Training records for former employees will be maintained for at least 3 years from the last date of employment at the RCRA facility. Training records will be maintained in the Training Department office at the facility.

Appendix H-1
Training Matrix

SI Group Inc. – Orangeburg SC
RCRA Training Matrix

Position	Job Description (as related to RCRA Compliance)	Training Topic												
		Waste Labeling	Waste Accumulation/ Movement	Waste Receipts	Secondary Containment	Types of Waste/Listed Waste	Waste Spills	Fork Lift Training	Universal Waste Requirements	Emergency Procedures	DOT- General Awareness	DOT - Function Specific	SPCC/SWPPP	LDAR	Procedure Review [1]
		Annual CBT; annual Classroom Training	Annual CBT; annual Classroom Training	Annual CBT; annual Classroom Training	Annual CBT; annual Classroom Training	Annual CBT; annual Classroom Training	Annual CBT; annual Classroom Training; annual Emergency Response Training (only those people whom are part of the site's Emergency Response Team receive Emergency Response training)	Annually - Classroom training and certification	Annual CBT; Annual classroom training; OJ; video training	Annual CBT	Annual CBT	3rd party training; every 3 years	Annual CBT	Annual CBTs - 2 training sessions	Procedures are routed for approval and review on a minimum of a 2 year basis; however procedures are typically updated more frequently based on changes at the site. Each procedure can have different reviewer/approval we don't have formal process where techs are required to review every environmental (waste) procedure on some frequency, etc.
Chemical Technicians (Levels 1 - 4)	Performs daily inspections of other waste storage tanks, piping; containment areas, and loading/unloading areas.	X	X	X	X	X	X	X	X	X	X		X	X	
Boiler Operators (type of Chemical Technician above)	Performs weekly inspections of < 90 day trailer pad; performs daily inspection of No. 4 Boiler waste tanks and piping. Monitors secondary containment areas for Boiler No.4 storage tanks and trailer pad. Offloads waste to be burned in Boiler No. 4. Ensures only approved waste is burned in Boiler No. 4. Completes boiler logs and burn slips. Manages waste within Boiler No. 4 storage tanks. Samples burn tank.	X	X	X	X	X	X	X	X	X	X		X	X	
Shipping Coordinator	Prepares waste shipments for pickup. Signs hazardous waste manifests/shipping papers; ensures off site shipments of waste are in compliance with DOT requirements.	X	X	X	X	X	X	X	X	X	X	X	X	X	
Logistics Technicians	Prepares waste for shipment; moves containers of waste onto transport vehicle.	X	X	X	X	X	X	X	X	X	X	X	X	X	
Logistics and Transportation Manager	Schedules waste shipments; signs hazardous waste manifests/shipping papers.	X	X	X	X	X	X		X	X	X	X	X	X	
Environmental Compliance Manager	Responsible for keeping facility and personnel in compliance with federal, state, local environmental regulations. Duties are outlined in Section H.3 of this Application. Conducts RCRA Training to site as needed. Maintains waste profile listing, updates Boiler No. 4 waste receipt and burn slip. Ensures only approved waste streams burned at Boiler No. 4.	X	X	X	X	X	X		X	X	X	X	X	X	
Sr. Env. Technician (LDAR Tech) /Env. Engineers	Manages LDAR Program; performs monitoring/calibration/recordkeeping as appropriate. Performs weekly inspections of < 90 day accumulation areas as appropriate. Assists with lab packs of hazardous waste.	X	X	X	X	X	X	X - Tech only	X	X	X		X	X	
Environmental Engineers	Performs weekly inspections of < 90 day accumulation areas as appropriate. Manages waste profiles (approvals, new profiles). Makes waste determinations. Conducts RCRA Training to site as needed.	X	X	X	X	X	X		X				X	X	
Chemists	Analyze No. 4 Boiler burn solvents for ash, density, viscosity, water, and pH.	X	X	X	X	X	X		X	X	X		X	X	
Quality Lab Manager	Ensure chemists are performing waste analyses in accordance with test methods.	X	X	X	X	X	X		X	X	X		X	X	
Maintenance Manager	Ensures employees are RCRA trained and are following procedures for generating and managing hazardous waste. Ensures PMs for Boiler No. 4 and associated waste tanks are completed in a timely manner.	X	X	X	X	X	X		X	X	X		X	X	
Maintenance Technician	Provide routine maintenance on Boiler No. 4 and associated waste tanks. Perform routine and non -routine preventative maintenance (PM) as required. Perform internal and external tank inspections. Manage waste streams generated within maintenance area.	X	X	X	X	X	X	X	X	X	X		X	X	
E&I Maintenance Technician	Perform calibration and adjustment of instruments and controls; maintains electrical power systems, electronic controls, and utilities systems for Boiler No. 4 and associated tanks. Manage waste streams generated within E&I activities.	X	X	X	X	X	X		X	X	X		X	X	
Emergency Response Coordinator	Responsible for coordinating with state and local emergency response personnel, in the event of emergency incidents for personnel associated with hazardous waste at the facility. Duties are outlined in Section H.3 of this Application.	X	X	X	X	X	X	X	X	X	X		X	X	
Safety, Health, and Security Manager	Responsible for ensuring that the facility maintains a safe working environment compliant with OSHA and South Carolina OSHA regulations. Duties are outlined in Section H.3 of this Application.	X	X	X	X	X	X		X	X	X		X	X	
Plant Manager	Responsible for keeping facility and personnel in compliance with federal, state, local environmental regulations.	X	X	X	X	X	X		X	X	X		X	X	
Production Managers	Ensures employees are RCRA trained and are following procedures for generating and managing hazardous waste. Ensures operators comply with RCRA procedures.	X	X	X	X	X	X		X	X	X		X	X	

	SI Group Inc. – Orangeburg SC RCRA Training Matrix	Training Topic												
		Waste Labeling	Waste Accumulation/ Movement	Waste Receipts	Secondary Containment	Types of Waste/Listed Waste	Waste Spills	Fork Lift Training	Universal Waste Requirements	Emergency Procedures	DOT- General Awareness	DOT - Function Specific	SPCC/SWPPP	LDAR	Procedure Review (1)
Position	**Job Description (as related to RCRA Compliance)**	**Annual CBT; annual Classroom Training**	**Annual CBT; annual Classroom Training**	**Annual CBT; annual Classroom Training**	**Annual CBT; annual Classroom Training**	**Annual CBT; annual Classroom Training**	**Annual CBT; annual Classroom Training; annual Emergency Response Training (only those people whom are part of the site's Emergency Response Team receive Emergency Response training)**	**Annually - Classroom training and certification**	**Annual CBT; Annual classroom training; OJ; video training**	**Annual CBT**	**Annual CBT**	**3rd party training; every 3 years**	**Annual CBT**	**Annual CBTs - 2 training sessions**	**Procedures are routed for approval and review on a minimum of a 2 year basis; however procedures are typically updated more frequently based on changes at the site. Each procedure can have different reviewer/approval we don't have formal process where techs are required to review every environmental (waste) procedure on some frequency, etc.**
Production Engineers	Work with Env. Dept. of generation of new waste. Ensure only approved waste streams burned at Boiler No. 4.	X	X	X	X	X	X		X	X	X		X	X	
EHS Administrative Personnel	Manage waste manifest; quarterly waste reporting, and Boiler No. 4 Incinerator fees.	X	X	X	X	X	X		X	X	X		X		

Notes:
CBT = Computer Based Training
RCRA = Resources Conservation and Recovery Act
DOT Department to Transportation
SPCC = Spill Prevention Control and Countermeasure
SWPPP = Storm Water Pollution Prevention
LDAR = Leak Detection and Repair
OSHA = Occupational Safety and Health Administration
(1) Procedures reviewed include but are not limited to the following:

Appendix H-2
New Hire Orientation Check List

SI Group
The Substance Inside

Production Trainer:_____

New Employee Orientation Signoff for: _____

Date	Topics covered during Orientation	Signature
	Sign-in with Human Resources Health Insurance Payroll Information Uniforms Fitting Locker Assignments Introduction to Shift/Workers and How the safety meetings are conducted. Cardinal Rules Guiding Principles	
	Required Safety Topics Safety Videos • It's Not Just About Me • More High Impact • Cell Phone in the Workplace • The Respiratory Protection Program • High Impact – Eye Safety Complete Safety Manual Review Plant Tour – Safety Showers, Pull Stations, LOTO, Fall Protection, Incidents and Accident Reporting, Introduction to SHERQ Committee	
	OC Tech MSSC Production Technician Certification 200 hrs Forklift Training New Employee Requirements • Probationary Period • Six, Twelve, and Fourteen Week Reviews • Force Progression — Must be an Technician II two years after completing Probationary Period (26 Weeks) Probationary Manual Issued Union Presentation	
	DOT Training HCN Training Environmental Discussion Phenol Training & Phenol DOT Training Kit Locations PSM Training Alkyl Demonstration **Hazardous Chemical Location:** CO Phenol Alkyls Caustic Methanol Hydrogen HCN NAK PO Sulfuric Acid Ammonia Sodium MA Hexane Heptane MECl2 DEG Formaldehyde Propofol	
	Computer Logon • Lotus Notes Outlook Mail • Maintenance Connect LIMS System • How to Print P&ID • Processing Equipment Demonstration	
	All Required CBT's	

Employee Signature _____ Date _____

Appendix H-3
Chemical Operator Training

Advancement Skills Assessment
Operator I to Operator II Level

Employee Name: _____

Employee Number: _____

Date Issued by Training Department: _____

Signature of Training Department Issuer: _____

Foreman: _____ **Area/Shift:** _____

Note: Those on an atypical work schedule (5 days/week, 10/4, etc.) shall be assigned an Assessing foreman by the Assistant Superintendent.

Candidate must have a level of Operator I before beginning work on Operator II. There is no waiting period from Operator I to Operator II.

If hired after May 27, 2001, must attain Operator II within two years of completing the Twenty (20) week probationary period.

Must be Operator II on or before**:** _____

Employee's Signature: _____

I. Safety:

Candidate must exhibit interest in their own safety in addition to overall safe operation of the plant. Assessment will be made by oral or written testing, and/or actual demonstration to a designated member of Operations Management. This will include:

A. Demonstrate working knowledge of the characteristics of each of the chemicals used in their process. This includes, but is not limited to: pH, corrosiveness, compatibility / incompatibility, solubility, combustibility, health effects, environmental effects, proper PPE for handling, disposal procedures, and release abatement procedures. Ability to retrieve a MSDS from the plant electronic database and interpret the data it contains.

(PRODUCTION FOREMAN WILL ASSESS THESE SKILLS)
To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____ 1. Retrieve a MSDS from the plant electronic database.
_____ _____ _____ 2. Identify the prominent hazards and health effects due to exposure as indicated by the MSDS.
_____ _____ _____ 3. Correctly answer questions about a key chemical used in their process relative to hazards, characteristics, (flammability, pH, reactivity, conditions to avoid), storage containers.
_____ _____ _____ 4. Properly identify the correct PPE to be used for handling a key chemical in their process. Examples: Supplied air mask and "Cricket" or Industrial Scientific CO detector for connecting a CO trailer. Level "B" suit, observer, man-down radio and HCN detector for taking a HCN sample.

B. Demonstrate the ability to properly obtain, use, and store, the PPE required for proper operation of their process. Examples may be: Obtaining materials from stores. Proper cleaning and storage of respirators. Knowledge of the OSHA requirements for respirator use, storage, fit testing.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____ 1. Demonstrate the ability to locate stock number, order material using Maintenance Connect, retrieve material from the stockroom.
_____ _____ _____ 2. Describe the proper storage procedure for respiratory protection devices.
_____ _____ _____ 3. Have an up to date fit test.
_____ _____ _____ 4. Describe and or demonstrate proper use of safety equipment required for their process. Examples: Demonstrate the ability to properly use a fresh air mask and CO detector including proper method for storage of mask when complete. Demonstrate the ability to properly use an alkyl suit and know the procedure for storage, cleaning, etc.

C. Demonstrate their knowledge of the safety policy / procedures pertinent to their process and operating area. This may include Plant Wide policy as well as Area specific policy.

(PRODUCTION SUPERVISOR WILL ASSESS SKILLS 1, 2, AND 5. TRAINING DEPARTMENT WILL ASSESS SKILLS IN 3 AND 4.)

To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____ 1. Describe the location of the evacuation assembly area for their work area.
_____ _____ _____ 2. Describe the location of the plant wide evacuation assembly area.
_____ _____ _____ 3. Demonstrate the ability to locate a plant safety policy in the electronic database.
_____ _____ _____ 4. Demonstrate the ability to perform a task covered by the plant wide safety policy. Examples: Proper use and storage of a ladder. Proper grounding of a trailer, etc.
_____ _____ _____ 5. Describe policies that are "area specific" to their process. (HCN, CO, etc.)

D. Demonstrate knowledge of the location of safety equipment in their process area. Examples may include: Safety showers, E.R.T. call out stations, fire extinguishers, turret nozzles, fire hose boxes, emergency shutdown switches, first aid equipment, alarms, warning lights, wind socks, escape routes.

(TRAINING DEPARTMENT WILL ASSESS THESE SKILLS.)

To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____ 1. Candidate should be able to correctly identify the location of the above equipment within the confines of their specific work area. This would be accomplished by going to the site of the candidate's operating area and via field demonstration answer the assessor's questions. Example questions may be: Show me the location of the nearest E.R.T. call out alarm activation point. Show the location of the turret nozzles that could be used to protect this area. Show the location of the two nearest safety showers. Where are the two nearest Ansul fire extinguishers?

E. Demonstrate knowledge of safety devices pertinent to their specific process. Examples may be: Relief valves, rupture discs, vacuum protection, nitrogen purges, chemical analyzers, safety and operating interlocks, process alarms, high level switches.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____ 1. Be able to physically locate and identify the above equipment listed above that is used on their process.
_____ _____ _____ 2. Be able to describe the purpose of the listed equipment that is used on their process.
_____ _____ _____ 3. Be aware of the listed equipment that is used on their process.

F. Demonstrate the knowledge of their response in the event of a plant wide emergency. This will include emergency shutdown of their process, evacuation procedures, E.R.T. call out, Emergency Medical call out procedures.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____1. Describe the action to be taken in the event of a plant emergency.
_____ _____ _____ 2. Describe the steps to be taken to properly shut down their process.
_____ _____ _____ 3. Describe how to call out the E.R.T.
_____ _____ _____ 4. Describe how to obtain medical assistance.

G. Demonstrate the knowledge of proper methods for obtaining, labeling, and delivery of routine and non-routine samples associated with their process.

(PRODUCTION SUPERVISOR WILL ASSESS THIS SKILL)
To demonstrate this skill a candidate would be required to complete the following:

(Assessor / employee / date)

_____ _____ _____ 1. Describe how to perform the above for samples taken during the operation of their process.

H. Demonstrate the ability to prepare a specific piece of equipment for line entry following applicable procedures. Includes lockout, tag out, try, blocking list, red tag master, line entry permit.

(PRODUCITON SUPERVISOR WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ 1. To demonstrate this skill a candidate would be required to properly complete the above task to prepare a pump of the assessor's choice from the candidates' process equipment.

(PRODUCTION FOREMAN WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ 2. The candidate must have current lockout, tag out training as verified by the Training Department records.

II. Environmental:

Candidate must possess sufficient knowledge to protect the environment and comply with regulations pertinent to their process. They should also have the ability to take the appropriate action in the event of an upset as well as have a general understanding of the environmental impact an upset could have on the surrounding area as well as the plant treatment system. Assessment will be made by oral or written testing, and/or actual demonstration to a designated member of Operations Management. This will include:

A. Demonstrate the action to be taken in the event a chemical release occurs on their process. This includes: Ability to recognize that a release is in progress. Ability to determine the source and contents of released material. Ability to properly report a release to the appropriate individuals. Ability to recognize the hazards associated with a release as well as the proper response such as barricades, E.R.T. call out, evacuations.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

The candidate will be given a written scenario describing an event involving a key hazard for his process. The candidate will be required to accurately describe the following.

(Assessor / employee / date)

_____ _____ _____ 1. Describe how you would know that you have a release.
_____ _____ _____ 2. Describe the chemicals being released.
_____ _____ _____ 3. Describe how you would initially report the release.
_____ _____ _____ 4. Describe the hazards associated with the release.
_____ _____ _____ 5. Are barricades appropriate for the given event as described in the scenario?
_____ _____ _____ 6. Is E.R.T. call out appropriate for the given scenario?
_____ _____ _____ 7. Is evacuation appropriate? If so what should be evacuated?

B. Demonstrate working knowledge of proper methods for handling chemical wastes from their process. This includes: Filter waste disposal / recovery, contaminated insulation, contaminated safety equipment, sample waste, waste from process spills or line draining activities.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

The candidate will be required to accurately answer / describe the following:

(Assessor / employee / date)

_____ _____ _____ 1. Identify the waste materials produced by your process.
_____ _____ _____ 2. Identify which, if any, of those streams are classified as hazardous waste.
_____ _____ _____ 3. Describe the components which cause the waste to be hazardous and the hazards associated with each.
_____ _____ _____ 4. Describe the proper method of disposal of the materials identified above as well as materials contaminated by those substances. Included in the description will be the proper labels for the containers as well as the disposition of those containers to the point where the candidate's responsibility ends.

C. Demonstrate knowledge of proper use and maintenance of satellite accumulation areas used by their process. Including: Labeling of containers and materials placed outside of containers, physical condition of containers both inside and out, location of containers, allowable content of containers, materials outside of containers.

(TRAINING DEPARTMENT WILL ASSESS THESE SKILLS)

(Assessor / employee / date)

_____ _____ _____ 1. The candidate must have completed RCRA training within the last year.

_____ _____ _____ 2. The candidate will accurately conduct an inspection of a satellite accumulation area and complete a standard inspection form to the satisfaction of the assessors. (Attached)

D. Demonstrate a general knowledge of the route of their process generated waste streams. This should include the process flow path from the vessels they operate into the treatment system as well as any adverse impact a process upset could have on the treatment system.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

(Assessor / employee / date)

_____ _____ _____ 1. The candidate will be required to accurately describe in general terms the flow path of the waste streams generated by his process up to the point where it enters the treatment system. The candidate should be able to complete a very general block flow diagram. An example would be:

The sodium bromide stream from racemic naproxen crude is transferred to T-1566 from D-1521. From T-1566 it is transferred to T-20-M-10. From T-20-M-10 it is transferred to either the sandbeds or the beltpress where the solids are removed. The remaining aqueous stream then enters the treatment system which ultimately discharges into the river.

The candidate should know if their waste streams are harmful to the treatment system. For example phenols, ammonia, amines, are harmful to the bugs.

III. Quality:

Candidate must possess adequate knowledge of the quality requirements of their process to allow them to produce on-spec product while remaining in compliance with applicable ISO and / or GMP regulations. Assessment will be made by oral or written testing, and / or actual demonstration to a designated member of Operations Management. This will include:

A. Ability to demonstrate working knowledge of the document control systems in place pertaining to his process documents. These include logbooks, batch records, process manuals, operating manuals, other procedures specific to their process.

(PRODUCTION FOREMAN WILL ASSESS ITEM #1. ASSISTANT SUPERINTENDENT WILL ASSESS SKILLS #2 and #3.)

Candidate will be able to accurately describe the following:

(Assessor / employee / date)

_____ _____ _____ 1. How to verify that a copy of his logbook / operating instructions is the most current as required by ISO procedures.
_____ _____ _____ 2. Candidate will be required to describe the location of the Area Quality guide as it pertains to his area.
_____ _____ _____ 3. Candidate will be required to accurately identify our Management Representative for our Quality System.

B. Working knowledge of ISO requirements as they pertain to issuing of documents used for day to day operation of their process. Examples: Who can issue logbooks, how long is an issued document valid?

(PRODUCTION FOREMAN WILL ASSESS THESE SKILLS)

Candidate will be able to accurately answer the following questions:

(Assessor / employee / date)

_____ _____ _____ 1. Who can issue process documents in your work area?
_____ _____ _____ 2. How many days after issue date can the logbook be used.

C. Working knowledge of the GMP regulations applicable when candidate is working on any process related to the manufacturing of pharmaceuticals or their intermediates. This will include having successfully completed a GMP training course in the year prior to application for advancement. This assessment will be assisted by the Assistant Manager of Quality Assurance or his designee.

(TRAINING DEPARTMENT WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ Candidate must have successfully completed a GMP training course during the last year if his process pertains to pharmaceutical manufacturing under GMP regulations.

D. Demonstrate the knowledge of specifications as determined by analysis performed on all processing steps associated with his process. This includes: Raw materials, intermediate processing steps, final product analysis for the process being operated. Candidate must have the ability to determine and recognize if the materials are in or out of specifications as well as demonstrate the proper course of action they would take for out of spec materials.

Candidate will be required to accurately identify specifications for his process materials. This may be accomplished by demonstration of personal knowledge or demonstration of the ability to locate those specifications in plant documentation.

(PRODUCTION SUPERVISOR OR TRAINING DEPARTMENT WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ Assessor will chose several key materials from the candidate's process and assign analytical values to each. Candidate will be required to determine if an analysis given to them for their process material is in or out of specification using either of the means described above.

IV. Process Operational Skills:

The candidate must possess adequate working knowledge of the process they are currently operating, or if they so desire, may choose one they have previously operated. This knowledge should be sufficient to allow them to operate the process unassisted during the course of normal day-to-day operation, as well as have the ability to recognize the need for assistance, and know where to find it when needed. Assessment will be made by oral or written testing, and / or actual demonstration to a designated member of Operations Management. This will include:

A. Demonstrate the knowledge of the physical location of all the equipment used on their process as shown on process flow diagrams, (drawings), and / or operator control interface, (computer), screens.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

(Assessor / employee / date)

_____ ____ _____ Candidate will be required to show the physical location of 10 items of his process equipment selected from either process drawing, computer screen or a combination of both.

B. Demonstrate the ability to recognize when their process is operating outside of desired parameters as well as the ability to suggest corrective actions.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

(Assessor / employee / date)

_____ _____ _____ 1. Candidate will be given a set of conditions for various steps of his process and will be required to identify whether the process is in or outside of desired parameters for those steps.

_____ _____ _____ 2. Candidate will be required to accurately describe corrective actions for any of the conditions that are outside desired parameters.

C. Demonstrate working knowledge of utility systems associated with their process. This includes knowledge of cooling supply sources such as cooling towers, brine supply header / chillers and their physical location and normal operating conditions. Also included are heating system sources such as steam supply headers, hot oil, dowtherm systems. The candidate must be able to identify these devices as well as the location of the block valves at the connection to their process.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

(Assessor / employee / date)

_____ _____ _____ 1. Candidate will be required to correctly physically identify the source of cooling / heating supply devices associated with his process. This will include cooling towers, brine chillers, oil heaters, and steam supply lines.

_____ _____ _____ 2. Candidate will be required to describe if those devices are operating normally. Examples of acceptable descriptions:
   a. The cooling tower has the correct water level in it and the pump is running.
   b. The brine chiller is running and the flow indicator shows flow.
   c. The oil heater is running and is at the desired temperature.
   d. The steam header I am using shows the correct pressure by the nearest pressure gauge.

_____ _____ _____ 3. The candidate will be required to physically locate the block valves for the above where their process connects to the supply header and be able to determine if the valves are open or closed.

D. Demonstrate the ability to startup and shutdown their process from any state without assistance.

(PRODUCTION SUPERVISOR WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ this ability will be determined by the Area Superintendent based upon actual process experience.

E. Demonstrate a working knowledge of calculations pertinent to their process. Including: Charge calculations, material balances, routine adjustments based upon analytical.

(PRODUCTION SUPERVISOR WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ Candidate will be required to accurately complete calculations normally performed by operators during the course of normal day to day operation of their process. If the candidates' process does not require calculations, examples from other process areas will be used. The candidate will be allowed to study those calculations until they can be successfully completed. For the actual demonstration of the ability, analytical or other numbers used may be changed within the normal process variability.

F. Demonstrate adequate general knowledge of their process to allow effective communication with others, when needed, to relay information pertaining to the state of the process, assist others when troubleshooting the process, inform emergency team members as needed in the event their process is involved in an emergency.

(PRODUCTION SUPERVISOR OR TRAINING DEPARTMENT WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ The candidate will be required to accurately answer questions about the state of his process at any given time. Examples may include: Tank levels, process point temperatures or pressures, process point flow rates. The candidate will be allowed to use the normal tools at his disposal to determine the correct answers without assistance from others.

G. Demonstrate the ability to properly operate their process unassisted by having done so as recognized by their Area Supervision. If Supervision deems the individual does not possess this ability they should be prepared to indicate specific events to support their position.

(PRODUCTION SUPERVISOR WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ **Demonstrated** to Assistant Superintendent.

V. General Knowledge:

Candidate should possess sufficient knowledge of general plant operations that are found and used throughout the plant. Assessment will be made by oral or written testing, and / or actual demonstration to a designated member of Operations Management. This will include:

A. Phase Separation. Candidate must demonstrate his ability to understand, recognize, and perform separations between different phases of materials. This will also include the understanding of emulsions, means of identification, and suggestions for breaking an emulsion.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

Assessment of this skill will be determined by having the candidate satisfactorily describe the following:

(Assessor / employee / date)

_____ _____ _____ 1. What is a phase separation?
_____ _____ _____ 2. What is the purpose of a phase separation?
_____ _____ _____ 3. Why do the phases separate?
_____ _____ _____ 4. What is an emulsion?
_____ _____ _____ 5. Why is an emulsion bad?
_____ _____ _____ 6. What do you do to break an emulsion when it has occurred on your process?

A demonstration of a properly made phase separation will be required.

B. Candidate must have sufficient working understanding of liquid pH and must be able to indicate what to do to raise and / or lower pH. Candidate must also have a working knowledge of what the results would be when strong acids and bases are combined. Candidate should demonstrate the relationship between pH conditions and their process.

(TRAINING DEPARTMENT WILL ASSESS THESE SKILLS)

Assessment of this skill will be determined by having the candidate satisfactorily describe the following:

(Assessor / employee / date)

_____ _____ _____ 1. What is pH an indicator of?
_____ _____ _____ 2. Why is pH control important to your process?
_____ _____ _____ 3. Under low pH conditions what effect will it have on your process?

(Assessor / employee / date)

_____ _____ _____ 4. Under high pH conditions what effect will it have on your process?
_____ _____ _____ 5. How do you raise the pH of aqueous solutions?
_____ _____ _____ 6. How do you lower the pH of aqueous solutions?
_____ _____ _____ 7. How do you measure pH?
_____ _____ _____ 8. What will happen when you mix a strong acid with a strong base?
_____ _____ _____ 9. Why are high and low pH materials considered hazardous?

A demonstration of an accurate measurement of pH of a process stream will be required.

C. Candidate should demonstrate the ability to create Maintenance Connect notifications to facilitate repairs to his process equipment. This will be verified by the candidate providing their supervision with the numbers of 10 different notifications they have generated to improve their process area. The actual creation of one of the notifications will be witnessed by a member of supervision. These numbers will be then verified by the Area Maintenance Planner.

(PRODUCTION SUPERVISOR WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ Demonstrated to Assistant Superintendent

D. Housekeeping. The candidate must demonstrate their ability to recognize housekeeping problems by taking a member of supervision on a housekeeping inspection in an area selected by supervision.

(PRODUCTION SUPERVISOR WILL ASSESS THIS SKILL)

(Assessor / employee / date)

_____ _____ _____ Demonstrated to Assistant Superintendent

E. Candidate should have the ability to (in general terms) explain the process control systems in use in their process and demonstrate the ability to indicate whether it is working properly or not. The candidate will also be required to identify instruments used on his process in the field.

Examples would be: PLC, Moore Controller, pneumatic controller, spence regulator, and manual operation.

(LEAD ASSESSOR WILL ASSESS THESE SKILLS)
Assessment of this skill will be determined by having the candidate satisfactorily describe the following:

(Assessor / employee / date)

_____ _____ _____ 1. How is the temperature of your process points determined / indicated?
_____ _____ _____ 2. How is the pressure of your of your process points determined / indicated?
_____ _____ _____ 3. What points on your process need to be controlled?
_____ _____ _____ 4. What are the devices that control your process points?
_____ _____ _____ 5. How are the materials that enter / leave your process measured?
_____ _____ _____ 6. Are there any devices on your process to assist you with phase separations?
_____ _____ _____ 7. Are there secondary devices on your process to back up the instruments listed above?

The candidate will be required to identify the physical location of the devices listed above.

F. Candidate should have working knowledge of liquid / solid separation. This can include filtration, centrifugation, or any other method as it pertains to their process.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)
Assessment of this skill will be determined by having the candidate satisfactorily describe the following:

(Assessor / employee / date)

_____ _____ _____ 1. What solids are present or formed in your process?
_____ _____ _____ 2. Are the solids good / bad?
_____ _____ _____ 3. What devices do you use to remove solids from your process?
_____ _____ _____ 4. How do you know the devices are working properly / improperly?
_____ _____ _____ 5. What is the filter media used in your process?

The candidate will be required to physically identify any equipment used for solids removal and describe the general operation of same.

G. Candidate should demonstrate the ability to do diligent, thorough work in filling out logbooks/log sheets for their process.

(PRODUCTION SUPERVISOR WILL ASSESS THESE SKILLS)

(Assessor / employee / date)

_____ _____ _____ Lead Assessor shall go through the last 10 logbook/log sheets that the candidate was involved with (along with candidate). The candidate's work must be neat, thorough, and accurate to satisfy this skill requirement.

APPROVALS

Signatures indicate that the employee has satisfactorily completed all the above-stated requirements, and is approved to progress to Operator II level.

Employee Signature _____ Date _____

Production Foreman _____ Date _____

Production Supervisor _____ Date _____

Production Engineer _____ Date _____

Production Manager _____ Date _____

Training Representative _____ Date _____

Human Resources Mgr. _____ Date _____

Forward to Training Department and Human Resources Department for action.

PROBATION OPERATOR REQUIREMENTS

NAME: **Date:**

Must be an Operator II within two years after completing the twenty (20) week probationary period. Probationary period ends

Must be an Operator II on or before

Signature: _____

THIS MANUAL MUST BE COMPLETED BEFORE AN ADVANCEMENT TEST CAN BE SCHEDULED. WHEN SCHEDULING AN ADVANCEMENT TEST, ATTACH THIS MANUAL TO THE TEST REQUEST AND SEND BOTH TO THE TRAINING DEPARTMENT.

Candidate must have completed all Safety Training Modules for the previous 12 months or since employment at the time of promotion.

Trainer Sign _____ **Date** _____

It is the intention of this document to define the requirements of the job and to provide documentation in support of these qualifications. When you sign this manual, you are attesting that this person has reached a level of competence to perform the skills required of an Operator I.

PROBATIONARY OPERATOR QUALIFICATIONS
Demonstration Skills

Training Dept. Sign / Date

_____ _____ 1. Demonstrate the ability to navigate Lotus Notes to complete the following tasks: Locate and demonstrate the ability to sign off MOC. Locate and respond to his/her email. Locate and open a MSDS sheet for one of the chemicals used for their process.

_____ _____ 2. Demonstrate the ability to follow a pipeline on your Process selected by Site Training Coordinator from point "A" to point "B".

_____ _____ 3. Demonstrate the ability to check and explain what pH range the following would be in samples provided of the following materials:

1. Acid
2. Base
3. Neutral

_____ _____ 4. Demonstrate the ability to use a process control system to change the set point of a control valve, start and stop a pump, and open and close A block valve. This must be done form a control station in the control room.

_____ _____ 5. Demonstrate how to properly change a filter in your plant And properly dispose of the filters and label the disposal container properly.

_____ _____ 6. Demonstrate the ability to correctly take daily tank readings from instruments in the field and from the control room.

PROBATIONARY TRAINING MANUALS

Training Rep. Date

_____ _____ Process Physics.
_____ _____ Using Process Safety Information
_____ _____ Basic Centrifugal Pump Operations
_____ _____ Basic Positive Displacement Pump Operations
_____ _____ Basic Vacuum Pump, Air Ejector, Strainer and Trap Operations
_____ _____ Basic Valve Operations
_____ _____ Basic Heat Exchanger Operations

Operator must be able to identify and discuss the following Operator Walk-through Skills:

HMIS labels present and legible?
Confine Space present?
Dike Floor Condition?
Is all equipment grounded?
Are all spray guards installed?
Are insulation repairs needed?
Are there steam leaks?
Are there any airline leaks?
Are there process leaks?
Any painting needed? (Piping, handrails, etc.)
Are caps and plugs installed?
Are gauges working and is working range marked?
Is there rust or corrosion present?
Any other housekeeping necessary?
Are Quick Connect items pinned or secured?
Are machine guards in place?
Is there any broken conduit?
Is area 5S compliant?
Are pipe hangers adequate?

Successful completion of unit test required prior to sign off of each course.

APPROVAL PAGE

The final evaluation will be done by the following:

Training Dept. _____ _____ Date _____ Approved o

Disapproved o

Foreman _____ Date _____ Approved o

Disapproved o

Unit Coordinator. _____ Date _____ Approved o

Disapproved o

Area Supt. _____ Date _____ Approved o

Disapproved o

STATE REASON FOR DISAPPROVAL BELOW:

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SECTION I
CLOSURE, POST CLOSURE PLANS, AND FEDERAL REQUIREMENTS
[40 CFR 264 Subparts G, H, I, and J and 40 CFR 270.14(b) 13; SC R.61-79.264 Subparts G, H, I, and J]

I.1 Closure Plans

This closure plan identifies and details the actions necessary to close the HWMUs at any point during its active life and at the end of its intended operating life, and the estimated schedule and costs to complete the closure. The closure will involve removal of HWMUs wastes and residues, followed by decontamination of three areas: waste storage tanks, related piping, and containment; the truck unloading area and associated piping; and fire tube boiler and baghouse. Details of this plan refer to final closure of the HWMUs. A post-closure plan is not submitted, as this Facility is not a hazardous waste disposal facility.

SI Group will maintain a copy of the approved closure plan and subsequent revisions onsite at all times until certification of closure completion has been submitted to, and accepted by, SCDHEC and U.S. EPA Region 4.

SI Group will notify the Director of the SCDHEC and the U.S. EPA Region 4 Regional Administrator in writing at least 45 days prior to the date it expects to begin closure. SI Group neither plans for, nor anticipates, partial closure of the HWMUs. Final closure of the HWMUs is not anticipated in the foreseeable future. Within 60 days following completion of closure activities, SI Group and a South Carolina-registered professional engineer will provide certification that the HWMUs were closed in accordance with the approved closure plan.

I.1.1 Closure Performance Standard

The SI Group closure plan eliminates the need for any post-closure maintenance. The closure plan is designed to ensure that no hazardous wastes remain at the HWMUs site after closure, ensure that the HWMUs will not require further maintenance and controls, minimize, or eliminate threats to human health and the environment, and to minimize or eliminate post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

I.1.2 Time and Activities Required for Partial Closure and Final Closure Activities

Partial closure of the HWMUs are not anticipated. Final closure of the HWMUs is estimated to take place in the year 2025 for purposes of estimated closure cost. It is anticipated that the HWMUs will

remain open and functional until the estimated closure date. Should it become necessary to close the HWMUs before the estimated closure date, the procedures outlined in this plan will be followed.

The anticipated schedule for closure of the HWMUs is shown in Table I-1. SI Group will notify the Director of the SCDHEC and the U.S. EPA Region 4 Regional Administrator within 45 days of the start of closure. The date for beginning closure activities will be no later than 30 days after receipt of the final volume of hazardous wastes to be stored at the HWMUs.

Table I-1
Anticipated Closure Schedule

Day	Activity
0	Receive final volume of hazardous waste
90	Complete removal of final waste inventory/hazardous waste feed
100	Complete purge of HWMUs and disconnection of fuel feed systems, begin decontamination of the boilers, tanks, and containment areas
120	Complete wash water sampling, wipe tests and analysis
130	Complete decontamination and disposal of wash water and drummed residue
170	Complete final inspection and remedial action, if necessary
180	Complete closure and certification submittal to SCDHEC and the Regional Administrator

Within 90 days following receipt of the final volume of hazardous wastes, all wastes will be removed from the HWMUs and properly disposed of offsite, in accordance with the approved closure plan. Closure activities will be conducted in accordance with the approved closure plan, and will be completed within 180 days of receiving the final volume of hazardous wastes at the HWMUs.

Within 60 days of completion of final closure, SI Group will submit to the SCDHEC and the U.S. EPA Region 4 Regional Administrator, by registered mail, a certification that the HWMUs have been closed in accordance with the specifications of the approved closure plan. An appropriate SI Group representative and a South Carolina-registered professional engineer will sign this certification. Any documentation requested in order to support this certification statement will be submitted to SCDHEC and Regional Administrator.

I.1.3 Maximum Waste Inventory

The maximum inventory of hazardous waste in storage at any one time at the HWMUs is 170,000 gallons, which is the combined, total volume of all of the hazardous waste storage tanks. This is intended to represent a maximum figure for the purposes of this permit application.

I.1.4 Closure Procedures

The closure will involve removal of HWMUs, wastes and residues, followed by decontamination of three areas: waste storage tanks, related piping, and containment; the truck unloading area and associated piping; and fire tube boiler and the baghouse. Note that tank, piping, and containment closure activities will occur at the boiler tank farm (shown in Figure B-4).

The boiler will be fired with natural gas for 4 hours after the last hazardous waste is burned. This should enhance the cleaning of the boiler and related ductwork. After the removal of the wastes, all areas will be decontaminated using steam cleaning, water blasting, or hand scrubbing with an industrial detergent.

A dedicated decontamination pad will be constructed adjacent to the storage tank farm to decontaminate all equipment, including tanks, ancillary piping, boiler, and baghouse. The decontamination pad will be sized to accommodate any heavy equipment used for closure activities, and a berm will be constructed on three sides. The pad will be lined with high-density polyethylene (HDPE), and sloped to one corner. All initial rinse waters will be collected using existing tanks, transfer pumps, sumps and sump pumps, and placed in appropriate containers (an existing tank trailer and/or 55-gallon drums) for disposal as hazardous waste.

Once decontamination is complete, each area will be visually inspected to identify any residue that may be present. Samples of residues will be collected from these potentially contaminated areas by surface wipe tests. One wipe test will be performed on approximately every 100 ft^2 of contaminated surface, including tanks, piping, incineration equipment, and containment areas. Chromium will be the metal component, and toluene, benzene, and aniline will be the organic components analyzed to determine if the decontamination was successful. The 2004 test burn conducted at the facility identified toluene, benzene, aniline, and chromium to be among the most thermally stable organic and inorganic compounds present in the waste. Thus, those constituents are most likely to persist through the hazardous waste burn, and their presence in any residue will serve as indicators that residual contamination remains following decontamination. Repeated cleaning with wire brushes, detergents, and solvents (hexane or an equivalent non-polar solvent) will continue until the wipe tests indicate that the surface is free of hazardous waste contamination. All wastes and/or solvents will be collected, drummed, and disposed of as a hazardous waste. Once final decontamination is considered complete, the HDPE liner will be removed from the dedicated decontamination pad and containerized for disposal.

As an alternative, analysis of the rinse waters can be used to determine if decontamination is complete. Rinse water from decontamination of the boiler, blending and storage tanks, tank trailers, and containment areas will be pumped or drained to a temporary holding tank after each portion of the facility is decontaminated. Samples will be taken from the temporary holding tanks to ensure that portion of the system has been decontaminated. Representative rinsate samples will be collected for laboratory analysis in order to determine the degree of contamination. At least two samples will be analyzed for each rinsate solution to confirm that the equipment has been decontaminated. If the rinsate shows concentrations of toluene, benzene, aniline, and chromium at levels below the South Carolina groundwater standards or tap water concentration limits (for constituents, such as aniline, that do not have groundwater Maximum Contaminant Limit [MCL]), the decontamination will be considered complete. Otherwise, repeated hand scrubbing with wire brushes, detergents, and solvents of all contaminated surfaces will continue until the rinsate tests indicate that concentrations of toluene, benzene, aniline, or chromium are below South Carolina groundwater standards/tap water concentration limits. For the purposes of the closure cost estimate, wipe testing, as opposed to rinsate analysis, was used as the method for determining if decontamination was complete.

Solid decontamination residues, including brushes, sponges, mops, and personal protective clothing, will be containerized as hazardous waste. Contaminated rinse water and solid cleanup residue will be disposed of offsite by permitted, authorized hazardous waste transporters and disposal firms under contract to SI Group. Non-contaminated rinse water, based on results of rinse water analysis, will be disposed of in the SI Group wastewater treatment system.

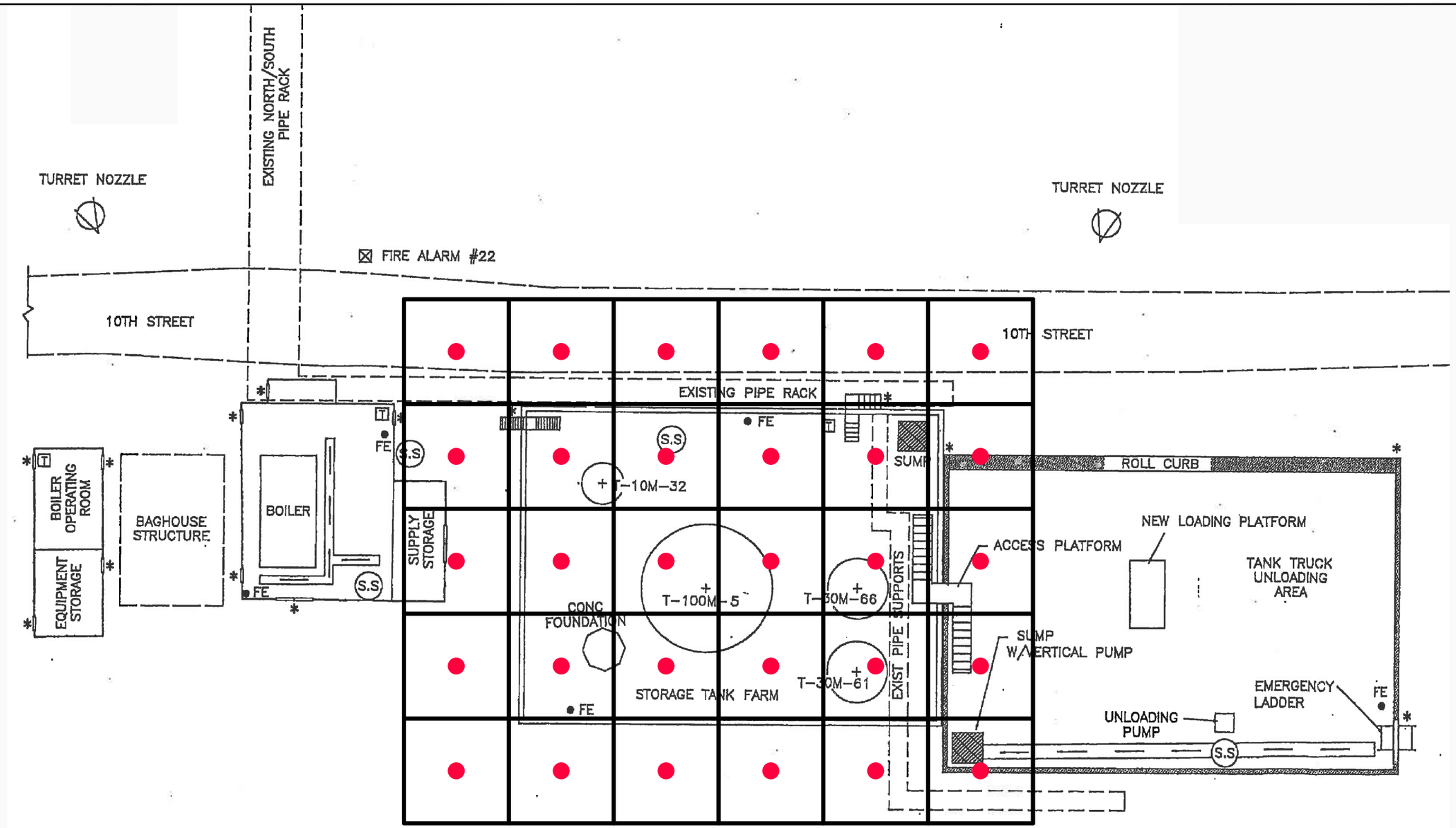
I.1.4.1 Inventory Removal

Closure will be initiated by termination of hazardous waste acceptance at the HWMUs. A hazardous waste services firm, using a licensed hazardous waste hauler to take the material to a licensed waste disposal facility, will remove wastes in the storage tanks. The feed system, pumps, filters, piping, and other ancillary equipment will be drained. These systems will be purged with light fuel oil to remove hazardous wastes. A hazardous waste services firm will dispose of the fuel oil contaminated with waste solvents as hazardous waste.

I.1.4.2 Disposal or Decontamination of Equipment, Structure, and Soils

After the system is shut down and cooled to ambient temperature, the waste feed piping systems will be disconnected and isolated by means of electronic and manual valves. The containment areas, truck loading/unloading area, storage tanks, waste feed lines, and ancillary equipment to and from the storage tanks and boiler will be decontaminated by both a high pressure water wash (hydro blast) with a detergent and steam cleaning.

While the impervious construction, frequent inspections, and prompt repair of any identified cracks in the containment areas make it unlikely that any contamination from hazardous waste has reached the soils beneath the containment areas, soils below the boiler tank farm containment areas and the boiler will be sampled to determine if any contamination from the hazardous wastes are present. A Sampling and Analysis Plan, which will define the sampling procedures, protocols, and analytical methods will be developed prior to any sampling activities. A total of 30 soil samples will be collected, one approximately every 400 ft^2, from the 0-1 foot depth interval and according to the sampling grid in Figure I-1 and tested for toluene, aniline, benzene, and chromium to determine if soil concentrations are above the U.S. EPA's *Protection of Groundwater Soil Screening Levels* as presented in the current U.S. EPA's Regional Screening Level summary tables.



LEGEND

- (S.S.) SAFETY SHOWER
- ●FE FIRE EXTINGUISHER
- TURRET NOZZLE
- TRENCH DRAIN
- T TELEPHONE
- ∗ ACCESS POINTS WITH WARNING SIGNS
- PROPOSED SOIL SAMPLING LOCATION
- SAMPLING GRID (APPROXIMATELY 400FT^2)

0 10 20
SCALE IN FEET

FIGURE I-1
PROPOSED SOIL SAMPLING LOCATIONS
SI GROUP
ORANGEBURG, SOUTH CAROLINA

REQUESTED BY:	ES
DRAWN BY:	KMB
DATE:	10/06/2017
PROJECT:	0888818280

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DATA SOURCES: TRC ENVIRONMENTAL CORPORATION CUSTOMER-FOCUSED SOLUTIONS CHICAGO, IL

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If results from soil sampling indicate that levels of toluene, aniline, benzene, or chromium are above U.S. EPA soil screening levels, the soils from beneath the containment areas will be excavated to a depth of one foot and disposed of at an appropriately-permitted facility. Soil samples will be collected, one approximately every 400 ft^2, from the floor of the excavation to confirm that the impacted soil has been remediated. In order to reflect as conservative of an approach as is possible, the costs to excavate and dispose the impacted soils to a depth of one foot below ground surface have been included in the closure cost estimate for the HWMUs. Should soil sampling results indicate that contamination has not penetrated the containment area floors, the cost estimate will be revised, as necessary. Similarly, should soil sampling results indicate that contamination has penetrated the containment area floors and the depth of impacted soils extended deeper than one foot below ground surface, the cost estimate will also be revised as necessary.

I.1.4.3 Closure of Tanks

The inside and outside of tanks will be decontaminated by steam cleaning, water blasting, or hand scrubbing with an industrial detergent and will be rinsed twice with water. Both secondary containment areas will receive the same treatment. Repeated hand scrubbing with wire brushes, detergents, and solvents of all contaminated surfaces will continue until the wipe tests indicate that the tank surfaces are free of hazardous waste contamination.

I.1.4.4 Closure of Boilers

After the final hazardous waste is burned in the boiler, a 4-hour "burnout" with natural gas will be conducted to help purge any unburned waste from the boiler. The inside surface of the combustion chamber of the boiler will be sand blasted to remove as much solid residue as possible. The boiler surface will be visually inspected to identify any waste or residue that may remain. Any remaining residue will be scraped with wire brushes or other suitable equipment. The residue will be placed in 55-gallon drums for offsite disposal as hazardous waste. Vacuuming ash residue from the boiler fire tubes, exhaust ducts, and bag house will minimize fugitive particulate emissions. Bags from the baghouse control device will be drummed for disposal as well. The interior of the boiler, boiler oil guns, exhaust ducting, baghouse, blending and storage tanks, tank trailers, waste feed piping, and waste transfer pumps will be decontaminated by a high pressure water wash with a detergent and steam cleaning.

SI Group may request a permit modification to amend the closure plan as necessary at any time before notification of partial or final closure of the HWMUs . A written request, including a copy of the closure plan amendments, must be submitted to the Director of the SCDHEC for authorization and approval.

Permit modifications will be requested under the following circumstances: 1) changes in operating plans or facility design that affect the closure plan; 2) there is a change in the expected year of closure; or 3) unexpected events occur during partial or final closure activities which require a modification of the closure plan. The schedule for closure will also be adjusted and a permit modification submitted if nearby SWMUs impact decontamination and/or closure of the boiler, hazardous waste storage tanks, piping, or ancillary equipment.

Request for permit modification will be made at least 60 days before a proposed change in facility design or operation, or no later than 60 days after an unexpected event has occurred which affects the closure plan. Request for permit modification will be made within 30 days of an unexpected event that occurs during closure activities. Should the Director of the SCDHEC request modifications to the amended plan, the modified plan will be submitted within 60 days of this request, or within 30 days if the modification is due to an event which occurs during closure activities.

I.2 Closure Cost Estimate

The cost estimate has been prepared to reflect the cost of closing SI Group's HWMUs at the point in its operating life when closure would be most expensive. This would occur when the maximum inventory is 170,000 gallons, which is the combined, total volume of all of the hazardous waste storage tanks. The closure cost estimate assumes the purchase of all required supplies and labor and the use of contracted waste transport and disposal services. The cost estimate of $811,721 is shown in Table I-2. The cost estimate will be adjusted annually for inflation, within 30 days after the close of the SI Group's fiscal year and before submission of updated financial assurance information per 40 CFR 264.143 and SC R.61-79.264.143.

The costs presented in this section for final closure of the waste storage tanks, related piping, and containment, the truck unloading area and associated piping, and fire tube boiler and the baghouse were estimated using the *CostPro Closure and Post Closure Care Cost Estimating Software*, Version 6.1 (CostPro), as provided by the U.S. EPA. The default labor rates and other remedial costs standard to CostPro were used, unless a particular rate was not built into the software. Non-default values used for pipe lengths, surface areas, and material volumes are based on information gathered at the facility by EnSafe. Where site-specific information was not available, non-default values used in the 2003 Permit Application were applied to the CostPro model. Additionally, a cost for laboratory analysis of aniline in soil was not part of the CostPro application. As directed by the U.S. EPA., laboratory costs for benzene, toluene, ethylbenzene, and xylene/gasoline hydrocarbons were entered into CostPro in place of another analysis that was not utilized for calculating the analytical cost for

toluene, benzene, and aniline. Instances where substitutions of site-specific data were entered into CostPro are documented on the output sheets, which are presented as Appendix I-1.

Table I-2
Closure Cost Estimate

Description	Amount
A. Decontamination of the Incineration Unit	$89,311
B. Disassembly of Ancillary Piping	$7,077
C. Demolition and Removal	$430
D. Removal of Soil	$6,791
E. Decontamination	$142,722
F. Sampling and Analysis	$54,884
G. Treatment and Disposal	$310,745
Subtotal	**$611,959**
H. Engineering Expenses (10%)	$61,196
I. Final Closure Certification	$3,278
Subtotal	**$676,434**
J. Contingency Allowance (20%)	$135,287
Total	**$811,721**

I.3 Financial Assurance for Closure

SI Group has obtained a *Financial Guarantee Bond Covering Closure and/or Post-Closure Care of Hazardous Waste Treatment Facility* for financial assurance of closure. Copies of the February 26, 2018 Surety Rider and the Argonaut Insurance Company Power of Attorney are provided in Appendix I-2. A copy of the Surety Bond is also provided in accordance with 40 CFR 270.14(b)(15) and SCR.61-79.270.14(b)(15).

SI Group will submit updated information on the above item to SCDHEC and to the U.S. EPA Region 4 within 90 days after the close of each succeeding fiscal year.

Appendix I-1
CostPro Output March 23, 2018

SI Group

Address: 725 Cannon Bridge Road
Orangeburg
SOUTH CAROLINA
29115
Comments:

Activity	Units	Closure Cost
Incinerators/BIFs	1	$811,720.58
		$811,720.58
Additional Costs		$0.00
Total Estimated Cost		**$811,720.58**

Incinerators and BIFs Summary (IB_02-1)

Removal of Waste Residue (IB-03)	$0.00	
Decontamination of the Unit (IB-04)	$89,311.42	
Disassembly of Ancillary Piping (IB-05)	$7,076.55	
Demolition and Removal (IB-06)	$429.82	
Removal of Soil (IB-07)	$6,791.29	
Backfill and Grading (BF-01)	$0.00	
Decontamination (DC-01)	$142,722.15	
Sampling and Analysis (SA-02)	$52,383.67	
Monitoring Well Installation (MW-01)	$0.00	
Transportation (TR-01)	$0.00	
Treatment and Disposal (TD-01)	$310,745.00	
User Defined Cost (UD-01)	$2,500.00	
Subtotal of Closure Costs	$611,959.90	
Percentage of Engineering Expenses	10.0	%
Engineering Expenses	$61,195.99	
Certification of Closure (IB-08)	$3,277.93	
Subtotal	$676,433.82	
Percentage of Contingency Allowance	20.0	%
Contingency Allowance	$135,286.76	
Landfill Closure (Cover Installation) (CI-02)	$0.00	
TOTAL COST OF CLOSURE	$811,720.58	

Incinerators and BIFs Inventory (IB_01-1)

UNIT DESCRIPTION

Type of incinerator or BIF	Boiler	
Type of Air Pollution Control Device (APCD)	Baghouse	
Type of heat recovery system	NA	
Length of ancillary piping	1,273.0	ft

MAXIMUM VOLUME OF SCRUBBER LIQUID

Maximum Volume of Scrubber Liquid	13,862.0	gal

MAXIMUM VOLUME OF NONLIQUID WASTE

Volume of incinerator or BIF ash	0.3	yd3
Volume of baghouse/cyclone/ESP dust	0.3	yd3
Volume of Nonliquid Waste	0.6	yd3

SURFACE AREA OF INCINERATOR OR BIF

Surface area of combustion chamber(s)	240.0	ft2
Surface area of APCD	700.0	ft2
Surface area of heat recovery equipment	0.0	ft2
Surface area of exhaust gas duct	396.0	ft2
Surface area of stack	377.0	ft2
Surface Area of Incinerator or BIF	1,713.0	ft2

SURFACE AREA OF ANCILLARY PIPING AND CONTAINMENT AREAS

Surface area of ancillary piping	1,301.0	ft2
Surface area of containment areas	4,800.0	ft2
Surface area of other structures	10,669.0	ft2
Surface Area of Ancillary Piping and Containment Areas	16,770.0	ft2

VOLUME OF MATERIAL TO BE DEMOLISHED AND REMOVED

Volume of materials constituting the incineration system	1,884.0	ft3
Volume of ancillary piping materials	492.1	ft3
Volume of other miscellaneous materials (such as containment areas) to be removed	2,400.0	ft3
Volume of Materials to be Demolished and Removed	4,776.1	ft3
Volume of Materials to be Demolished and Removed in yd3	176.9	yd3

VOLUME OF CONTAMINATED SOIL TO BE REMOVED

Length	0.0	ft
Width	0.0	ft
Depth	0.0	ft

Facility: SI Group **Unit:** Unit1 03/23/2018

Volume of Contaminated Soil to be Removed	0.0	ft3
Volume of Contaminated Soil to be Removed in yd3	0.0	yd3

Notes: All non-default values used as inputs in this cost estimate were derived from the 2003 RCRA Permit Application from site-specific plans or from field measurements taken at the facility.

Inputs taken from 2003 Application: 3.A 3.B 4.A 4.B
Inputs taken from plans: 5.B 5.C
Inputs taken from field measurements: 1.D 4.D 4.E 5.A

Additional Notes:
2.A - Based on conversation with environmental services company values of 0.50 to 0.75 gal/ft2 of scrubber liquid should be used. Square footage in calculation (18483 ft2) includes all surfaces to be cleaned (incineration system piping containment areas tanks truck unloading area) and uses conservative value of 0.75 gal/ft2.
5.B - Containment area of tank farm is 60' by 80'
5.C - Includes tanks (4909 ft2) and truck unloading area (5760 ft2)
6.A - Includes boiler (283 ft3) baghouse (1215 ft3) stack (188.5 ft3) exhaust duct (198 ft3)
6.C - Assumes that the concrete pad in the containment areas is 6-inches thick.

Incinerators and BIFs Decontamination of the Unit (IB_04-1)

Surface area of unit to be cleaned	18,483.0	ft
Choose the appropriate level of PPE:	Protection Level B	
Labor and equipment cost per work hour	$89.26	per Work Hour
Work rate required to clean the unit	0.0405	Work hr per ft2
Number of hours required to clean the unit	748.6	Work hrs
Subtotal of labor and equipment cost to clean unit by steam cleaning	$66,820.04	
Rate	1.0	gals per ft2
Volume of decontamination fluid	18,483.0	gal
Decontamination fluid is contained in:	Drums	
Number of drums required to contain decontamination fluid	337	Drums
Cost of one drum	$66.74	
Cost of drums needed to contain decontamination fluid	$22,491.38	
TOTAL COST OF DECONTAMINATION OF THE UNIT	$89,311.42	

Notes: Suface area includes incineration system piping containment areas tanks truck unloading area.

Default CostPro values used for all inputs.

Disassembly of Ancillary Piping (IB_05-1)

Length of ancillary piping to be disassembled	1,273.0	ft
Choose the appropriate level of PPE	Protection Level D	
Labor and equipment cost per work hour	$37.05	per Work Hour
Work rate required to disassemble one foot of ancillary piping	0.1500	Work hr per Ft
Number of hours required to disassemble ancillary piping	191.0	Work hrs
TOTAL COST OF DISASSEMBLY OF ANCILLARY PIPING	$7,076.55	

Notes: Default CostPro values used for all inputs.

Incinerators and BIFs Demolition and Removal (IB_06-1)

Total volume of unit to be demolished	176.9	yd3
Choose the appropriate level of PPE	Protection Level D	
Labor and equipment cost per work hour	$63.65	per Work Hour
Work rate required to demolish and remove one ft3	0.0030	Work hr per yd3
Number of hours required to demolish and remove the unit	0.5	Work hrs
Subtotal of labor and equipment cost to demolish and remove the unit	$31.82	
Cost of mobilization and demobilization (flat rate)	$398.00	
TOTAL COST OF DEMOLITION AND REMOVAL	$429.82	

Notes: Default CostPro values used for all inputs.

Incinerators and BIFs Removal of Soil (IB_07-1)

Volume of contaminated soil to be removed	177.8	yd3
Choose the appropriate level of PPE	Protection Level D	
Labor and equipment cost per work hour	$53.28	per Work Hour
Work rate required to remove one yd3	0.0300	Work hr per yd3
Number of hours required to remove soil	5.3	Work hrs
Cost to remove soil	$282.38	
Number of debris box containers needed to hold soil	9	Containers
Cost of one 20-yd3 -capacity debris box container (rent per week)	$678.99	per Container
Cost of debris box containers	$6,110.91	
Cost of mobilization and demobilization (flat rate)	$398.00	
TOTAL COST OF REMOVAL OF SOIL	$6,791.29	

Notes: 1 foot of soil will be removed from underneath the boiler tank farm containment area.

Boiler tank farm: 80'x60'x1' = 4800 ft3 = 177.8 yd3

Default CostPro values used for all other inputs.

Incinerators and BIFs Certification of Closure (IB_08-1)

Number of units requiring certification of closure	1	Units
Cost of certification of closure per unit	$3,277.93	
TOTAL COST OF CERTIFICATION OF CLOSURE	$3,277.93	

Notes: Default CostPro values used for all inputs.

Decontamination Summary (DC_01-1)

Decontamination of Unit by Steam Cleaning or Pressure Washing (DC-02)	$142,113.61
Decontamination of Unit by Sandblasting (DC-03)	$608.54
Decontamination of Heavy Equipment (DC-04)	$0.00
TOTAL COST OF DECONTAMINATION	$142,722.15

Decontamination by Steam Cleaning or Pressure Wash (DC_02-2)

Area of unit to be decontaminated	18,483.0	ft2
Choose the appropriate level of PPE	Protection Level D	
Labor and equipment cost per hour	$52.35	per Work Hour
Work rate to steam clean or pressure wash one ft2	0.0405	Work hr per ft2
Number of hours required to steam clean or pressure wash the unit	748.6	Work hrs
Subtotal of labor and equipment costs to decontaminate unit by steam cleaning or pressure washing	$39,189.21	
Ratio of decontamination fluid to area	1.0	gals per ft2
Volume of decontamination fluid generated	18,483.0	gal
Decontamination fluid container type:	Drums	
Number of drums required to contain decontamination fluid for removal	337	Drums
Cost of one drum	$66.74	per Drum
Cost of drums needed to contain decontamination fluid	$22,491.38	
TOTAL COST OF DECONTAMINATION OF UNIT BY STEAM CLEANING OR PRESSURE WASHING	$61,680.59	

Notes: (STEAM CLEANING) Surface area (18483 ft2) includes all surfaces to be cleaned (incineration system piping containment areas tanks truck unloading area).

Default CostPro values used for all other inputs.

Decontamination by Steam Cleaning or Pressure Wash (DC_02-1)

Area of unit to be decontaminated	18,483.0	ft2
Choose the appropriate level of PPE	Protection Level C	
Labor and equipment cost per hour	$77.40	per Work Hour
Work rate to steam clean or pressure wash one ft2	0.0405	Work hr per ft2
Number of hours required to steam clean or pressure wash the unit	748.6	Work hrs
Subtotal of labor and equipment costs to decontaminate unit by steam cleaning or pressure washing	$57,941.64	
Ratio of decontamination fluid to area	1.0	gals per ft2
Volume of decontamination fluid generated	18,483.0	gal
Decontamination fluid container type:	Drums	
Number of drums required to contain decontamination fluid for removal	337	Drums
Cost of one drum	$66.74	per Drum
Cost of drums needed to contain decontamination fluid	$22,491.38	
TOTAL COST OF DECONTAMINATION OF UNIT BY STEAM CLEANING OR PRESSURE WASHING	$80,433.02	

Notes: (PRESSURE WASHING) Surface area (18483 ft2) includes all surfaces to be cleaned (incineration system piping containment areas tanks truck unloading area).

Default CostPro values used for all other inputs.

Decontamination by Sandblasting (DC_03-1)

Area of unit to be decontaminated	240.0	ft2
Choose the appropriate level of PPE	Protection Level C	
Labor and equipment cost per hour	$77.40	per Work Hour
Work rate to sandblast one ft2	0.0290	Work hr per ft2
Number of hours required to sandblast the unit	7.0	Work hrs
Subtotal of labor and equipment costs to decontaminate unit by sandblasting	$541.80	
Ratio of sand to area	2.0	lb per ft2
Volume of material used for sandblasting	480.0	lb
Number of drums required to contain decontamination sands for removal	1	Drums
Cost of one drum	$66.74	per Drum
Cost of drums needed to contain decontamination sands	$66.74	
TOTAL COST OF DECONTAMINATION OF UNIT BY SANDBLASTING	$608.54	

Notes: Only the inside of the boiler will be sandblasted. Default CostPro values used for all other inputs.

Sampling and Analysis Inventory (SA_01-1)

Number of Drilling and Subsurface Soil Samples (2.5-inch boring)	0	Samples
Number of Drilling and Subsurface Soil Samples (4-inch boring)	0	Samples
Number of Concrete Core Samples	0	Samples
Number of Wipe Sample Locations	185	Sample Location
Number of Surface Water and Liquid Sample Locations	0	Sample Location
Number of Soil, Sludge, and Sediment Soil Samples	30	Sample Location
Number of Groundwater Sample Locations	0	Sample Location
Number of Lysimeters to be Sampled	0	Lysimeters

Notes: Wipe samples will be taken every 100 ft2 of decontaminated surface area. Total surface area is 18483 ft2 so 185 wipe samples will be taken. Soil samples will be taken approximately every 400 ft2 (30 soil sampling locations) according to the sampling grid in Figure I-1. Additionally after excavation is complete confirmation samples will be taken at the same locations (i.e. 2 total soil sampling events).

Sampling and Analysis Summary (SA_02-1)

Drilling and Subsurface Soil Sample - 2.5-Inch-Diameter-Holes (SA-03)	$0.00
Drilling and Subsurface Soil Sample - 4-Inch-Diameter-Holes (SA-04)	$0.00
Concrete Core Sample (SA-05)	$0.00
Wipe Sample (SA-06)	$35,778.07
Surface Water and Liquid Sample (SA-07)	$0.00
Soil, Sludge, and Sediment Sample (SA-08)	$16,605.60
Groundwater Sample (SA-09)	$0.00
Soil-Pore Liquid Sample (SA-10)	$0.00
Analysis of Subsurface Soil Sample (SA-11)	$0.00
TOTAL SAMPLING AND ANALYSIS COST	$52,383.67

Wipe Samples (SA_06-1)

COLLECTION OF WIPE SAMPLES

Number of sampling locations	185	Sample Location
Choose the appropriate level of PPE	Protection Level D	
Labor and equipment cost per work hour	$69.49	per Work Hour
Work rate required to collect samples from one sampling location	0.5000	Work hrs per Sample
Number of hours required to collect all samples	92.5	Work hrs
Cost of Collection per Sampling Event	$6,427.82	per Event

ANALYSIS OF WIPE SAMPLE

Cost of Analysis per Sampling Event	$29,350.25	per Event

SAMPLING EVENTS

Number of sampling events	1	Events
TOTAL COST OF SAMPLING AND ANALYSIS OF WIPE SAMPLES	$35,778.07	

Notes: Sampling methods used:
BTEX/gasoline hydrocarbons (mod 8020)(PID/FID) w/prep - 185 samples at 125/sample
Chromium H hexavalent (SW 7195) with prep - 185 samples at 33.65/sample
Default CostPro values used for all other inputs.

Facility: SI Group **Unit:** Unit1 03/23/2018

Wipe Samples (SA_06)
Cost of Analysis per Sampling Event

Method		Standard	Qty	Quick	Qty	Total
BTEX/gasoline hydrocarbons (mod 8020)(PID/FID), w/prep	Both	$125.00	185	$199.14	0	$23,125.00
Chromium H, hexavalent (SW 7195) with prep	Liquid	$33.65	185	$67.30	0	$6,225.25

Soil, Sludge, and Sediment Samples (SA_08-1)

COLLECTION OF SOIL, SLUDGE, AND SEDIMENT SAMPLES		
Number of sampling locations	30	Sample Location
Choose the appropriate level of PPE	Protection Level D	
Labor and equipment cost per work hour	$61.76	per Work Hour
Work rate required to collect samples from one sampling location	1.0000	Work hrs per Sample
Number of hours required to collect all samples	30.0	Work hrs
Cost of Collection per Sampling Event	$1,852.80	per Event
ANALYSIS OF SOIL, SLUDGE, AND SEDIMENT SAMPLES		
Cost of Analysis per Sampling Event	$6,450.00	per Event
SAMPLING EVENTS		
Number of sampling events	2	Events
TOTAL COST OF SAMPLING AND ANALYSIS OF SOIL, SLUDGE, AND SEDIMENT SAMPLES	$16,605.60	

Notes: Sampling methods used:
BTEX/gasoline hydrocarbons (mod 8020)(PID/FID) w/prep - 30 samples at 150/sample
Chromium (SW 7191) with prep - 30 samples at 65/sample
2 sampling events - initial sampling and confirmation sampling post-excavation
Default CostPro values used for all other inputs.

Facility: SI Group **Unit:** Unit1 03/23/2018

Soil, Sludge, and Sediment Samples (SA_08)
Cost of Analysis per Sampling Event

Method		Standard	Qty	Quick	Qty	Total
BTEX/gasoline hydrocarbons (mod 8020)(PID/FID), w/prep	Both	$150.00	30	$199.14	0	$4,500.00
Chromium (SW 7191), with prep	Both	$65.00	30	$58.36	0	$1,950.00

Treatment and Disposal Summary (TD_01-1)

Treatment and Disposal of Wastes (TD-02)	$310,745.00
Treatment and Disposal of Decontamination Fluids (TD-03)	$0.00
Total Cost of Treatment and Disposal	$310,745.00

Treatment and Disposal of Waste (TD_02-3)

SOLID WASTE TREATMENT AND DISPOSAL		
Solid Waste Type (Optional: Enter Name)	0	
Volume in yd3 of solid waste to be treated and disposed of	0.0	yd3
Treatment and disposal costs per yd3	$0.00	per yd3
Cost to Treat and Dispose of Solid Waste	$0.00	
LIQUID WASTE TREATMENT AND DISPOSAL		
Liquid Waste Type (Optional: Enter Name)	0	
Volume in gallons of liquid waste to be treated and disposed of	0.0	gal
Treatment and disposal costs per gallon	$0.00	per Gallon
Cost to Treat and Dispose of Liquid Waste	$0.00	
DRUMMED WASTE TREATMENT AND DISPOSAL		
Drummed Waste Type (Optional: Enter Name)	Solid Decontamination Residue	
Number of drums to be treated and disposed of	30	Drums
Treatment and disposal costs per drum	$253.00	per Drum
Cost to Treat and Dispose of Drummed Waste	$7,590.00	
TOTAL COST FOR TREATMENT AND DISPOSAL OF WASTE	$7,590.00	

Notes: 'Solid Decontamination Residue' will be drummed and disposed of as hazardous waste and includes ash residues baghouse dust brushes sponges mops and PPE. Assumed to generate 1 drum of waste per day. Decontamination is anticipated to take 30 days so 30 drums of waste will be generated. Average value of 253 for solid hazardous drummed waste used.

Treatment and Disposal of Waste (TD_02-2)

SOLID WASTE TREATMENT AND DISPOSAL		
Solid Waste Type (Optional: Enter Name)	0	
Volume in yd3 of solid waste to be treated and disposed of	0.0	yd3
Treatment and disposal costs per yd3	$0.00	per yd3
Cost to Treat and Dispose of Solid Waste	$0.00	
LIQUID WASTE TREATMENT AND DISPOSAL		
Liquid Waste Type (Optional: Enter Name)	Max. Inventory of Haz Waste	
Volume in gallons of liquid waste to be treated and disposed of	170,000.0	gal
Treatment and disposal costs per gallon	$1.67	per Gallon
Cost to Treat and Dispose of Liquid Waste	$283,900.00	
DRUMMED WASTE TREATMENT AND DISPOSAL		
Drummed Waste Type (Optional: Enter Name)	0	
Number of drums to be treated and disposed of	0	Drums
Treatment and disposal costs per drum	$0.00	per Drum
Cost to Treat and Dispose of Drummed Waste	$0.00	
TOTAL COST FOR TREATMENT AND DISPOSAL OF WASTE	$283,900.00	

Notes: Average rate of 1.67 per gallon for liquid hazardous bulk waste used.

Treatment and Disposal of Waste (TD_02-1)

SOLID WASTE TREATMENT AND DISPOSAL

Solid Waste Type (Optional: Enter Name)	0	
Volume in yd3 of solid waste to be treated and disposed of	0.0	yd3
Treatment and disposal costs per yd3	$0.00	per yd3
Cost to Treat and Dispose of Solid Waste	$0.00	

LIQUID WASTE TREATMENT AND DISPOSAL

Liquid Waste Type (Optional: Enter Name)	Liquid Waste (Residue)	
Volume in gallons of liquid waste to be treated and disposed of	8,500.0	gal
Treatment and disposal costs per gallon	$1.67	per Gallon
Cost to Treat and Dispose of Liquid Waste	$14,195.00	

DRUMMED WASTE TREATMENT AND DISPOSAL

Drummed Waste Type (Optional: Enter Name)	Blasting Sand/Filter Bags	
Number of drums to be treated and disposed of	20	Drums
Treatment and disposal costs per drum	$253.00	per Drum
Cost to Treat and Dispose of Drummed Waste	$5,060.00	
TOTAL COST FOR TREATMENT AND DISPOSAL OF WASTE	$19,255.00	

Notes: Liquid waste treatment and disposal costs include a .05 tax per gallon. It is assumed that 8500 gallons of hazardous waste (5% of the maximum hazardous waste storage volume [170000 gallons]) may remain as residual wastes in the tanks and require disposal by a licensed hazardous waste services at closure. Average value of 1.67/gallon for liquid hazardous bulk waste used.

Approximately 20 drums of blasting sand and filter bags estimated to be generated during decontamination of the boiler and baghouse. Average value of 253/drum of hazardous drummed solids used.

User Defined Activity (UD_01-1)

NAME OF CLOSURE OR POST-CLOSURE ACTIVITY	Sampling and Analysis Plan Development	
Number of units of work to be performed	1	
Type of unit	Tons	
Appropriate level of PPE	Protection Level B	
Labor, material, and equipment cost per work hour	$125.00	
Work rate to perform one unit of activity	20.0000	Work hrs per Unit
Number of hours required to perform activity	20.0	Work hrs
Additional cost per unit	$0.00	per Unit
Cost to conduct activity	$2,500.00	

Other cost(s) associated with this activity

Description of other costs	0
Cost	$0.00
Description of other costs	0
Cost	$0.00
Description of other costs	0
Cost	$0.00
Description of other costs	0
Cost	$0.00
Description of other costs	0
Cost	$0.00
TOTAL COST OF USER DEFINED ACTIVITY	$2,500.00

Notes: Cost to develop a Sampling and Analysis Plan: 20 hrs at Professional Engineer rate of 125/hr

Appendix I-2
SI Group Hazardous Waste Surety Bond

SURETY RIDER

To be attached to and form a part of

Bond No. SUR0024557

dated effective 2/26/2015
(MONTH-DAY-YEAR)

executed by SI Group, Inc. , as Principal,
(PRINCIPAL)

and by Argonaut Insurance Company , as Surety,

in favor of South Carolina Department of Health and Environmental Control
(OBLIGEE)

in consideration of the mutual agreements herein contained the Principal and the Surety hereby consent to changing

The Bond Amount to:

Eight Hundred Eleven Thousand Seven Hundred Twenty And 58/100 ($811,720.58)

Nothing herein contained shall vary, alter or extend any provision or condition of this bond except as herein expressly stated.

This rider is effective 6/8/2018
(MONTH-DAY-YEAR)

Signed and Sealed 6/8/2018
(MONTH-DAY-YEAR)

SI Group, Inc.
(PRINCIPAL)

By: Richard P. Barlow
(PRINCIPAL)

Argonaut Insurance Company
(SURETY)

By: Julie Karnes
Julie Karnes, Attorney-in-Fact

S-0443/GEEF 10/99

AS-0117958

Argonaut Insurance Company
Deliveries Only: 225 W. Washington, 24th Floor
Chicago, IL 60606
United States Postal Service: P.O. Box 469011, San Antonio, TX 78246

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the Argonaut Insurance Company, a Corporation duly organized and existing under the laws of the State of Illinois and having its principal office in the County of Cook, Illinois does hereby nominate, constitute and appoint:

Carolyn E. Wheeler, Loretta M. Jones, Mary Y. Volmar, Joy M. Williams, Sandra King, Vicki Nobinger,Rachel A. Chaveriat, Julie Karnes, Bonnie L. Rice,Rebecca J. Hobbs, Sandy McElhaney

Their true and lawful agent(s) and attorney(s)-in-fact, each in their separate capacity if more than one is named above, to make, execute, seal and deliver for and on its behalf as surety, and as its act and deed any and all bonds, contracts, agreements of indemnity and other undertakings in suretyship provided, however, that the penal sum of any one such instrument executed hereunder shall not exceed the sum of:

$75,000,000.00

This Power of Attorney is granted and is signed and sealed under and by the authority of the following Resolution adopted by the Board of Directors of Argonaut Insurance Company:

"RESOLVED, That the President, Senior Vice President, Vice President, Assistant Vice President, Secretary, Treasurer and each of them hereby is authorized to execute powers of attorney, and such authority can be executed by use of facsimile signature, which may be attested or acknowledged by any officer or attorney, of the Company, qualifying the attorney or attorneys named in the given power of attorney, to execute in behalf of, and acknowledge as the act and deed of the Argonaut Insurance Company, all bond undertakings and contracts of suretyship, and to affix the corporate seal thereto."

IN WITNESS WHEREOF, Argonaut Insurance Company has caused its official seal to be hereunto affixed and these presents to be signed by its duly authorized officer on the 18th day of July, 2013.

ARGONAUT INSURANCE COMPANY CORPORATE SEAL 1948 ILLINOIS

Argonaut Insurance Company

by: _____

Joshua C. Betz, Senior Vice President

STATE OF TEXAS
COUNTY OF HARRIS SS:

On this 18th day of July, 2013 A.D., before me, a Notary Public of the State of Texas, in and for the County of Harris, duly commissioned and qualified, came THE ABOVE OFFICER OF THE COMPANY, to me personally known to be the individual and officer described in, and who executed the preceding instrument, and he acknowledged the execution of same, and being by me duly sworn, deposed and said that he is the officer of the said Company aforesaid, and that the seal affixed to the preceding instrument is the Corporate Seal of said Company, and the said Corporate Seal and his signature as officer were duly affixed and subscribed to the said instrument by the authority and direction of the said corporation, and that Resolution adopted by the Board of Directors of said Company, referred to in the preceding instrument is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand, and affixed my Official Seal at the County of Harris, the day and year first above written.

KATHLEEN M. MEEKS Notary Public, State of Texas Comm. Expires 07-15-2021 Notary ID 562002-5

Kathleen M. Meeks

(Notary Public)

I, the undersigned Officer of the Argonaut Insurance Company, Illinois Corporation, do hereby certify that the original POWER OF ATTORNEY of which the foregoing is a full, true and correct copy is still in full force and effect and has not been revoked.

IN WITNESS WHEREOF, I have hereunto set my hand, and affixed the Seal of said Company, on the 8th day of June 2018

ARGONAUT INSURANCE COMPANY CORPORATE SEAL 1948 ILLINOIS

James Bluzard, Vice President-Surety

THIS DOCUMENT IS NOT VALID UNLESS THE WORDS ARGO POWER OF ATTORNEY AND THE SERIAL NUMBER IN THE UPPER RIGHT HAND CORNER ARE IN BLUE, AND THE DOCUMENT IS ISSUED ON WATERMARKED PAPER. IF YOU HAVE QUESTIONS ON AUTHENTICITY OF THIS DOCUMENT CALL (210) 321 - 8400.

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[40 CFR 270.14(d); SC R.61-79.270.14 (d)] 0929

APPENDICES

Appendix J-1 SWMUs and AOCs Identified in the 1993 RFA
Appendix J-2 Active SWMUs and AOCs as of May 2018

SECTION J
SOLID WASTE MANAGEMENT UNITS
[40 CFR 270.14(d); SC R.61-79.270.14 (d)]

In 1992, U.S. EPA contractor A.T. Kearney conducted a Preliminary Review (PR) and Visual Site Inspection (VSI) at the Ethyl Corporation facility in Orangeburg South Carolina (later Albemarle Corporation, and now owned and operated by SI Group). The PR and VSI were conducted to identify potential SWMUs and areas of concern (AOCs). In 1993, a RCRA Facility Assessment (RFA) report was drafted by A.T. Kearney which identified 160 SWMUs and three AOCs. That report is hereby incorporated into this Application by reference; with a copy of the 1993 RFA included on the CD that accompanies this Application. It contains, where known, dates of releases, nature of the releases, types and quantities of wastes handled and operating history and dimensions.

Subsequent to the 1993 RFA report being issued, Albemarle Corporation, U.S. EPA, and SCDHEC agreed that many of the units named as SWMUs in the RFA were process units and storage tanks that should not have been named as SWMUs. The outcome of this agreement was ultimately memorialized in an Administrative Order on Consent executed between U.S. EPA and Albemarle Corporation in October 2000. This 2000 Administrative Order named RCRA actions for 15 SWMUs and 2 AOCs. The 2000 Administrative Order was terminated in October 2014 (with the exception of continuing document preservation requirements). That Order is also incorporated into this Application by reference; with a copy of the Order included on the CD that accompanies this Application.

Activity at the subject SWMUs and AOCs progressed and, in March 2006, SCDHEC issued the facility's RCRA Permit. The March 2006 RCRA Permit was subsequently modified in October 2006 and again in January 2008. The 2008 RCRA Permit presented the status of various SWMUs and AOCs in numerous tables within the permit. Collectively, the 2008 RCRA Permit named 15 SWMUs and 5 AOCs subject to action under the RCRA program. The 2008 RCRA Permit also listed 6 SWMUs that were deferred to other environmental programs.

To simplify presentation of the SWMUs and AOCs subject to action under RCRA for this RCRA Application, a single Table J-1 has been prepared (Appendix J-1). Table J-1 includes all SWMUs and AOCs named in U.S. EPA's RFA and notes the subsequent status changes in the SWMUs and AOCs since the time of the RFA until the time of this Application. The appendix also contains a two-page map showing the locations of all SWMU's and AOC's in the 1993 RFA.

As noted above, the 1993 list has been refined through further work to an active list of SWMU's and AOC's. Detailed descriptions of each of these may be found in Appendix J-2, with a map showing the location of each.

Appendix J-1
SWMUs and AOCs Identified in the 1993 RFA

Section J - Appendix J-1
SWMU and AOC Status Summary Table
SI Group Inc.
Orangeburg, South Carolina

SWMU/AOC	SWMU Name	NFA[1] Issued in 1993 (or earlier)	NFA issued after 1993	In Progress[2]	Units Transferred to Another Program	Unit Regulated Under RCRA
SWMU 1	Landfill				Transferred to Solid Waste	
SWMU 2	Old Spoils Area			RFI		
SWMU 3	Former Hi-TOC Lagoon			CMS		
SWMU 4	French Drain A	X				
SWMU 5	French Drain B	X				
SWMU 6	French Drain C	X				
SWMU 7	East/West French Drain	X				
SWMU 8	South Swap French Drain	X				
SWMU 9	South Swamp (changed to AOC E)		X (recommended in 2015)			
SWMU 10	Storm water Basin & Ditches	X				
SWMU 11	Storm water Outfall Ditches				Transferred to Bureau of Water	
SWMU 12	Former Industrial Sewer			CMS		
SWMU 13N	Former North-South Ditch Northern			RFI		
SWMU 13S	Former North-South Ditch Southern			CMS		
SWMU 14	Former East-West Ditch			RFI		
SWMU 15	Current North-South Ditch			CMS		
SWMU 16	Primary Clarifier				Transferred to Bureau of Water	
SWMU 17	T9639 (T-10M-21) 10,000-gal Oily Waste Tank		X			
SWMU 18	Deep Sump				Transferred to Bureau of Water	
SWMU 19	Equalization Tank	X				
SWMU 20	Mechanical Dewatering System (A - Filter Presses (2); B- Floc Tanks (2))	X				
SWMU 21	Sludge Roll-Offs	X				
SWMU 22	Sludge Holding Basin / Old Holding Area			LUC		
SWMU 23	Sandbeds No. 1-4 (23A through 23D)			CMS		
SWMU 24	Pond 1			LUC		
SWMU 25	Pond 2				Transferred to Bureau of Water	
SWMU 26	Pond 3			LUC		
SWMU 27	Secondary Clarifier				Transferred to Bureau of Water	
SWMU 28	Sludge Decant Tank	X				
SWMU 29	Less-Than-90-Day Drum Storage		X			
SWMU 30	GSX Area	X				
SWMU 31	Sample Container Shed	X				
SWMU 32	Transformer Containment Box	X				
SWMU 33	Equipment Laydown Yard	X				
SWMU 34	Paint Solids Drum Storage Area	X				
SWMU 35	Sand Blast Drum Storage Area	X				
SWMU 36	Welding/Vehicle Shop Waste Collection Areas	X				
SWMU 37	Plant 5 Waste Collection Drums	X				
SWMU 38	Plant 7 Blending Area Drums	X				
SWMU 39	Plant 8 Waste Collection Areas (2)	X				
SWMU 40	Plant 9 Waste Collection Area	X				
SWMU 41	Plant 12 Waste Collection Area	X				
SWMU 42	Second Street Waste Collection Area	X				
SWMU 43	Raw Materials Warehouse Waste Collection Area	X				
SWMU 44	Drum Loading Waste Collection Area	X				
SWMU 45	EPTD Decon Waste Collection Drum	X				
SWMU 46	Maintenance Area Waste Collection Drum	X				

Section J - Appendix J-1
SWMU and AOC Status Summary Table
SI Group Inc.
Orangeburg, South Carolina

SWMU/AOC	SWMU Name	NFA[1] Issued in 1993 (or earlier)	NFA issued after 1993	In Progress[2]	Units Transferred to Another Program	Unit Regulated Under RCRA
SWMU 47	R&D Laboratory Waste Accumulation Containers	X				
SWMU 48	Plant 1 Sample Bottle Drum	X				
SWMU 49	Plant 7 Waste Collection Drum	X				
SWMU 50	Plant 8 Sample SAA	X				
SWMU 51	T-20M-10 EPTD Hydrolysis Tank	X				
SWMU 52	K-1600-2 EPTD Vacuum Oil Tank	X				
SWMU 53	K-1600-3 Waste Oil Hydrolysis Tank	X				
SWMU 54	T-7333 (T-1M-51) 1000-gal Cleaning Solvents Tank	X				
SWMU 55	T-6M-17 Dilute Alkyl Holding Tank	X				
SWMU 56	T-500-14 Washout Kerosene Portable Tank	X				
SWMU 57	K-1000-11 Hydrolysis Feed Tank	X				
SWMU 58	K-1000-26 Hydrolysis Holding Tank	X				
SWMU 59	K-2M-14 Hydrolysis Tank	X				
SWMU 60	T-10M-23 Intermediate Organics Tank	X				
SWMU 61	T-8200-1 MMT Column Bottoms Wastewater Tank	X				
SWMU 62	T-8200-2 MMT Column Bottoms Wastewater Tank	X				
SWMU 63	T-6M-18 Former DMC-Water Stripper Bottoms	X				
SWMU 64	T-6M-23 DMC-Water Stripper Bottoms Tank	X				
SWMU 65	T-4800-1 MMT Washwater Tank	X				
SWMU 66	T-5143B (T-2M-7) 2000-gal MMT Column Bottoms Tank		X			
SWMU 67	T-5143A (T-2M-8) 2000-gal MMT Column Bottoms Tank		X			
SWMU 68	K-4M-2 Former MPA Process Wastewater Tank	X				
SWMU 69	K-4M-8 MPA Process Wastewater Tank	X				
SWMU 70	T-100M-3 Wastewater Tank	X				
SWMU 71	T-100M-4 DETDA Wastewater Tank	X				
SWMU 72	T-15M-41 DETDA Wastewater Tank	X				
SWMU 73	T8155 T-15M-42 15,000-gal Hazardous Waste Fuel Tank		X			
SWMU 74	T-10M-11 Wastewater Tank	X				
SWMU 75	T-5M-1 301 Lights Tank	X				
SWMU 76	T-5M-4 Orthoalkylation Still Bottoms Tank	X				
SWMU 77	T-5M-3 Orthoalkylation Still Bottoms Tank	X				
SWMU 78	T-1M-30 Column Vent Lights Tank	X				
SWMU 79	T-1M-47 Phenol Scrubber Tank	X				
SWMU 80	T-431 DR-3 Acidification Water Washes Tank	X				
SWMU 81	T-433 Groundwater Recovery Tank	X				
SWMU 82	T-9241 (T-30M-69) (T-434) 30,000 gal DR-3 Acidic Wastes Tank	X				
SWMU 83	T-437 DR-3 Process Wastewater Tank	X				
SWMU 84	T-9240 (T30M-70) (T-438) 30,000 gal DR-3 Acidic Wastes Tank	X				
SWMU 85	T-1431 DR-3 Reactors Wastewater Tank	X				
SWMU 86	T-1432 DR-3 Process Wastewater Tank	X				
SWMU 87	T-1437 DR-3 Reactors Wastewater Tank	X				
SWMU 88	D-1413 Pressure Wash Tank	X				
SWMU 89	T-9320 DR-3 Wastewater Collection Tank	X				
SWMU 90	T-19M-1 330 Process Sump Wastewater Tank	X				
SWMU 91	T-11M-2 330 MeCl Recovery Wastewater Tank	X				
SWMU 92	T-10M-14 330 Heel Organics Tank	X				

Section J - Appendix J-1
SWMU and AOC Status Summary Table
SI Group Inc.
Orangeburg, South Carolina

SWMU/AOC	SWMU Name	NFA[1] Issued in 1993 (or earlier)	NFA issued after 1993	In Progress[2]	Units Transferred to Another Program	Unit Regulated Under RCRA
SWMU 93	T-30M-65 330 Acidic Wastewater Tank	X				
SWMU 94	T-300-9 330 Process Wastewater Tank	X				
SWMU 95	V-1482 (T-500-58) 500 gallon Scrubber Spent Acid Tank	X				
SWMU 96	T-1135 (T-1OM-24) Spent Caustic Tank	X				
SWMU 97	T-225-2 Neutralization Tank	X				
SWMU 98	K-3000-4 702 Still Bottoms Tank	X				
SWMU 99	K-3000-6 702 Bottoms Tank	X				
SWMU 100	T-9232 (T-30M-60) 30,000 gallon Hazardous Waste Storage Tank	X				
SWMU 101	T-1M-23 Waste Hydrolysis Kettle	X				
SWMU 102	T-15M-46 DETDA Extraction Tank	X				
SWMU 103	T-15M-45 Oily Waste Tank	X				
SWMU 104	T-15M-34 701 Process Acidic Wastewater Tank	X				
SWMU 105	T-15M-29 Caustic Waste Tank	X				
SWMU 106	T-15M-33 701 Process Acidic Wastewater Tank	X				
SWMU 107	T9730 (T-15M-61) 15,000 gallons DII Spent Acid Tank	X				
SWMU 108	T-8332 (T-100M-2) 100,000 Hazardous Waste Fuel Tank	X			Regulated under DHEC R.61-79.264	X
SWMU 109	T-8331 (T-30M-37) 30,000 gallon Hazardous Waste Tank	X			Regulated under DHEC R.61-79.264	X
SWMU 110	T-8333 (T-30M-61) 30,000 gallon Hazardous Waste Storage Tank	X			Regulated under DHEC R.61-79.264	X
SWMU 111	T-8345 (T- 10M-5) 10,000 gallon Hazardous Waste Fuel Tank	X			Regulated under DHEC R.61-79.264	X
SWMU 112	T-200M-1 Sludge Holding Tank	X				
SWMU 113	T-20M-9 Sludge Holding Tank	X				
SWMU 114	T-3300-4 Water Recycle Tank	X				
SWMU 115	T-2300-1 pH Adjustment	X				
SWMU 116	Former Drum Sump		X			
SWMU 117	K-500-14 Waste Transfer Hopper	X				
SWMU 118	T-500-18 Portable Hazardous Waste Tank	X				
SWMU 119	K-1000-3 Hazardous Waste Collection Tank	X				
SWMU 120	E-1 Tank Trailer	X				
SWMU 121	E-3 Tank Trailer	X				
SWMU 122	E-4 Tank Trailer	X				
SWMU 123	E-5 Tank Trailer	X				
SWMU 124	E-6 Tank Trailer	X				
SWMU 125	Boiler 4	X			Regulated under DHEC R.61-79.264	X
SWMU 126	Boiler 4 AECS	X				
SWMU 127	DR-3 Incinerator	X				
SWMU 128	MMT Flare	X				
SWMU 129	Former Trash Incinerator	X				
SWMU 130	Former Burn Pit			CMS		
SWMU 131	Former Ground Burner Unit			RFI		
SWMU 132	Former Aluminum Alkyl Burn Pit			RFI		
SWMU 133	Bubble Pots	X				
SWMU 134	Plant 8 Scrubber	X				
SWMU 135	Plant 9 HCL Scrubber	X				
SWMU 136	Plant 11 Scrubber	X				

Section J - Appendix J-1
SWMU and AOC Status Summary Table
SI Group Inc.
Orangeburg, South Carolina

SWMU/AOC	SWMU Name	NFA[1] Issued in 1993 (or earlier)	NFA issued after 1993	In Progress[2]	Units Transferred to Another Program	Unit Regulated Under RCRA
SWMU 137	Plant 12 DMA Scrubber	X				
SWMU 138	Plant 14 Scrubber	X				
SWMU 139	BIF Loading/Unloading Area		X			
SWMU 140	Railcar Loading/Unloading Area	X				
SWMU 141	Used Acid/Base Loading Area	X				
SWMU 142	DETDA Trailer Unloading Area	X				
SWMU 143	Cylinder Cleaning Solvents Loading/Unloading Area	X				
SWMU 144	Blending Area Loading/Unlading Area	X				
SWMU 145	Plant 8 Loading Area	X				
SWMU 146	EPTD Decon Area	X				
SWMU 147	Container Decontamination Area		X			
SWMU 148	Trailer Washing Area	X				
SWMU 149	Railcar Washing Area	X				
SWMU 150	Vehicle/Equipment Washing Area	X				
SWMU 151	Aluminum Alyls Staging and Washing Area	X				
SWMU 152N	North Sandblast Area			CMS		
SWMU 152S	South Sandblast Area			Under Review		
SWMU 153	Dump Trucks	X				
SWMU 154	Refuse Dumpsters	X				
SWMU 155	Scrap Metal Dumpsters	X				
SWMU 156	Plant 8 Catalyst Dumpster	X				
SWMU 157	Lime Grit Bin	X				
SWMU 158	Groundwater Well	X				
SWMU 159	Plant 8 Wastewater Sumps		X			
SWMU 160	Plant 10 Sump		X			
AOC A	North Fork Edisto River			Under Review		
AOC B	Area East of Landfill		X			
AOC C	DMC Spill Site		X			
AOC D	Fire Training Area			CS		
AOC E	South Swamp (in area of former SWMU 9)			CS		
AOC F	Eastern Debris Area			LUC		
AOC G	Product Area South of Pond 1			RFI		
AOC H	Product Area Northeast of Pond 3			RFI		

Notes:

1) Solid Waste Management Units (SWMUs) in this category cannot be addressed until the plant is decommissioned and have been issued a no further action (NFA) required at this time

2) See Appendix J-2 for SWMU/AOC summary and additional details regarding current status

RCRA = Resource Conservation and Recovery Act

DHEC = Department of Health and Environmental Control

CS = Confirmatory Sampling

RFI = RCRA Facility Investigation

CMS = Corrective Measures Study

LUC = Requiring Land Use Controls

NFA = No Further Action

FIGURE III.1
Approximate Location of SWMUs (No. 1 of 2)

SWMU NUMBER	SWMU NAME
	Land Units
1.	Landfill
2.	Old Spoils Area
	A. North Spoils Area
	B. South Spoils Area
	C. North Aluminum Oxide Area
	D. South Aluminum Oxide Area
	E. East Aluminum Oxide Area
	F. A/B Lagoon
	G. C/D Lagoon
	H. Former Landfill Area
3.	Former Hi-TOC Lagoon
4.	French Drain A
5.	French Drain B
6.	French Drain C
7.	East/West French Drain
8.	South Swamp French Drain
9.	South Swamp
10.	Stormwater Collection System
	9. Stormwater Impoundment Basin
11.	Stormwater Outfall Ditches (point of discharge)
	Wastewater Treatment System Units
13.	Former North/South Ditch
14.	Former East/West Ditch
15.	Current North/South Ditch
16.	Primary Clarifier
17.	T-10K-21 Oily Waste Tank
18.	Deep Sump
19.	Equalization Tank
20.	Mechanical Dewatering System
	A. Filter Presses
	B. Floc Tanks
21.	Sludge Roll-Offs
22.	Sludge Holding Basin
23.	Sand Bed Nos. 1 - 4
24.	Pond No. 1
25.	Pond No. 2
26.	Pond No. 3
27.	Secondary Clarifier
28.	Sludge Decant Tank
	Waste Storage Units
29.	Less-Than-90-Day Drum Storage Area
30.	GSX Area
31.	Sample Container Shed
32.	Transformer Containment Box
33.	Equipment Laydown Yard
34.	Paint Solids Drum Storage Area
35.	Sand Blast Drum Storage Area

SWMU NUMBER	SWMU NAME
	Air Emission Units
125.	Boiler No. 4
126.	Boiler No. 4 AECS
127.	DR-3 Incinerator
128.	MMT Flare
129.	Former Trash Incinerator
130.	Former Burn Pit
131.	Former Ground Burner Unit
132.	Former Aluminum Alkyl Burn Pit
133.	Bubble Pots
	Loading/Unloading Areas
139.	RIF Loading/Unloading Area
141.	Used Acid/Base Loading Areas
142.	DETDA Trailer Unloading Area
143.	Cylinder Cleaning Solvents Loading/Unloading Area
144.	Blending Area Loading/Unloading Area
145.	Plant No. 8 Loading Area
	Miscellaneous Units
146.	EPTD Decon Area
147.	Container Decontamination Area
148.	Trailer Washing Area
149.	Railcar Washing Area
150.	Vehicle/Equipment Washing Area
151.	Aluminum Alkyls Staging and Washing Area
152.	Sand Blasting Areas
153.	Dump Trucks
155.	Scrap Metal Dumpsters
156.	Plant No. 8 Catalyst Dumpster
157.	Lime Grit Bin
158.	Ground-Water Recovery Well
159.	Plant No. 3 Wastewater Sumps
160.	Plant No. 10 Sump

AOC	AOC NAME
A.	North Fork Edisto River
B.	Area East of Landfill
C.	DNC Spill Site

The following units are located throughout the facility:

SWMU NUMBER	SWMU NAME
10.	Stormwater Collection System
	A. Drainage Ditches
12.	Industrial Sewer System
140.	Railcar Loading/Unloading Area
154.	Refuse Dumpsters

ETHYL CORP.
ORANGEBURG, S.C.

PLANT MAP
FOR FIVE YEAR PLAN

DRAWN BY: JSJ III
DATE: 10/25/90
DWG. NO. □BH00A186 REV. 0

FIGURE III-2
APPROXIMATE LOCATION OF SWMUs
MAP 2 of 2

36. Welding/Vehicle Shop Waste Collection Areas
37. Plant No. 5 Waste Collection Drums
38. Plant No. 7 Blending Area Drums
39. Plant No. 8 Waste Collection Areas (2)
40. Plant No. 9 Waste Collection Area
41. Plant No. 12 Waste Collection Area
42. Second Street Waste Collection Area
43. Raw Materials Warehouse Waste Collection Area
44. Drum Loading Waste Collection Area
45. EPTD Decon Waste Collection Drum
46. Maintenance Area Waste Collection Drum
47. R&D Laboratory Waste Accumulation Containers
48. Plant No. 1 Sample Bottle Drum
49. Plant No. 7 Waste Collection Drum
50. Plant No. 8 Sample SAA
51. T-22M-10 EPTD Hydrolysis Tank
52. K-1600-2 EPTD Vacuum Oil Tank
53. K-1600-3 EPTD Vacuum Oil Tank
54. T-1M-51 Cleaning Solvents Tank
55. T-6M-17 Dilute Alkyls Holding Tank
56. T-500-14 Washout Kerosene Portable Tank
57. K-1000-11 Hydrolysis Feed Tank
58. K-1000-26 Hydrolysis Holding Tank
59. K-2M-14 Hydrolysis Tank
60. T-10M-23 Intermediate Organics Tank
61. T-8200-1 MMT Column Bottoms Wastewater Tank
62. T-8200-2 MMT Column Bottoms Wastewater Tank
63. T-6M-18 Former DMC-Water Stripper Bottoms Tank
64. T-6M-23 DMC-Water Stripper Bottoms Tank
65. T-4800-1 MMT Washwater Tank
66. T-2M-7 MMT Column Bottoms Tank
67. T-2M-8 MMT Column Bottoms Tank
68. K-4M-2 Former MPA Process Wastewater Tank
69. K-4M-8 MPA Process Wastewater Tank
70. T-10M-3 Oily Wastewater Tank
71. T-10M-4 DETDA Wastewater Tank
72. T-15M-41 DETDA Wastewater Tank
73. T-15M-42 Hazardous Waste Fuel Tank
74. T-10M-11 Wastewater Tank
75. T-5M-1 301 Lights Tank
76. T-5M-4 Orthoalkylation Still Bottoms Tank
77. T-5M-3 Orthoalkylation Still Bottoms Tank
78. T-1M-30 Column Vent Lights Tank
79. T-1M-47 Phenol Scrubber Tank
80. T-431 DR-3 Acidification Water Washes Tank
81. T-433 Ground-Water Recovery Tank
82. T-434 DR-3 Acidic Wastes Tank
83. T-437 DR-3 Process Wastewater Tank
84. T-438 DR-3 Acidic Wastes Tank
85. T-1431 DR-3 Reactors Wastewater Tank
86. T-1432 DR-3 Process Wastewater Tank
87. T-1437 DR-3 Reactors Wastewater Tank
88. D-1413 Pressure Wash Tank
89. T-9230 DR-3 Wastewater Collection Tank
90. T-19M-1 330 Process Sump Wastewater Tank
91. T-11M-2 330 HCl Recovery Wastewater Tank
92. T-10M-14 330 Heel Organics Tank
93. T-30M-65 330 Acidic Wastewater Tank
94. T-300-9 330 Process Wastewater Tank
95. T-500-58 Scrubber Spent Acid Tank
96. T-10M-24 Spent Caustic Tank
97. T-225-2 Neutralization Tank
98. K-3000-4 702 Still Bottoms Tank
99. K-3000-6 702 Still Bottoms Tank
100. T-30M-60 Hazardous Waste Storage Tank
101. T-1M-23 Waste Hydrolysis Kettle
102. T-15M-46 DETDA Extraction Tank
103. T-15M-45 Oily Wastewater Tank
104. T-15M-34 701 Process Acidic Wastewater Tank
105. T-15M-29 Caustic Waste Tank
106. T-15M-33 701 Process Acidic Wastewater Tank
107. T-15M-61 Dil Spent Acid Tank
108. T-100M-2 Hazardous Waste Fuel Tank
109. T-30M-37 Former Hazardous Waste Tank
110. T-30M-61 Hazardous Waste Storage Tank
111. T-10M-5 Hazardous Waste Fuel Tank
112. T-200M-1 Sludge Holding Tank
113. T-20M-9 Sludge Holding Tank
114. T-3300-4 Water Recycle Tank
115. T-2300-1 pH Adjustment Tank
116. Former Drum Sump
117. K-500-14 Waste Transfer Hopper
118. T-500-18 Portable Hazardous Waste Tank
119. K-1000-3 Hazardous Waste Collection Tank
120. E-1 Tank Trailer
121. E-3 Tank Trailer
122. E-4 Tank Trailer
123. E-5 Tank Trailer
124. E-6 Tank Trailer
133. Bubble Pots
134. Plant No. 8 Scrubber
135. Plant No. 9 HCl Scrubber
136. Plant No. 11 Scrubber
137. Plant No. 12 DMA Scrubber
138. Plant No. 14 DMA Scrubber

FIGURE III.1
Approximate Location of SWMUs (No. 1 of 2)

SWMU NUMBER	SWMU NAME
	Land Units
1.	Landfill
2.	Old Spoils Area
	A. North Spoils Area
	B. South Spoils Area
	C. North Aluminum Oxide Area
	D. South Aluminum Oxide Area
	E. East Aluminum Oxide Area
	F. A/B Lagoon
	G. C/D Lagoon
	H. Former Landfill Area
3.	Former Hi-TOC Lagoon
4.	French Drain A
5.	French Drain B
6.	French Drain C
7.	East/West French Drain
8.	South Swamp French Drain
9.	South Swamp
10.	Stormwater Collection System
	B. Stormwater Impoundment Basin
11.	Stormwater Outfall Ditches (point of discharge)
	Wastewater Treatment System Units
13.	Former North/South Ditch
14.	Former East/West Ditch
15.	Current North/South Ditch
16.	Primary Clarifier
17.	T-104-21 Oily Waste Tank
18.	Deep Sump
19.	Equalization Tank
20.	Mechanical Dewatering System
	A. Filter Presses
	B. Floc Tanks
21.	Sludge Roll-Offs
22.	Sludge Holding Basin
23.	Sand Bed Nos. 1 - 4
24.	Pond No. 1
25.	Pond No. 2
26.	Pond No. 3
27.	Secondary Clarifier
28.	Sludge Decant Tank
	Waste Storage Units
29.	Less-Than-90-Day Drum Storage Area
30.	GSX Area
31.	Sample Container Shed
32.	Transformer Containment Box
33.	Equipment Laydown Yard
34.	Paint Solids Drum Storage Area
35.	Sand Blast Drum Storage Area

SWMU NUMBER	SWMU NAME
	Air Emission Units
125.	Boiler No. 4
126.	Boiler No. 4 AECS
127.	DR-3 Incinerator
128.	MMT Flare
129.	Former Trash Incinerator
130.	Former Burn Pit
131.	Former Ground Burner Unit
132.	Former Aluminum Alkyl Burn Pit
133.	Bubble Pots
	Loading/Unloading Areas
139.	BIF Loading/Unloading Area
141.	Used Acid/Base Loading Areas
142.	DETDA Trailer Unloading Area
143.	Cylinder Cleaning Solvents Loading/Unloading Area
144.	Blending Area Loading/Unloading Area
145.	Plant No. 8 Loading Area
	Miscellaneous Units
146.	EPTD Decon Area
147.	Container Decontamination Area
148.	Trailer Washing Area
149.	Railcar Washing Area
150.	Vehicle/Equipment Washing Area
151.	Aluminum Alkyls Staging and Washing Area
152.	Sand Blasting Areas
153.	Dump Trucks
155.	Scrap Metal Dumpsters
156.	Plant No. 8 Catalyst Dumpster
157.	Lime Grit Bin
158.	Ground-Water Recovery Well
159.	Plant No. 3 Wastewater Sumps
160.	Plant No. 19 Sump

AOC	AOC NAME
A.	North Fork Edisto River
B.	Area East of Landfill
C.	DMC Spill Site

The following units are located throughout the facility:

SWMU NUMBER	SWMU NAME
10.	Stormwater Collection System A. Drainage Ditches
12.	Industrial Sewer System
140.	Railcar Loading/Unloading Area
154.	Refuse Dumpsters

ETHYL CORP. ORANGEBURG, S.C.	
PLANT MAP FOR FIVE YEAR PLAN	
DRAWN BY: JSJ III	
DATE: 10/25/90	
DWG. NO. DBH00A186	REV. 0

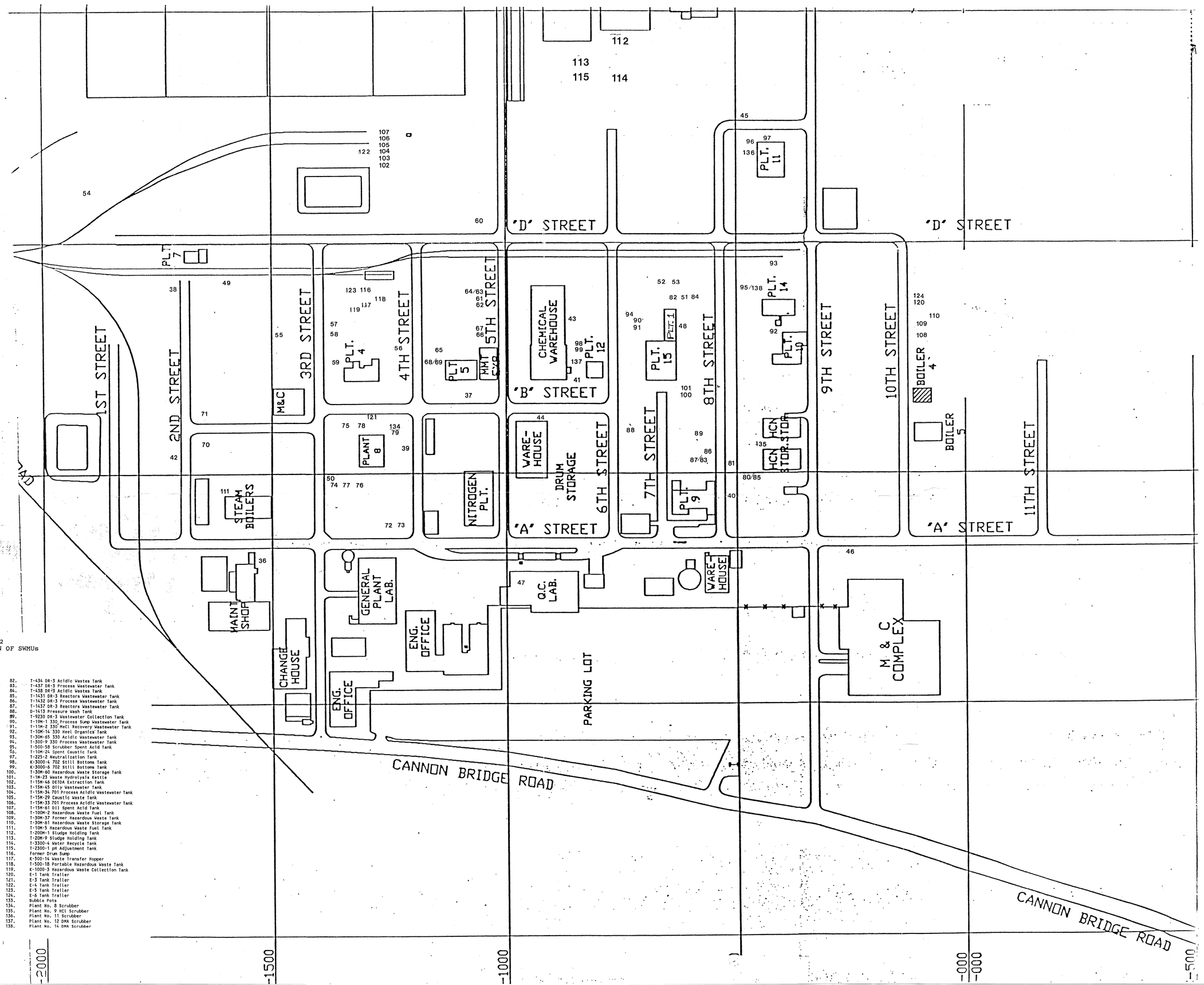

FIGURE III-2
APPROXIMATE LOCATION OF SWMUs
MAP 2 of 2

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45. EPID Decon Waste Collection Drum
46. Maintenance Area Waste Collection Drum
47. R&D Laboratory Waste Accumulation Containers
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49. Plant No. 7 Waste Collection Drum
50. Plant No. 8 Sample SAA
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52. K-1600-2 EPID Vacuum Oil Tank
53. K-1600-3 EPID Vacuum Oil Tank
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55. T-6M-17 Dilute Alkyls Holding Tank
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64. T-6M-23 DMC-Water Stripper Bottoms Tank
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67. T-2M-8 MMT Column Bottoms Tank
68. K-6M-2 Former MPA Process Wastewater Tank
69. K-6M-8 MPA Process Wastewater Tank
70. T-100M-3 Oily Wastewater Tank
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92. T-10M-14 330 Keel Organics Tank
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94. T-300-9 330 Process Wastewater Tank
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96. T-10M-24 Spent Caustic Tank
97. T-225-2 Neutralization Tank
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101. T-1M-23 Waste Hydrolysis Kettle
102. T-15M-46 DETDA Extraction Tank
103. T-15M-45 Oily Wastewater Tank
104. T-15M-34 701 Process Acidic Wastewater Tank
105. T-15M-29 Caustic Waste Tank
106. T-15M-33 701 Process Acidic Wastewater Tank
107. T-15M-61 Dil Spent Acid Tank
108. T-100M-2 Hazardous Waste Fuel Tank
109. T-30M-37 Former Hazardous Waste Tank
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111. T-10M-5 Hazardous Waste Fuel Tank
112. T-200M-1 Sludge Holding Tank
113. T-20M-9 Sludge Holding Tank
114. T-3300-4 Water Recycle Tank
115. T-2300-1 pH Adjustment Tank
116. Former Drum Sump
117. K-500-14 Waste Transfer Hopper
118. T-500-18 Portable Hazardous Waste Tank
119. K-1000-3 Hazardous Waste Collection Tank
120. E-1 Tank Trailer
121. E-3 Tank Trailer
122. E-4 Tank Trailer
123. E-5 Tank Trailer
124. E-6 Tank Trailer
133. Bubble Pots
134. Plant No. 8 Scrubber
135. Plant No. 9 HCl Scrubber
136. Plant No. 11 Scrubber
137. Plant No. 12 DMA Scrubber
138. Plant No. 14 DMA Scrubber

Appendix J-2
Active SWMUs and AOCs as of May 2018

Appendix J-2
SWMU and AOC Descriptions

SI Group Corporation
Orangeburg, South Carolina

H&H Job No. SGI-002
May 29, 2020
Revision 1

Appendix J-2
SWMU and AOC Descriptions
SI Group Corporation
Orangeburg, South Carolina
H&H Job No. SGI-002

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Table A-4 SWMUs and AOCs in the Confirmatory Sampling Process

FIRE TRAINING AREA (AOC D)

General Description

The Fire Training Area (FTA) was not yet constructed at the time of the 1993 RFA, but was later identified by DHEC as an AOC. Constructed in the mid-1990's, the FTA is located east of the Old Spoils Area (SWMU 2) and northeast of Pond No. 2 (SWMU 25). The FTA is comprised of a paved, curbed concrete pad covering approximately 6,000 square feet, a concrete drainage trough, and a concrete sump/pump station. The curbed containment pad houses several small training structures and is used for fire training exercises. Prior exercises conducted at the FTA included spraying a mixture of purchased diesel and purchased gasoline onto the training structures, igniting the fuels, and extinguishing the fires by various techniques. In 2007, the fire training practices were modified to utilize propane/natural gas, except for a limited amount of fuel oil in a shallow 4 ft by 4 ft metal container placed on the concrete containment pad. Descriptions of the FTA are provided in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002.

Assessment History and Results

Descriptions of assessment activities and findings associated with the FTA are provided in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002. The 2001/2002 CS investigation at the FTA included the advancement of 14 soil borings. The sample locations were determined based upon the potential for impacts to occur in un-paved overspray areas, beneath expansions joints in the concrete, beneath low points in the concrete trough, and in locations where staining was evident. Samples exhibiting higher organic vapor analyzer (OVA) readings, staining, or odors were submitted for analysis.

Results of 2001/2002 CS soil sampling indicated the presence of methylene chloride above groundwater protection screening levels. The concentrations of methylene chloride are below ingestion and direct contact screening levels. A temporary well TW-6 was installed in

January 2002 downgradient of the FTA and benzene was detected at that time at concentrations that exceeded the MCL. No other constituents of concern were detected at concentrations that exceeded MCLs. The presence of benzene in monitoring wells upgradient from the FTA indicated that benzene is attributable to an upgradient source, believed to be the Old Spoils Area (SWMU 2). Recent groundwater data (2017 through 2019) at monitoring well MW-62, which is located at the downgradient edge of the FTA, indicates no VOCs detected above screening levels, no SVOCs detected, and arsenic and iron detected above their screening levels. Arsenic and iron are present in groundwater at a higher concentration upgradient of the FTA, indicating the FTA is not a likely source of either metal compound.

Corrective Measures

Based on the findings of the CS investigation, it was concluded that a minor release has occurred to soils at the FTA (methylene chloride above its soil screening level, or SSL), but no release attributable to the FTA has occurred to groundwater. Recommendations for future action at the FTA are presented in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002. Based on the CS results, a No Further Action request was submitted to DHEC on July 9, 2007. In their May 21, 2009 letter, DHEC indicated that based on the methylene chloride levels in soil that No Further Action was not warranted, and requested an RFI Work Plan be prepared for AOC D. At the time of preparing this permit renewal, it was discussed with DHEC that the CS data will be revisited to determine the next steps and whether additional sampling is necessary.

SOUTH SWAMP (AOC E / SWMU 9)

General Description

The South Swamp is a low-lying 1.4-acre area located in the southeastern portion of the site in proximity to the North Fork Edisto River. No industrial operation or development has occurred in the South Swamp. Vegetation losses in the northern portion of the South Swamp were observed in the early 1980's. In a July 2004 meeting with DHEC and EPA, it was agreed that the South Swamp is not a SWMU, but rather an Area of Concern and was renamed as AOC E in the 2008 permit. Further description of the South Swamp is provided in the *RCRA Facility Assessment* dated February 1993.

Assessment History and Results

Descriptions of assessment activities associated with the South Swamp are provided in the *Ground-Water Conditions at the Ethyl Property* dated January 1981, and the *Site Evaluation Report* dated June 1981. Investigations documented in the January 1981 draft Ground-Water Conditions report included advancing three well point borings to determine geology and groundwater level in the South Swamp to depths of 9 to 14 ft. The South Swamp is overlain by 2 to 5 ft of humus, with sand beneath the humus, and a clay unit beneath the sand. The report indicates groundwater flowing into the area at the time of the 1981 evaluation was found to contain benzene, chlorobenzene, chloroform, methylene chloride, and toluene. Assessment described in the June 1981 Site Evaluation focused on surface soils within the South Swamp. Nine soil samples were collected at a depth of 0 to 1 ft below ground surface and composites created from these. Chemical analyses indicated the presence of 1-2 dichlorobenzene.

Groundwater upgradient of the South Swamp is monitored semi-annually as part of site wide monitoring. Recent groundwater data (2017 through 2019) for MW-54, which is immediately upgradient of the South Swamp, indicate the presence of 1,4 dichlorobenzene, benzene, chlorobenzene, methylene chloride, arsenic, manganese, and mercury above groundwater screening levels.

Corrective Measures

A December 1980 letter to DHEC presents the decision to install a French drain hydraulically upgradient of the South Swamp to recover impacted groundwater flowing in the area. The 145-ft long x 12 ft deep South Swamp Drain was put into operation on November 21, 1980 and has been in operation since that time (now referred to as Drain D). Vegetation in the South Swamp returned in the years that followed installation of Drain D as described in the *Ground-Water Program Status, Activity and Plans* dated December 1984.

In 2012, assessment of SWMU 130 was conducted and revealed groundwater impacts associated with SWMU 130 and further to the west, impacts believed to be originating from the Sludge Holding Basin and adjacent Sandbeds and (SWMUs 22 and 23). An interim measure was implemented in 2015 comprised of two new French drains (Drain F and Drain G). These two drains essentially span the distance between existing Drain C at SWMU 130 and existing Drain D at South Swamp, with a degree of overlap at each end. Consequently, Drain G near South Swamp serves to provide additional groundwater capture upgradient of South Swamp.

Assessment of conditions at South Swamp are warranted to further understand conditions at AOC E.

Table A-5 SWMUs and AOCs Requiring a RCRA Facility Investigation (RFI)

OLD SPOILS AREA (SWMU 2)

General Description

The Old Spoils Area (SWMU 2) occupies approximately seven acres northeast of the main plant area and is comprised of seven diked surface impoundments (sub-areas) that previously received process solids from the main plant. The upper portion of one of the surface impoundments (A-B Lagoon) also received general plant waste and was referred to as the Former Landfill Area. An eighth sub-area known as the Old Spoils Area Ditch (OSD) routes surface water run-off from the OSA to the inlet of Pond 2 (SWMU 25), which is part of the plant's permitted WWTS.

The OSA impoundments/disposal areas were created by constructing dikes in a topographically low area. The dikes were extended and/or disposal areas added on an as-needed basis. The Old Spoils Area began operations in the late 1960s, and ceased operations in 1979. Descriptions of the Old Spoils Area (OSA) and associated operations are provided in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992, *Closure Plan Old Spoils Area* dated April 26, 1996, and the *RCRA Facility Assessment* dated February 1993.

Briefly, the OSA is comprised of eight individual sub-areas (North Spoils, South Spoils, A-B Lagoon, C-D Lagoon, North Aluminum Oxide, South Aluminum Oxide, East Aluminum Oxide, and the Old Spoils Ditch). Process wastes including wastewater biological solids and other process waste streams, were placed or pumped into the OSA until 1979. Based on 2018 RFI data and volume estimates provided in the *Part I RCRA Facility Investigation Report* dated September 9, 2019, the OSA is estimated to contain approximately 87,000 cubic yards of process waste sediment and approximately 11,000 cubic yards of soil used for historical grading and dike construction. The OSA also contains some debris such as sample bottles, filter elements, plastic piping, wood, debris, and construction materials from the plant. The seven lagoons were filled at varying points in time and as a result, the sludge characteristics vary among the lagoons. The North Spoils sub-area generally holds rainwater year-round.

Assessment History and Results

As described in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992, a total of 28 borings were advanced at the OSA (referred to in reports as Phase I activity). Additional assessment (referred to in reports as Phase II activities) as described in the *Closure Plan Old Spoils Area* dated April 26, 1996. This assessment included 15 borings.

Consistent with the processes where the waste is generated, results of Phase I and II waste analyses indicate detections of benzene, toluene, ethylbenzene, and xylene (BTEX), chlorobenzene, acetone, methylene chloride, 2,4-dimethylphenol, dichlorobenzene, and phenol as well as inorganic compounds such as aluminum, calcium, sodium, nitrogen, iron, magnesium, manganese, nitrogen, phosphorus, ammonia, and chloride. TCLP testing has been performed on the waste samples and results of these tests confirm the leachate concentrations were below RCRA characteristic hazardous waste criteria.

To characterize the nature and extent of a confining layer previously identified underlying the wastes within the SWMU, 30 geotechnical borings were completed at the SWMU perimeter in 1995. These borings defined the depth and confirmed continuity of the naturally-occurring confining clay layer in the vicinity of the SWMU.

As part of the 1995 Phase II assessment, 14 sludge samples from the upper two feet of the seven OSA lagoons were composited and analyzed. The 14 composite samples were obtained by collecting four waste subsamples from each of the seven disposal areas. Detectable concentrations of toluene, methylene chloride, ethylbenzene, and o,p-dichlorobenzene were detected above groundwater protection screening levels. Aluminum, arsenic, manganese, mercury, and nickel were detected above groundwater protection values and direct exposure screening levels.

Groundwater quality downgradient of the Old Spoils Area is monitored regularly at MW-6 and MW-44. Recent groundwater data (2017 to 2019) indicates the presence of benzene, chlorobenzene, antimony, arsenic, cobalt, iron, and manganese above screening levels.

An RFI was conducted at SWMU 2 in 2018 (in combination with an RFI at adjacent SWMU 13N / North-South Ditch Northern and SWMU 14 / East West Ditch). Throughout the 2018 RFI, a total of 179 soil borings, 26 cone penetration test (CPT) borings, 30 test pits, and 17 temporary monitoring wells were installed to evaluate conditions at SWMU 2. The 2018 RFI identified impacts in sediment within each sub-area of the Old Spoils Area, and further identified impacts in soils comprising the dikes between the sub-areas as well as perimeter soils. In addition to the sediment and soil impacts, free product was identified at various locations throughout the Old Spoils Area, and groundwater contamination was identified. Waste characterization sampling of impacted sediment and soils encountered during the RFI sampling of the Old Spoils Area are characteristically non-hazardous. The specific contaminants encountered during the RFI were consistent with prior investigations, and included various types of organic compounds, including chlorinated VOCs, BTEX constituents, and limited SVOCs. Multiple metals were identified above screening criteria, including antimony, arsenic manganese, and thallium.

The RFI generally determined that impacted sediments and free product comprise the majority of the contaminant source associated with the Old Spoils Area. Impacts associated with these sources appear to have contributed to impacts to native soil and groundwater in the vicinity of the Old Spoils Area. In addition to chemical impacts associated with the sediment and free product, debris-like material was identified in the vicinity of the A-B Lagoon sub-area. This area was historically used for placement of plant waste material and was referred to as the Former Landfill Area. A portion of the encountered debris in this location was identified as suspect asbestos-containing material (ACM).

In addition to the contamination identified within the seven sub-areas of the Old Spoils Area, the Old Spoils Ditch (OSD), which is a drainage ditch that carried surface water runoff from the Old Spoils Area into Pond 2, was determined to have accumulated multiple feet of sediment and exhibited similar impacts to the sub-areas that comprise the Old Spoils Area. Further, two areas of impacts were identified to the north of the Old Spoils Area, one north of the North Spoils sub-area, along the northern perimeter dike separating the Old Spoils Area from an area of wetlands, and one north of the C-D Lagoon, in a location currently used as a staging area for clean fill material used throughout the facility. Impacts within these locations are similar in nature to those observed within the Old Spoils Area, however the impacts were not fully delineated during the 2018 RFI activities.

The RFI activities included a limited assessment of the geotechnical properties of the sediments contained within the sub-areas of the Old Spoils Area. This testing demonstrated that the sediment has limited structural integrity, having low shear strength and high compressibility. This assessment, in combination with the fact that the southern perimeter dikes of the A-B and C-D Lagoons are steep and eroding, presents concern of the structural integrity of the Old Spoils Area.

The results of this RFI were submitted to DHEC in the *Part I RCRA Facility Investigation Report SWMU 2 Old Spoils Area, SWMU 13N North-South Ditch Northern, and SWMU 14 East-West Ditch* dated September 9, 2019. This RFI Report included a discussion of additional assessment recommended to be done in various locations where impacts were not fully delineated or understood, including the Former Landfill Area and the two areas of impacts located north of the North Spoils sub-area and north of the CD Lagoon. The proposed additional assessment also included a detailed evaluation of the geotechnical stability of the southern perimeter dikes for the Old Spoils Area. The Part I RFI Report was approved by DHEC in a letter dated November 6, 2019. The letter also requested preparation of Part II RFI Work Plan.

The additional assessment activities were presented to DHEC in the *Part II RFI Work Plan SWMU 2 (Old Spoils Area), SWMU 13N (N-S Ditch – North Section), SWMU 14 (E-W Ditch)*. This work plan was approved by DHEC on November 20, 2019, and the proposed assessment activities were completed in November and December of 2019. The Part II RFI Report was being drafted at the time of preparing this permit application.

Corrective Measures

In October 1994, the use of constructed wetlands was considered as a candidate remedial alternative for the Old Spoils Area. Although results of the plant growth trials indicate that three of the four species tested survived and grew in most of the test soils, the remedial alternative was not pursued at that time. Remedial alternatives for the Old Spoils Area were initially considered in the *Closure Plan Old Spoils Area* dated April 26, 1996 but were not acted on. A *Corrective Measures Study Work Plan* was prepared for the OSA in March 2001 and was not acted on because sufficient data was not available for corrective measures decision-making. Accordingly, an RFI was conducted, as described above, in two parts. The Part I RFI was completed in 2018, which identified data gaps that were assessed during the Part II RFI, which was completed in November and December of 2019. The Part II RFI Report is currently being drafted at the time of this permit application, and it will include a recommendation as to whether a CMS is appropriate for SWMU 2.

FORMER NORTH-SOUTH DITCH NORTHERN (SWMU 13N)

General Description

Prior to 1984, wastewater from the Former Industrial Sewer (SWMU 12) discharged to the unlined Former North-South Ditch (SWMU 13). Based on the layout of SWMU 12, process sewers and ditches associated with the Former Industrial Sewer connect to SWMU 13. The northern portion of SWMU 13 flowed south to the unlined Former East-West Ditch (SWMU 14), which then discharged to Wastewater Pond No. 1 (SWMU 24). The southern portion of SWMU 13 flowed north and crossed under River Road (aka 5th Street), intersected the northern portion of SWMU 13 and flowed into the Former East-West Ditch (SWMU 14). These Former North-South and East-West Ditches were taken out of service in 1984. A replacement north-south drainage system consisting of a concrete-lined North-South Ditch was constructed in 1984 (referred to in the 1993 RFA as SWMU 15, the Current North-South Ditch), which discharged into the Primary Clarifier (SWMU 16). While not well-documented, the northern portion of SWMU 13 was replaced with above ground piping installed in the vicinity of the former North-South Ditch Northern, crossing under River Road and routed to the Primary Clarifier. A description of the former SWMU 13 ditch is provided in a partial archive copy of the *N-S Closure Plan Letter to DHEC & Application to Construct Wastewater Collection System, Ethyl Corp* dated May 20, 1983, and the *RCRA Facility Assessment* dated February 1993.

The 1993 RFA indicates that approximately 10,000 gallons of liquid waste were pumped through the on-site wastewater treatment system when Former North-South Ditch was taken out of operation, though it does not distinguish between the northern and southern sections. Similarly, the RFA notes approximately 9,500 cubic yards of contaminated soil and ditch construction materials were removed and disposed in the on-site landfill (SWMU 1), though project records do not indicate where this excavation occurred and if the northern portion of SWMU 13 was excavated and backfilled. Based on field indications from the 2018 Part I RFI conducted at SWMU 13N, it appears that impacted vadose zone soils were removed at the time it was taken out of service.

Assessment History and Results

Soil sampling was performed along the northern and southern portions of the Former North-South Ditch in October 1983 prior to taking the ditch out of service as described in the *N-S Ditch Sampling Memo and Lab Data, from Dennis Colton to Jeff Sgambat* dated October 6, 1983. This memo describes installation of eight soil borings adjacent to the N-S Ditch and a ninth background boring (PD-1) upgradient of the ditch. Results of 1983 soil sampling indicate the presence of chloroform, methylene chloride, trichloroethene, vinyl chloride, toluene, chlorobenzene, benzene, ethylbenzene, and 1,1,1 trichloroethane in ditch soils. Elevated detections were observed in boring locations to depths up to 14 ft below the ground surface.

As noted earlier, the Former North-South Ditch was bisected by River Road. The northern portion of the Former North-South Ditch was subject to an RFI in 2018, in combination with the adjacent SWMU 2 / Old Spoils Area and SWMU 14 / East-West Ditch. The southern portion of the Former North-South Ditch was subject to a separate RFI in 2017, in conjunction with the adjacent SWMU 3 / Former Hi-TOC Lagoon and SWMU 15 / Current North-South Ditch. Results of the RFI for the southern section of the North-South Ditch are discussed under SWMU 13S. Results of the 2018 RFI for the northern section of the North-South Ditch are discussed below.

Throughout the 2018 RFI, a total of 25 soil borings, three temporary monitoring wells, and one temporary product collection well were installed to evaluate conditions at SWMU 13N. Consistent with prior assessment activities conducted at SWMU 13N, extensive contamination of soil and groundwater was identified within the extent of SWMU 13N, including limited waste sediments and free phase product. Samples of SWMU 13N vadose and saturated zone soils were analyzed for hazardous waste characteristics and the results indicate that the soils were characteristically non-hazardous. The specific contaminants encountered during the RFI were consistent with prior investigations, and included various types of organic compounds, including chlorinated VOCs, BTEX constituents, and limited SVOCs. Multiple metals were identified above screening criteria, including antimony, arsenic, and mercury. Imported fill soil was

identified within SWMU 13N, consistent with historical records indicating that the ditch was dredged and backfilled when it was taken out of service.

The results of the RFI indicated that impacts extend west (up-gradient) from SWMU 13N towards the primary plant areas, indicating a potential contributing upgradient source, potentially related to the Former Industrial Sewer (SWMU 12). The extent of impacts in this location were not fully delineated during the 2018 RFI activities.

The results of this RFI were submitted to DHEC in the *Part I RCRA Facility Investigation Report SWMU 2 Old Spoils Area, SWMU 13N North-South Ditch Northern, and SWMU 14 East-West Ditch*, September 9, 2019. This RFI Report included a discussion of additional assessment recommended to further delineate impacts located west and upgradient of SWMU 13N. The Part I RFI Report was approved by DHEC in a letter dated November 6, 2019. The letter also requested preparation of Part II RFI Work Plan.

The additional assessment activities were presented to DHEC in the *Part II RFI Work Plan SWMU 2 (Old Spoils Area), SWMU 13N (N-S Ditch – North Section), SWMU 14 (E-W Ditch)*. This work plan was approved by DHEC on November 20, 2019, and the proposed assessment activities were completed in November and December of 2019. The Part II RFI Report was being drafted at the time of preparing this permit application.

Corrective Measures

Based on the 1983 soil sampling data indicating impacts along SWMU 13, Ethyl/Albemarle removed SWMU 13N (and SWMU 13S) from service. 1983 project records indicate substantial soil removal occurred at that time but further investigation is required for SWMU 13N. An RFI was conducted for SWMU 13N, as described above, in two parts. The Part I RFI was completed in 2018, which identified data gaps that were assessed during the Part II RFI, which was completed in November and December of 2019. The Part II RFI Report is currently being

drafted at the time of this permit application, and it will include a recommendation as to whether a CMS is appropriate for SWMU 13N.

FORMER EAST-WEST DITCH (SWMU 14)

General Description

Prior to 1984, wastewater from the Former Industrial Sewer (SWMU 12) discharged to the Former North-South Ditch (SWMU 13), which then crossed under River Road and flowed into to the Former East-West Ditch (SWMU 14). The Former East-West Ditch then discharged to Wastewater Pond No. 1 (SWMU 24). SWMU 13 and SWMU 14 were taken out of service in 1984. A replacement concrete-lined North-South Ditch was constructed in 1984 (referred to in the 1993 RFA as SWMU 15, the Current North-South Ditch), which routed wastewater to the Primary Clarifier (SWMU 16), eliminating the need for the East-West Ditch. A description of the former SWMU 14 ditch is provided in the *RCRA Facility Assessment* dated February 1993.

Consistent with plant archives, the RFA notes that little information is available regarding SWMU 14. The Former East-West Ditch was unlined and was located just south of the South Aluminum Oxide Area (part of SWMU 2), and discharged to Pond No.1 (SWMU 24).

Assessment History and Results

The Former East-West Ditch was the subject of an RFI conducted in 2018, in combination with the adjacent SWMU 2 / Old Spoils Area and SWMU 13N / North-South Ditch Northern. Throughout the 2018 RFI, a total of 19 soil borings, one permanent monitoring well, and one temporary product collection well were installed to evaluate conditions at SWMU 14. The results of this RFI identified extensive contamination of soil and groundwater within the extent of SWMU 14, including limited waste sediments and free phase product. Samples of SWMU 14 vadose and saturated zone soils were analyzed for hazardous waste characteristics and the results indicate that the soils were characteristically non-hazardous.

The specific contaminants encountered during the RFI included various types of organic compounds, including chlorinated VOCs, BTEX constituents, and limited SVOCs. Multiple metals were identified above screening criteria, including antimony, arsenic, and mercury. Limited imported fill soil Imported fill soil was identified within SWMU 14,

consistent with historical records indicating that the ditch may have been partially excavated and backfilled when it was taken out of service.

The results of this RFI were submitted to DHEC in the *Part I RCRA Facility Investigation Report SWMU 2 Old Spoils Area, SWMU 13N North-South Ditch Northern, and SWMU 14 East-West Ditch* dated September 9, 2019.

Corrective Measures

An RFI was conducted for SWMU 14, as described above, in two parts. The Part I RFI was completed in 2018, which identified data gaps that were assessed during the Part II RFI, which was completed in November and December of 2019. The Part II RFI Report is currently being drafted at the time of this permit application, and it will include a recommendation as to whether a CMS is appropriate for SWMU 14.

FORMER GROUND BURNER UNIT (SWMU 131) AND FORMER ALUMINUM ALKYL BURN PIT (SWMU 132)

General Description

The Former Ground Burner Unit (SWMU 131) is located in the north-central portion of the manufacturing area and operated from 1950 to 1986 as an incinerator for liquid process waste streams. The Former Aluminum Alkyl Burn Pit (SWMU 132) is located immediately adjacent to the Former Ground Burner Unit and operated from 1958 until the late 1970s.

Descriptions of the Former Ground Burner Unit (GBU) / Former Aluminum Alkyl Burn Pit (ABP) are provided in the *RCRA Facility Assessment* dated February 1993 and the *Confirmatory Sampling Report Revision 0* dated October 9, 2002. The GBU was comprised of a one-foot deep, unlined 10 ft x 10 ft burn pit. The pit was within an earthen berm and surrounded by corrugated metal walls to contain the flames. The pit was equipped with two atomizer nozzles set approximately two feet above the base of the shallow pit. During use, liquid waste was pumped from the process waste tanks under high pressure and was ignited as it exited the nozzles. The unit incinerated a variety of combustible wastes generated from site operations, including 2,4,6-tri-tert-butylphenol, herbicidal intermediates, solvents, oil and sludge, halogenated aromatics and aliphatics, alcohols, and insecticide intermediates. The nozzles were dismantled and the pit backfilled in 1986. The area is currently enclosed within a chain-link fence and covered with gravel.

The ABP was similar in construction to the GBU. During operation, this unit received pyrophoric aluminum alkyls, which ignited spontaneously upon contact with air. The unit was backfilled in the late 1970s and like the GBU is currently covered with gravel.

Assessment History and Results

Descriptions of assessment activities and findings associated with the GBU and ABP are provided in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002. This assessment included advancement of eight soil borings in the GBU area and five soil borings in

the ABP area. An additional soil sample was also collected from the borehole and adjacent temporary well. Eleven of the fourteen samples were chosen for laboratory analysis based on OVA readings and field observations of staining.

The 2001/2002 CS results for the GBU and ABP indicate soils are impacted with organic compounds at concentrations above 2002 screening levels. Specifically, concentrations of methylene chloride, ethylbenzene, toluene, benzo(a)anthracene, n-nitrosodiphenylamine exceeded soil screening levels in both the GBU and ABP areas. No metal exceedances were observed at the GBU and ABP areas. In addition to the above testing, one sample from each of the two areas was also analyzed by TCLP methods for waste characterization purposes. TCLP constituent analyses and analyses for ignitability, corrosivity, and reactivity indicate soils in these areas are characteristically non-hazardous.

The 2001/2002 CS assessment also included installing three temporary monitoring wells in the area of the GBU and ABP. Results indicated that groundwater immediately downgradient of both units has been impacted by compounds also detected in soils. Specifically, the concentrations of benzene, chlorobenzene, aluminum, and iron exceed screening levels in groundwater downgradient of these areas. Upgradient groundwater analysis indicated no detectable organics and no metals above screening levels.

In addition to the 2001/2002 CS groundwater data, groundwater quality downgradient of these SWMUs is monitored regularly at monitoring well MW-16R. Recent monitoring data (2017 through 2019) indicates no detections of VOCs, SVOCs, or metals at concentrations above MCLs or EPA Tapwater RSLs.

Corrective Measures

Following a meeting with DHEC in April 2007 regarding the results of the 2001/2002 CS, DHEC requested that an Interim Action Plan (IAP) be developed that included additional soil assessment to refine the lateral and vertical delineation of soil impacts, the excavation of impacted soil to approximately 5 ft below ground surface (not to exceed 1 ft below the water

table), and the installation of a permanent monitoring well to monitor groundwater conditions downgradient of these SWMUs. This IAP was submitted to DHEC on August 20, 2007, and conditionally approved on May 22, 2009. In response to the conditional approval, which was unclear as to whether the IAP could be executed as written, on June 30, 2009, the facility requested DHEC concurrence with using in-situ sampling and a resolution on the target constituents of concern (COC) based on the previously submitted practical quantitation limit (PQL) addendum. Following extensive discussion of PQLs, it was determined that the challenges in execution of the proposed Interim Action and the relatively low risks associated with SWMUs 131 and 132 relative to other SMWUs at the facility necessitated the re-prioritization of the proposed interim action at SWMUs 131 and 132.

Access to the area surrounding the GBU and ABP is highly restricted and only allowed under strict safety protocols due to adjacent chemical manufacturing operations. Consistent with long range planning goals discussed with SCDHEC in a meeting on October 31, 2014, activities for SWMUs 131/132 are awaiting completion of higher priority SWMU actions at the plant. At the time of preparing this permit renewal, it was discussed with DHEC that additional investigation at the GBU and ABP is necessary to define the nature and extent of contamination associated with these SWMUs, and the schedule for additional investigation activities will be discussed at a later date.

PRODUCT AREA SOUTH OF POND 1 (AOC G)

General Description

During preliminary IM activities at Pond 1 (SWMU 24), an area of free product in vadose zone soils was identified along the southern edge of Pond 1. In DHEC's May 22, 2018 approval letter for the Pond 1/3 Interim Measures Report (IM Report), DHEC requested this free product area be designated as an AOC. The AOC conditions are described below.

Assessment History and Results

The 2017 Pond 1 IM effort included partial removal of these adjacent impacted soils during pond excavation activities. Prior to excavation activities, several test pits were dug using a mini-excavator and soils were field screened with visual, olfactory, and photoionization (PID) methods. Based on field screening results, free product and impacted soil were identified in three test pits. Two additional test pits to the east and west of the impacted test pits showed no signs of free product. The test pits also revealed the locations of two parallel and adjacent water lines (one 4-inch PVC and one 3-inch PVC) that run along the southern side of Pond 1 adjacent to River Road. These water lines were active with one containing potable water and the other containing wastewater. With the product area delineated, the impacted soil was excavated on June 27, 2017. Soil was excavated from the pond bank between the two clean test pits, to a depth of approximately 8 to 10 ft below ground surface. The lateral excavation extents did not progress beyond the two water lines on the southern side of the excavation due to concerns with line integrity. The final excavation extent was approximately 75 ft long by 15 ft wide x 8 to 10 ft deep, with the north side of the excavation terminating within the Pond 1 basin.

On the southern wall of the excavation below the water lines, product was observed to coat the soil matrix of saturated zone soils left in place (these soils were inaccessible for excavation). A low point was excavated in the floor of the excavation in proximity to the observed remaining free product and was filled with a sand and pea-sized gravel mix available on-site. The low area was approximately 6 ft wide (East-West direction) by 12 ft long (North-South direction) by 2 ft deep. If warranted for future remedial activities along River Road, the gravel 'sump' may serve

as a subsurface collection point for free product remediation activities. For future reference, GPS coordinates for the location of the gravel sump were collected.

After excavation of the accessible impacted soils, one base sample and three sidewall confirmation samples were collected from the excavation for analysis of VOCs, SVOCs, and target analyte list (TAL) metals. Disposal and characterization sampling of the excavated soils was also conducted.

The confirmation sample results indicated that ethylbenzene was detected above its Industrial Regional Screening Level (RSL; 25,000 µg/kg) in the base (32,500 µg/kg) and the south sidewall sample (47,200 µg/kg). The south sidewall sample was collected from an area with inaccessible soils due to the active water lines, therefore, the high detection was not unexpected. In addition, 2,6-dinitrotoluene was detected at an estimated concentration (12,100 J ug/kg), above its Industrial RSL (1,500 µg/kg) in the east sidewall sample. No additional constituents were detected at concentrations that exceed Industrial RSLs. Several other VOCs, SVOCs and metals constituents were detected at concentrations above their respective SSLs. Following sampling, the excavation was backfilled with imported fill and a sump installed as described under the Corrective Measures subheading below.

As previously discussed, the presence of active below-ground water lines in the project area limited the lateral extent of free product excavation activities to the south of Pond 1. Regarding direct exposure concerns of soils left in place, the remaining soils with Industrial RSL exceedances are limited in magnitude and distribution, and are capped with clean backfill, thus preventing human exposure. As it relates to contaminants leaching to groundwater, remaining soils that exhibit concentrations that exceed SSLs may have the potential to leach to groundwater. It's important to note that the impacted soil left in place is not thought to be attributed to operations at Pond 1, but rather a separate source which was later identified as AOC G. For these impacted soils that remain, the constructed low-point sump provides access for potential further assessment and remediation, if warranted.

Following the completion of the Interim Measure for Ponds 1 and 3, a groundwater assessment was conducted in the vicinity of AOC G, which included the installation and sampling of one temporary monitoring well (TMWG-1). The results of this assessment were reported to DHEC in the *Groundwater Assessment Report*, dated January 16, 2019. The assessment generally identified limited screening level exceedances for a variety of VOCs, however multiple additional compounds present above screening levels in the prior soil samples were not present above screening criteria in groundwater, indicating that residual impacts at AOC G are likely not a significant contributor to groundwater impacts in the area.

Following DHEC approval of the initial groundwater assessment, one permanent monitoring well (MW-79) was installed to allow for routine monitoring of groundwater conditions downgradient of AOC G. This well has been included in the semi-annual site-wide groundwater monitoring activities. As reported in the *Annual Groundwater Monitoring Report – March 2019 and September 2019* dated March 30, 2020, MW-79 was dry at the time it was first intended to be sampled, and therefore a groundwater sample was not collected until March 2020. The results of this sample will be documented in the 2020 Annual Groundwater Monitoring Report, which will be drafted following the completion of the September 2020 semi-annual groundwater sampling event, which has yet to be conducted at the time of this permit application.

Corrective Measures

During execution of the Pond 1 IM effort and as noted above, excavation was conducted to remove a substantial portion of the free product impacted soil along the southern side of Pond 1. However, excavation was terminated before all of the impacted soils were removed due to nearby active water utility lines. The final excavation extent was approximately 75 ft long by 15 ft wide x 8 to 10 ft deep. A low point was excavated in the floor of the excavation in proximity to the observed remaining free product and was filled with a sand and pea-sized gravel mix. The low area was approximately 6 ft wide (East-West direction) by 12 ft long (North-South direction) by 2 ft deep. The gravel sump, which was located by GPS coordinates,

may serve as a subsurface collection point for free product that could be extracted during future remediation activities at the site.

PRODUCT AREA NORTHEAST OF POND 3 (AOC H)

General Description

During 2017 IM activities at Pond 3 (SWMU 26), an area of free product in vadose zone soils was identified along the northeastern corner of Pond 3. In DHEC's May 22, 2018 approval letter for the Pond 1/3 Interim Measures Report (IM Report), DHEC requested this free product area be designated as an AOC. The AOC conditions are described below.

Assessment History and Results

During excavation of sediment in the northeast corner of Pond 3 near the current wastewater treatment system (WWTS) effluent building, black viscous oily material and heavily stained soils were observed in soil along an approximate 60-ft length of the sidewall of Pond 3, in close proximity to the wastewater effluent building. The stained and oily soils had elevated PID readings (>100 ppm), and occurred at an approximate depth of 5 to 8 ft bgs and is not thought to be attributed to Pond 3 sediment. The oily and stained material was intermixed into residual sediment and sediment impacted sidewall soils. The stained and impacted soils were excavated and disposed at the off-site landfill along with impacted sediments from Pond 3. The excavation proceeded approximately 4 to 5 ft into the sidewall where the oily material was observed. However, due to structural concerns at the effluent building and underground utilities in close proximity to the excavation, the excavation was terminated prior to removing all of the impacted soil. A total of approximately 150 tons of impacted intermixed sediment and soils were excavated from this area and disposed off-site.

To allow the excavation to be backfilled, a gravel-filled trench drain and low-point 'sump' was constructed in this area using No. 57 stone covered in geotextile fabric. The gravel trench drain is approximately 75 ft long, 3 ft wide, and 2 ft deep and the low-point sump (approximately 4 ft long x 4 ft wide x 2 ft deep) is located within the lowest area of the gravel trench drain. The gravel trench drain and sump were then covered by backfill. For future reference, GPS coordinates for the location of the gravel trench drain and sump were collected.

To characterize the impacted soils left in place prior to construction of the gravel trench drain and slope improvements, samples were collected from a depth interval (5 to 8 ft bgs) determined to be impacted based on field screening results. One grab sample was collected for laboratory analysis of VOCs and gasoline range organics (GRO), and one composite sample was collected for analysis of SVOCs, TAL Metals, and diesel range organics (DRO). The lab results indicate that DRO was detected at a concentration of 19,000 mg/kg and GRO was detected at a concentration of 12 mg/kg, suggesting the observed oily material was primarily a diesel-based oil (such as may have been used with a diesel-powered river water pump). In addition, several VOCs were detected at concentrations that exceed SSLs.

Following the completion of the Interim Measure for Ponds 1 and 3, a groundwater assessment was conducted in the vicinity of AOC H, which included the installation and sampling of one temporary monitoring well (TMWH-1). The results of this assessment were reported to DHEC in the *Groundwater Assessment Report*, dated January 16, 2019. The assessment generally identified limited screening level exceedances for benzene, arsenic, and manganese, however multiple additional compounds present above screening levels in the soil samples were not present above screening criteria in groundwater, indicating that residual impacts at AOC H are likely not a significant contributor to groundwater impacts in the area.

Following DHEC approval of the initial groundwater assessment, one permanent monitoring well (MW-80) was installed to allow for routine monitoring of groundwater conditions downgradient of AOC H. This well has been included in the semi-annual site-wide groundwater monitoring activities. As reported in the *Annual Groundwater Monitoring Report – March 2019 and September 2019*, the results from the September 2019 sample collected from MW-80 were generally consistent with data collected from TMWH-1, with the exception that arsenic was not detected. Groundwater monitoring at AOC H will continue as part of the semi-annual groundwater monitoring conducted at the facility, and data from this location will be included with annual groundwater monitoring reports.

Corrective Measures

During execution of the Pond 3 IM efforts and as noted above, excavation was conducted to remove a substantial portion of the free product impacted soil along the northeastern corner of Pond 3. However, excavation was terminated before all of the impacted soils were removed due to the nearby effluent building and due to Pond 3 dike integrity constraints. a gravel-filled trench drain and low-point 'sump' was constructed in this area using No. 57 stone covered in geotextile fabric. The gravel trench drain is approximately 75 ft long, 3 ft wide, and 2 ft deep and the low-point sump (approximately 4ft long x 4ft wide x 2 ft deep) is located within the lowest area of the gravel trench drain. The gravel trench drain and sump were then covered by backfill. The gravel drain and sump was located by GPS coordinates.

Table A-6 SWMUs and AOCs Requiring a Corrective Measures Study (CMS)

FORMER HI-TOC LAGOON (SWMU 3)

General Description

The Former Hi-TOC Lagoon (SWMU 3) was an approximate 50 ft long x 40 ft wide x 4 ft deep surface impoundment constructed with a 6-inch thick soil liner and was used as a settling area for waste solids suspended in process wastewaters. The Former Hi-TOC Lagoon operated from 1969 to 1979, when it was taken out of service, excavated and backfilled. Descriptions of the former lagoon and associated operations are provided in the *Source Area and Ground Water Assessment Report* dated February 19, 1998, and the *RCRA Facility Assessment* dated February 1993.

The former lagoon was used to manage wastes from the AN-330 process including process wastewaters generated from processes using methylene chloride, heptane, chlorobenzene, methanol, and toluene. The waste solids were periodically removed from the Hi-TOC Lagoon and placed in the Old Spoils Area (SWMU 2). Process water from the Hi-TOC lagoon was routed to the on-site wastewater treatment system. The Former Hi-TOC Lagoon was taken out of service, excavated, and backfilled in 1979. Materials from the lagoon were reportedly moved to the Old Spoils Area (SWMU 2).

Assessment History and Results

Assessment activities have been conducted for the purposes of locating and delineating the area of the former Hi-TOC Lagoon, characterizing the chemical nature of impacted soils within the area, assessing the lagoon's impact on area groundwater quality and for purposes of planning corrective actions at the subject SWMU. Descriptions of early assessment activities and findings associated with the former lagoon are provided in the *Source Area and Ground Water Assessment Report* dated February 19, 1998, and the *RCRA Facility Assessment* dated February 1993.

Investigation at this SWMU conducted in July 1997 included the advancement of 17 DPT borings within the area of the former Hi-TOC Lagoon, and field screening using an OVA and observations from the borings for the presence of staining, odor, etc. Three soil samples selected from the area borings were analyzed for TCLP analysis including volatile and semi-volatile organic compounds, metals, pesticides and herbicides. Sampling results indicate stained soils were present in an area approximately 50 ft x 80 ft at the Former Hi-TOC Lagoon. In addition, the three samples tested by TCLP methods indicate leachable levels of benzene are present, as well as leachable levels of the naturally-occurring inorganic compounds barium and selenium. Two temporary monitoring wells TMW-1 and TMW-2 were installed and sampled in July 1997 and the investigation also confirmed the presence of a naturally-occurring confining clay layer below this SWMU.

More recently, an RFI was conducted at SWMU 3 in 2017 (in combination with an RFI at adjacent SWMU 13 and SWMU 15). Throughout the 2017 RFI, a total of 51 soil boring, 6 temporary monitoring wells, and one temporary product collection well were installed to evaluate conditions at SWMU 3. The 2017 RFI more fully delineated the SWMU and reveals a footprint of staining and free product associated with SWMU 3, representing approximately 5,800 cubic yards of product-impacted soils below the water table. Groundwater was sampled during the RFI using existing monitoring wells and six temporary wells. Arsenic, benzene, chlorobenzene, mercury, and toluene were detected in shallow groundwater at concentrations above MCLs, and 1,1-dichloroethane, manganese, m&p-xylene, and o-xylene were detected above EPA Tapwater RSLs. Of these compounds, chlorobenzene, mercury, toluene, m&p-xylene, and o-xylene were detected in vadose and saturated zone soil at notable concentrations that exceed their SSLs and may be a contributing source to groundwater impacts at and downgradient of the Former Hi-TOC Lagoon. Arsenic was detected in groundwater at concentrations above its MCL; however, soil concentrations appear to be naturally occurring. Detections of 1,1-dichloroethane and manganese above RSLs are limited to one downgradient location and are not thought to be attributed to the Former Hi-TOC Lagoon.

The results of this RFI were submitted to DHEC in the *RCRA Facility Investigation Report SWMU 3, SWMU 13, and SWMU 15 Hi-TOC Lagoon, North-South Ditch, and Current North-South Ditch*, September 13, 2017. The RFI was approved by DHEC in a letter dated January 24, 2018.

Groundwater downgradient of the Former Hi-TOC Lagoon is routinely monitored at MW-29, Drain D, and MW-54 during site-wide semi-annual groundwater monitoring events. Recent groundwater monitoring data (2017 through 2019) from these locations indicates that SWMU 3 appears to continue contributing to elevated concentrations of benzene, chlorobenzene, toluene, and xylenes at MW-29. These compounds are consistent with those detected in prior investigations at SWMU 3. These compounds are also present above screening levels in groundwater samples collected from downgradient locations Drain D, Drain G, and MW-54.

Corrective Measures

Remedial alternatives for the Former Hi-TOC Lagoon were initially considered *Source Area and Ground Water Assessment Report* dated February 19, 1998. Groundwater recovery and soil vacuum extraction were identified as candidate methods and were not acted on at that time.

In the approval letter for the RFI Report, DHEC requested a CMS for the subject SWMUs including the Hi-TOC Lagoon. A CMS Work Plan was submitted to DHEC on May 21, 2018 and approved on January 9, 2020. The CMS is currently in progress, with a current proposed deadline of March 1, 2021.

FORMER INDUSTRIAL SEWER (SWMU 12)

General Description

The Former Industrial Sewer (SWMU 12) is a network of underground piping that formerly transported process wastewaters from main manufacturing areas to the on-site wastewater treatment plant. The system of drains, ditches, and sumps, originally installed by Wannamaker Chemical, was periodically extended to accommodate the growth of the facility. The sewer system was replaced with above ground piping during the period from 1991 to 1999. The Former Industrial Sewer is depicted in Drawing OBX00A040, and described in the *RCRA Facility Assessment* dated February 1993.

Assessment History and Results

Assessment indirectly associated with the Former Industrial Sewer began in 1980 in the manufacturing area of the plant. This assessment included installation of nineteen monitoring wells as described in a partial draft copy of *Groundwater Conditions at the Ethyl Property* dated January 1981. The 1980 assessment was initiated after installation of a groundwater recovery French drain at the South Swamp (AOC E / SWMU 9). Three of the 1980 wells were located in the manufacturing area of the site and identified degraded groundwater quality in this area.

In 1989, assessment was conducted in association with free product detected at Plant 9 as described in the *Remedial Action and Ground-Water Assessment for the Plant 9 Area* dated January 1989. The discovery of free product resulted in the installation of 16 soil borings in August 1988, to delineate the extent of free product and to collect product thickness and fluid level measurements. Three additional monitoring wells and six permanent piezometers were installed in November 1989 to monitor groundwater conditions at Plant 9. Groundwater analyses indicated the source of the hexane was the Industrial Sewer in the vicinity of Plant 9 and that free product was present. A groundwater recovery well (RW-1) was installed in February 1990 to recover free phase product discovered in 1988. Results indicated the recovery well installed in Plant 9 eliminated free product on the shallow groundwater table during the period from 1990 to 1991.

In 1991, additional groundwater investigation was performed in the vicinity of a wastewater sump at Plant 10 in response to detections of heptane in groundwater at MW-52. This 1991 assessment is described in *Liquid Phase Heptane Assessment of the Shallow Subsurface at the Plant 10 Area* dated October 11, 1991. A total of 18 temporary wells and three permanent piezometers were installed in Plant 10 at the time of the 1991 assessment of free product at MW-52. Groundwater data from these wells resulted in Ethyl/Albemarle's decision to replace the Industrial Sewer with above-grade piping.

In August 1995, 18 direct-push technology (DPT) screening samples were collected and analyzed to identify the presence of constituents in the immediate vicinity of Plants 9 and 10 as described in *Report Comprehensive Ground-Water Sampling Event* dated January 30, 1996.

Groundwater data collected from recent groundwater monitoring events (2017 through 2019) at monitoring wells (MW-14, MW-51, MW-52, P-1, and P-5) and recovery wells (P-4/RW-3 and RW-1) in the Plant 9 and Plant 10 areas indicate no exceedances of screening levels in upgradient well P-1, and the presence of 1,1-dichoroethane, acrolein, acrylonitrile, benzene, arsenic, and iron at monitoring well MW-14 and recovery wells P-4/RW-3 and RW-1. Additional groundwater data for the same period was evaluated at four monitoring wells (MW-11R, MW-16R, MW-17, and MW-19) throughout the remainder of the active plant areas, including areas that previously relied on the industrial sewer for process wastewater conveyance. The data indicate no exceedances of screening levels in groundwater for these areas throughout the previous three years.

The 2017 RFI conducted at the Hi-TOC Lagoon (SWMU 3) and the southern portion of the North-South Ditch (SWMU 13S), revealed upgradient free phase product impacts below the water table and may be attributable to the former process sewers in this area (SWMU 12). A review of historical drawings indicated that SWMU 12 historically discharged into a surficial ditch that then flowed to the southern end of the North-South Ditch Southern, supporting the conclusion that SWMU 12 has contributed to the impacts identified in this area.

In addition to the impacts adjacent to the Hi-TOC and the North-South Ditch Southern, an RFI conducted at the Old Spoils Area (SWMU 2), the northern portion of the North-South Ditch (SWMU 13N), and the East-West Ditch (SWMU 14) identified upgradient impacts extending west from SWMU 13N towards the primary plant area. These impacts appear to coincide with locations where SWMU 12 previously conveyed process wastewater, and SWMU 12 may be contributor to these impacts.

Corrective Measures

The South Swamp Drain was installed downgradient of the Industrial Sewer at Plants 9 and 10 in 1980 and a groundwater recovery well was installed in Plant 9 in 1990. An early evaluation of remedial alternatives for the Former Industrial Sewer was presented in the *Plant 9 Sewer Study* dated August 1990 and replacement of the Plant 9 Industrial Sewer with above ground piping was initiated in 1991. Subsequently, Albemarle replaced the Former Industrial Sewer with above-grade piping throughout the facility and completed the Former Industrial Sewer replacement project in 1999 at a cost of approximately $15,000,000. The buried SWMU 12 piping was taken out of service in the 1990s but remains in place under the plant. Select features of the sewer system remain in service, such as containment area sumps and floor drains.

In addition to the corrective actions noted above, two additional groundwater recovery wells were installed in the Plant 9 and Plant 10 areas following a 1997 evaluation of the groundwater remediation systems at the site, as described in *Remedial System Evaluation and Ground Water Modeling* dated April 1997. As recommended in this 1997 report, one permanent water level monitoring well (P-4), located between Plant 9 and Plant 10, was converted to a recovery well (P-4/RW-3), and a new recovery well (RW-2) was installed further downgradient of Plant 10, in 1999. Groundwater modeling performed as part of the 1997 evaluation indicates these wells effectively capture impacted groundwater in the Plant 9 and 10 areas. After many years of operation, RW-2 became irreparably plugged with silt in and was abandoned in 2012. Since the time of its installation, groundwater quality downgradient of RW-2 has improved such that no constituents are present above screening levels in recent (2017-2019) monitoring data and reinstallation of RW-2 has not been necessary. In addition, recovery well P-4/RW-3 had a

screen failure as determined by a 2017 assessment, and pumping in this well was stopped. Since this time, samples have been collected during recent monitoring events to evaluate groundwater conditions at this location. In 2019, groundwater concentrations in P-4/RW-3 decreased, with benzene being below its MCL. This well will remain inactive for groundwater recovery but will be used for future groundwater monitoring.

In addition to the remedial evaluations described above, an additional evaluation of groundwater control was conducted in 1999 as described in *Ground Water Flow and Recovery Modeling Area C and South Swamp Drain Areas* dated January 22, 1999. This remedial evaluation recommended installation of a Groundwater Interceptor to supplement existing groundwater recovery at the Former Burn Pit (SWMU 130) and upgradient of the South Swamp (SWMU 9). Following an RFI conducted at SWMU 130 in 2012 and 2013, it was recommended that the groundwater recovery system be expanded to capture groundwater between Drain C at SWMU 130 and Drain D at South Swamp. This expansion, which included installation of Drain F and Drain G, was completed in 2015 as part of SWMU 130, 22, and 23 interim measures. Details are provided in the *Interim Measures Report SWMUs 130, 22 and 23* dated August 31, 2016.

Due to the proximity of a portion of impacts related to SWMU 12, the ongoing corrective measure study (CMS) for SWMUs 3, 13S, and 15 will include an evaluation of corrective measures for impacts relating to SWMU 12 in the vicinity of SWMUs 3 and 13S. In accordance with the *CMS Work Plan* submitted to DHEC on May 21, 2018 and approved on January 9, 2020, this CMS has a current deadline of March 1, 2021. Similarly, it is anticipated that the upgradient impacts adjacent to SMWU 13N, which are considered associated with SWMU 12, will be addressed to the extent feasible during the CMS for SWMUs 2, 13N, and 14.

FORMER NORTH-SOUTH DITCH SOUTHERN (SWMU 13S)

General Description

Prior to 1984, wastewater from the Former Industrial Sewer (SWMU 12) discharged to the unlined Former North-South Ditch (SWMU 13), which ultimately discharged to Wastewater Pond No. 1 (SWMU 24) through the unlined Former East-West Ditch (SWMU 14). Both of the subject former ditches were taken out of service in 1984. A replacement north-south drainage system consisting of a concrete-lined North-South Ditch was constructed in 1984 (referred to in the 1993 RFA as SWMU 15, the Current North-South Ditch), which discharged into the Primary Clarifier (SWMU 16). Descriptions of the former SWMU 13 ditch are provided in a partial archive copy of the *N-S Closure Plan Letter to DHEC & Application to Construct Wastewater Collection System, Ethyl Corp* dated May 20, 1983, and the *RCRA Facility Assessment* dated February 1993.

The 1993 RFA indicates that approximately 10,000 gallons of liquid waste were pumped through the on-site wastewater treatment system when Former North-South Ditch was taken out of operation. The RFA notes approximately 9,500 cubic yards of contaminated soil and ditch construction materials were removed and disposed in the on-site landfill (SWMU 1). The specific location of this excavation is not known. After excavation, the ditch was backfilled with native soil, graded to the same level as the adjoining land, and a vegetative cover was put in place.

The Former North-South Ditch was bisected by River Road. The Southern portion drained northward from its southern terminus near the Former Hi-TOC Lagoon, crossed under River Road and then flowed into the Former East-West Ditch. The northern portion of the North-South Ditch flowed southward into the Former East-West Ditch.

Assessment History and Results

Soil sampling was performed along the northern and southern portions of the Former North-South Ditch in October 1983 prior to taking the ditch out of service as described in

the *N-S Ditch Sampling Memo and Lab Data, from Dennis Colton to Jeff Sgambat* dated October 6, 1983. This memo describes installation of eight soil borings adjacent to the N-S Ditch and a ninth background boring (PD-1) upgradient of the ditch. Results of 1983 soil sampling indicate the presence of chloroform, methylene chloride, trichloroethene, vinyl chloride, toluene, chlorobenzene, benzene, ethylbenzene, and 1,1,1 trichloroethane in ditch soils. Elevated detections were observed in boring locations to depths up to 14 ft below the ground surface.

As noted earlier, the Former North-South Ditch was bisected by River Road. The northern portion of the Former North-South Ditch was included in the RFI conducted throughout 2018 and 2019 for the Old Spoils Area (SWMU 2), discussed further in the section for the northern portion of the North-South Ditch (SWMU 13N). The southern portion of North-South Ditch was the subject of an RFI in 2017 as described further below.

Southern Portion of the Former North-South Ditch

An RFI was conducted at the southern portion of SWMU 13 in 2017 (in combination with an RFI at the adjacent SWMU 3 / Hi-TOC Lagoon and SWMU 15 / Current North-South Ditch). Throughout the 2017 RFI, a total of 30 soil borings and 3 temporary monitoring wells were installed to evaluate conditions at SWMU 13S. The 2017 RFI of the southern portion of the Former North-South Ditch (NSD-S) reveals a footprint of staining and free product associated with the southern portion of SWMU 13, representing approximately 3,600 cubic yards of product-impacted soils below the water table along the ditch alignment and approximately 1,800 cubic yards of saturated zone free phase product soil in the delineated upgradient areas attributed to upgradient sources (including SWMU 12). The RFI data confirms that the vadose zone soils, by virtue of no exceedances of Industrial RSLs, were removed at the time the SWMU was taken out of service.

Groundwater was sampled during the 2017 RFI using existing monitoring wells and three temporary wells. Aluminum, arsenic, benzene, chlorobenzene, and 1,2-dichloropane were

detected in shallow groundwater at concentrations above MCLs, and 1,1-dichloroethane, manganese, and vanadium were detected above EPA Tapwater RSLs. Of these compounds, chlorobenzene and manganese were detected in saturated zone soil at concentrations that exceed SSLs and may be a contributing source to groundwater impacts. Arsenic was detected in groundwater at concentrations above its MCL; however, soil concentrations in the vicinity of SWMU 13S appear to be naturally occurring

The results of this RFI were submitted to DHEC in the *RCRA Facility Investigation Report SWMU 3, SWMU 13, and SWMU 15 Hi-TOC Lagoon, North-South Ditch, and Current North-South Ditch*, September 13, 2017. The RFI was approved by DHEC in a letter dated January 24, 2018.

Corrective Measures

Based on the 1983 soil sampling data indicating impacts along SWMU 13, Ethyl/Albemarle removed the ditch from service and replaced it with a concrete lined ditch (referred to in the 1993 RFA as the Current North-South Ditch, SWMU 15). Subsequently, SWMU 15 was replaced by above-ground piping.

In the approval letter for the RFI Report, DHEC requested a CMS for the subject SWMUs including the North-South Ditch Southern. A CMS Work Plan was submitted to DHEC on May 21, 2018, and approved on January 9, 2020. The CMS is currently in progress, with a current proposed deadline of March 1, 2021.

CURRENT NORTH-SOUTH DITCH (SWMU 15)

General Description

The SWMU identified in the 1993 RFA as the Current North-South Ditch was a 3 ft wide x 4 ft deep x 350 ft long concrete-lined ditch constructed in 1984 (as depicted in a 1984 Revision 1 of drawing OBH00A066), which routed wastewater from the plant interior to the Primary Clarifier. Based on this as-built drawing, SWMU 15 was situated just east of the current pipe rack. However, since the time of the 1993 RFA, the subject SWMU 15 ditch and the Industrial Sewer System (SWMU 12) have been replaced with above-grade piping. Documentation is not available to provide greater clarity on what pertinent actions coincided with removing SWMU 15 from service.

Descriptions of the proposed SWMU 15 ditch features are provided in a partial archive copy of the *N-S Closure Plan Letter to DHEC & Application to Construct Wastewater Collection System, Ethyl Corp* dated May 20, 1983, and the *RCRA Facility Assessment* dated February 1993.

Assessment History and Results

An RFI was conducted at the southern portion of the Former North-South Ditch (SWMU 13S) in 2017 and within the SWMU 15 alignment area. Throughout the 2017 RFI, a total of 4 soil borings were installed to evaluate conditions at SWMU 15. Prior to this 2017 RFI, no assessment has been conducted in connection with SWMU 15. The 2017 RFI results reveal a footprint of staining and free product representing approximately 3,600 cubic yards of product-impacted soils below the water table, portions of which are within the SWMU 15 location. The RFI data confirm that vadose zone soils associated with SWMU 15 are impacted. Notable impacts to saturated zone soils east of SWMU 13 are present and may be at least partially attributable to SWMU 15. The RFI data do not reveal if these eastern impacts are associated with SWMU 13S or SWMU 15 uniquely. It is most likely they are associated with both SWMU 13S and SWMU 15.

Groundwater was sampled in the vicinity of SWMU 15 during the 2017 RFI using existing monitoring wells and three temporary wells. As previously mentioned, groundwater in the vicinity of SWMU 13S and SWMU 15 had several compounds above MCLs (aluminum, arsenic, benzene, chlorobenzene, and 1,2-dichloropane) and several compounds above Tapwater RSLs (1,1-dichloroethane, manganese, and vanadium).

The results of this RFI were submitted to DHEC in the *RCRA Facility Investigation Report SWMU 3, SWMU 13, and SWMU 15 Hi-TOC Lagoon, North-South Ditch, and Current North-South Ditch*, September 13, 2017. The RFI was approved by DHEC in a letter dated January 24, 2018.

Corrective Measures

The subject SWMU 15 ditch was taken out of service in 1999. By virtue of its location, SWMU 15 will be addressed concurrently with corrective measures for the Former North-South Ditch Southern (SWMU 13S) and the Former Hi-TOC Lagoon (SWMU 3).

In the approval letter for the RFI Report, DHEC requested a CMS for the subject SWMUs including the Current North-South Ditch. A CMS Work Plan was submitted to DHEC on May 21, 2018, and approved on January 9, 2020. The CMS is currently in progress, with a current proposed deadline of March 1, 2021.

SANDBEDS (SWMU 23)

General Description

The Sandbeds (SWMU 23) began operation in 1979 and are comprised of 4 adjacent bermed areas that are used to dewater process solids (Sandbeds 1-4 also referred to as SWMU 23A through SWMU 23D). Collectively, they cover 2.5 acres in the south-central portion of the site and were originally constructed with a soil liner, perimeter berm, and filtrate/leachate collection system. Operations transitioned from the original sand-bed filtering methods to use of Geotubes in 2004. Filtrate from sandbed operations is routed to the on-site WWTS. Descriptions of the Sludge Holding Basin/Sandbeds and associated operations are provided in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992 and the *RCRA Facility Assessment* dated February 1993.

Assessment History and Results

Assessment activities and findings associated with the Sandbeds are described in the 1992 *Site Assessment and Evaluation of Remedial Alternatives Report*. Investigations at the subject SWMUs conducted between September and October 1991 included collection of 22 soil samples within and around the SWMU 23 and SWMU 22. Consistent with the processes where the waste solids are generated, composite samples of process solids collected from within the Sandbeds indicate the presence of toluene, phenol, xylene, aluminum, calcium, iron, magnesium, manganese, sulfur, and phosphorous. Samples of Sandbed solids have been analyzed by TCLP methods on multiple occasions and have been shown to be non-hazardous.

Assessment conducted in late 2012 and early 2013 at SWMU 130, situated hydraulically downgradient of SWMU 23, provided groundwater quality findings pertinent to SWMU 23. These 2012/2013 assessment activities included a geophysical survey to the south-southeast and downgradient of SWMU 23, and two monitoring wells were installed in December 2012 and sampled in March 2013 to better understand groundwater conditions upgradient and downgradient of SWMU 23A-D. Based on the results of these assessment and groundwater

sampling activities, it appears that a release from SWMU 23 to groundwater on the plant property has occurred.

Recent groundwater data (2017 through 2019) from MW-69, installed immediately downgradient of the Sandbeds, frequently indicated the presence of benzene, toluene, phenol, antimony, arsenic, cobalt, and vanadium at concentrations above groundwater screening levels. In addition to these compounds, the compounds chlorobenzene, methylene chloride, DBCP, 1,2-dibromoethane (EDB), 2,4,6-trichlorophenol, aniline, 4,4-DDD, and cyanide were present above screening criteria during at least one recent groundwater monitoring event.

Corrective Measures

An early evaluation of remedial alternatives for the Sludge Holding Basin and Sandbeds was conducted and findings are presented in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992. The recommendation from the 1992 *Site Assessment and Evaluation of Remedial Alternatives Report* was to replace the subject SWMUs with mechanical filtration. Belt presses were subsequently installed but continued operation of the Sandbeds was required to keep up with filtration loads. Sandbed operations were switched to Geotubes dewatering devices in 2004 and a centrifuge was installed in 2014 to further supplement dewatering operations.

In addition to these filtration changes described above, site-wide groundwater remedial evaluations were conducted in 1999 as described in Ground *Water Flow and Recovery Modeling Area C and South Swamp Drain Areas* dated January 22, 1999. This remedial evaluation recommended installation of a Groundwater Interceptor to supplement site-wide downgradient groundwater recovery. An expanded groundwater interceptor system was installed in the southern portion of the site in 2015, spanning the distance between SWMU 130 and AOC E / SWMU 9 (see SWMU 130 discussion).

In an April 2013 meeting, Albemarle Corporation and DHEC agreed that a supplemental interim measure was appropriate to mitigate further releases to groundwater from SMWU 23. An Interim Measures Plan for SWMU 23A, one of the four adjacent sandbed sections, was submitted in June 2013, which specified removal of Sandbed solids, reconstruction of the perimeter berms to a suitable slope, and installation of an HDPE liner. Liner installation was completed in 2104, and subsequently, IM Plans were prepared and HDPE liners units were installed for the other three Sandbed units SWMU 23B through SWMU 23D in 2015 and 2016.

In 2019, during SWMU 22 interim measure activities, a French drain groundwater collection system was installed along the northern (Drain H) and western (Drain I) perimeter of SWMU 22 (Sludge Holding Basin). The French drain provides several benefits which improve long-term conditions at SWMU 22. The French drain also serves to intercept potentially impacted groundwater from the Sandbeds to prevent contamination of clean backfill placed within the SWMU 22 floor basin and prevent impacted groundwater from passing beneath the OHA toward the river.

Sandbeds 1-4 (SWMU 23A through SWMU 23D) remain in operation and further assessment and corrective measures, if needed, will be addressed at the time the units are taken out of service.

FORMER BURN PIT (SWMU 130)

General Description

The Former Burn Pit (SWMU 130) has previously been described as an approximate 150 ft. long x 80 ft. wide earthen pit used to burn organic wastes. Burning activities were terminated in the pit in 1962 and the pit was subsequently backfilled. A groundwater recovery trench known as Drain C was installed in 1988 at the burn pit to recover contaminated groundwater in the immediate area. As described further below, an RFI was conducted at SWMU 130 in 2012, and the extent of observed SWMU 130 impacts below the ground surface were much larger than anticipated (approximately 500 ft long x 300 ft wide). An additional groundwater interceptor trench (Drain F) was installed in 2015 as an Interim Measure to further mitigate migration of groundwater impacts in the vicinity of SWMU 130, and extends south and west of the original Drain C, which remains in service.

Earlier descriptions of the Former Burn Pit are provided the *RCRA Facility Assessment* dated February 1993, the *Source Area and Groundwater Assessment Report* dated February 19, 1998, and the *SWMU Data Summary* dated October 25, 2004.

Assessment History and Results

Assessment in the area of the Former Burn Pit was initially conducted in 1985 as described in Investigation *of Shallow Ground-Water Quality and Remedial Action Alternatives at Ethyl Corporation*. The 1985 assessment included an area designated in the report as Area C, corresponding to the location of the Former Burn Pit. Groundwater samples in Area C indicated elevated concentrations of total organic carbon and it was recommended that a French drain be installed to recover groundwater at Area C. Drain C is discussed further in the Corrective Measures section below.

Following installation of Drain C in the Former Burn Pit area in 1988, additional assessment was conducted at the Former Burn Pit as described in the 1998 *Source Area and Groundwater Assessment Report*. The subject investigation included the advancement of 18 DPT borings in

the vicinity of the Former Burn Pit. The extent of soil impact was also estimated based on field screening using an OVA and observations from the borings for the presence of staining, odor, etc. Two soil samples from the area borings were submitted for TCLP testing including volatile and semi-volatile organic compounds, metals, pesticides and herbicides and results indicated the soils are not characteristically hazardous. Waste-like materials were not encountered within any of the DPT borings, which is consistent with reports that such materials were removed during closure and backfilling of the Burn Pit in 1962. The pit's extent was correlated to soil staining and elevated OVA readings detected in the soils, which were observed in an area approximately 300 ft. x 150 ft. The western boundary of the impacted soils extended beneath the Sludge Holding Basin (SWMU 22).

An RFI was conducted at SWMU 130 in 2012 and revealed the presence of staining in vadose zone soil, and heavy staining and free product in soil below the water table in an area approximately 250 ft long x 200 ft wide. This large area of free product is referred to as the "Primary NAPL Area". These impacts continue to be confined vertically by the Duplin clay geologic unit located at depths ranging from of approximately 6 ft to 19 ft below ground surface in the vicinity of the Former Burn Pit. As observed in prior assessments, soil impacts associated with the Former Burn Pit extend substantially under the southeast portion of the nearby SWMU 22 / Old Holding Area. TCLP testing for VOCs, SVOC, pesticides, herbicides, metals, reactivity, corrosivity, and ignitability conducted as part of the 2012 RFI confirm the vadose zone soil and soil below the water table are characteristically non-hazardous.

Groundwater quality at the SWMU is monitored regularly at monitoring well MW-63 installed immediately downgradient of the Former Burn Pit. Constituents detected in groundwater during the RFI at concentrations exceeding their respective MCLs include 1,2,4-trichlorobenzene (1,2,4-TCB), 1,2-DCA, 1,2-dichloropropane (1,2-DCP), 1,4-Dichlorobenzene (1,4-DCB), acetone, benzene, chlorobenzene, chloroform, methylene chloride, toluene, TCE, 1,2,4-TCB, 1,4-DCB, 1-methylnaphthalene, 2,4,5-trichlorophenol, bis(2-ethylhexyl) phthalate, phenol,

arsenic, and cadmium. Cobalt, iron, magnesium, and vanadium were detected in several samples at concentrations that exceed their EPA Tapwater RSLs.

In October 2018, a CMS Work Plan was approved for SWMU 130 that included supplemental assessment of impacts associated with SWMU 130. This supplemental assessment was completed in 2018, and the results confirmed the presence of a smaller area of NAPL located to the southwest of SWMU 130, which is referred to as the "Secondary NAPL Area". Additionally, an area of high VOC detections in groundwater was detected east and downgradient of SWMU 130, and is referred to as "Secondary Area by the River". The results of the supplemental assessment were used to support a preliminary technology evaluation for SWMU 130 that led to additional assessment and treatability testing. The supplemental assessment results and the proposed additional assessment and treatability tests were submitted to DHEC as part of the *Treatability Test Plan*, dated May 14, 2019.

The additional assessment and treatability testing activities were conducted between June and October 2019. Additional assessment activities generally included further assessment and delineation of the two secondary areas identified during the 2018 supplemental assessment activities. The results of these assessments provided complete delineation of the NAPL associated with the Secondary NAPL Area and delineation of the MCL exceedances associated with the Secondary Area Near River. Additional characterization of the impacts confirmed that compounds detected at each secondary area were generally similar to the primary impacts associated with SWMU 130, and therefore it is considered appropriate to address both secondary areas as part of SWMU 130.

Treatability testing conducted at SWMU 130 included bench-scale tests and field screening activities to test the viability of in-situ chemical oxidation (ISCO), source containment and source removal. The results are detailed in the *Additional Assessment and Treatability Test Report – SWMU 130 Source Area – Former Burn Pit* (Treatability Test Report) dated

December 29, 2019. In the March 24, 2020 approval letter for the Treatability Test Report, DHEC requested a CMS Report for SWMU 130 be completed by May 29, 2020.

Corrective Measures

As noted earlier, a groundwater recovery trench (Drain C) was installed at the Former Burn Pit in 1988. The configuration of Drain C, as described in *Remedial System Evaluation and Ground Water Modeling* dated April 1997, is comprised of a gravel-filled trench extending 220 ft with a 36" sump installed in the center of the 220 ft alignment to a depth of approximately 11.5 ft.

Corrective measures alternatives for the Former Burn Pit were revisited after the 2012 RFI as presented in the *RCRA Facility Investigations Report – SWMU 130 Former Burn Pit*, dated July 19, 2013. An Interim Measure was recommended to further address groundwater impacts associated with the Former Burn Pit. As presented in the *Interim Measures Work Plan, SWMUs 130, 22, and 23*, Revision 1 dated June 10, 2014, a new French drain system (Drain F) was installed south and west of Drain C in 2015. As described in the *Interim Measures Report, SWMUs 130, 22 and 23*, Revision 0 dated August 24, 2016, Drain F is comprised of an approximately 500 ft long x 16" wide trench, with a slotted 6" diameter HDPE collection pipe installed to a depth of approximately 11 ft at the east end and approximately 5 ft at the west end, and is equipped with a 16" HPDE collection sump at the eastern-most end. The slotted collection pipe is set in 36" deep sand and gravel pack and topped with native soils to the ground surface. Drain F underwent post-installation repairs in early 2016 to address a separated joint between the sump and collection pipe.

In summary, corrective measures implemented at the Former Burn Pit over time include the following:

- Discontinue use of pit and backfill with clean soil (performed in 1962)
- Install a downgradient groundwater recovery trench, Drain C (installed in 1988)

- Installation of the supplemental groundwater recovery trench, Drain F, extending south and west of Drain C (installed in 2015)
- Long-term downgradient groundwater monitoring at monitoring wells in the vicinity of this SWMU (on-going)
- Continued use of existing institutional controls which include property line fencing, facility entrance security guard, and corporate health & safety and training policies

Following these above corrective measures, and as indicated in the section above, a CMS has been undertaken for SWMU 130. This CMS is currently underway to evaluate potential corrective measure alternatives to address impacted media associated with the SWMU 130 Source Area (including the Primary NAPL Area, Secondary NAPL Area, and Secondary Area Near River). On May 29, 2020, a letter was submitted to DHEC requesting an extension on completing the CMS with a submittal date in December 2020.

NORTH SANDBLAST AREA (SWMU 152N)

General Description

At the time of EPA's 1993 RFA, there were two Sand Blasting Areas at the site. The RFA-identified sandblast area located in the northern portion of the site is referred to in this permit application as the North Sandblast Area (SWMU 152N). Descriptions of the North Sandblast Area (SWMU 152N) are provided in the *Data Submittal Soil Sampling and Analysis Sandblasting Material Areas* by Dames and Moore dated November 24, 1992, the *Corrective Measures Study Work Plan* dated March 5, 2001, and the *RCRA Facility Assessment* dated February 1993.

The North Sandblast Area is made up of two separate work areas where portable tanks are sandblasted and painted, and are referred to as Sub-Area 3 and Sub-Area 4. Sub-Area 3 was used for sandblasting from 1980 to 1985 and is situated north of SWMUs 131/132. Sandblasting was initiated in Sub-Area 4 in 1985, situated west of the North Spoils portion of the Old Spoils Area (SWMU 2), and continues at present. Suspected constituents of concern at SWMU 152N was lead in spent sandblasting sand that may have accumulated in these areas and in underlying soils from equipment historically painted with lead-based paint.

Assessment History and Results

Descriptions of assessment activities and findings associated with the North Sandblast Area are provided in a partial archive copy of the *Data Submittal Soil Sampling and Analysis Sandblasting Material Areas* by Dames and Moore dated November 24, 1992. Eighteen soil samples were collected at the North Sandblast Area in 1992 and analyzed for total RCRA metals. Ten of the samples were collected in Sub-Area 3, and eight samples were collected in Sub-Area 4. In addition, the sample from each sub-area with the highest metal concentration was also analyzed for toxicity characteristic leachate procedure (TCLP) metals. Two background samples were analyzed for total metals for comparative purposes. A figure depicting locations of these borings is not available in Albemarle's project archives.

Total metals analyses for North Sandblast Area sand/soil indicate elevated metal concentrations in Sub-Areas 3 and 4. Arsenic and mercury exceed risk-based screening levels in Sub-Area 3, and arsenic and lead exceed risk-based screening levels in Sub-Area 4. TCLP analyses indicated no exceedances for RCRA hazardous waste criteria.

Groundwater quality downgradient from the North Sandblast Area Sub-Area 3 is monitored regularly at monitoring well MW-16R. Recent groundwater monitoring data (2017 through 2019) at MW-16R indicates no exceedances of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), or metals screening levels. Routine groundwater monitoring is not conducted close enough to indicate conditions at Sub-Area 4; however temporary monitoring wells (TMW2-3 and TMW2-19) installed during the RFI for SWMUs 2, 13N, and 14 were located in close proximity to and downgradient of Sub-Area 4. No exceedances of contaminants associated with Sub-Area 4 (arsenic, barium, cadmium, lead, and mercury) were identified in groundwater samples collected from these temporary monitoring wells.

Corrective Measures

Remedial alternatives considered initially for the North Sandblast Area are presented in the *Corrective Measures Study Work Plan* dated March 5, 2001. Sub-Area 3 of the North Sandblast Area is no longer in operation, while Sub-Area 4 of the North Sandblast Area continues to operate. The CMS has not been initiated while awaiting completion of higher priority SWMU actions at the plant.

Table A-7 SWMUs and AOCs in Corrective Action

No SWMUs or AOCs are currently in this stage

Table A-8 SWMUs and AOCs Requiring Land Use Controls

SLUDGE HOLDING BASIN (SWMU 22)

General Description

The Sludge Holding Basin (SWMU 22, aka Old Holding Area) began operation in 1979 and covers an approximate 5-acre area in the southeast portion of the site. The Sludge Holding Basin was used to stage dewatered process solids originating in the Sandbeds (SWMU 23). The Sludge Holding Basin was constructed with a soil liner and perimeter berm, and was used to further dewater solids prior to disposal in the on-site landfill. Prior to the interim measure conducted throughout 2019, the unit held approximately 26,000 tons of process solids. Accumulated water in SWMU 22 is routed to the on-site wastewater treatment system for treatment. Descriptions of the Sludge Holding Basin and associated operations are provided in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992 and the *RCRA Facility Assessment* dated February 1993.

Assessment History and Results

Early assessment activities and findings associated with the Sludge Holding Basin / SWMU 22 and Sandbeds / SWMU 23 are described in the 1992 *Site Assessment and Evaluation of Remedial Alternatives Report*. Investigations at the subject SWMUs conducted between September and October 1991 included collection of 22 soil samples. Consistent with the processes where the waste solids are generated, composite samples of process solids collected from within the Sandbeds indicated the presence of toluene, phenol, xylene, aluminum, calcium, iron, magnesium, manganese, sulfur, and phosphorous. Samples of process solids have been analyzed by TCLP methods on multiple occasions and have been shown to be non-hazardous.

An RFI was conducted at SWMU 22 in 2016, comprised of 15 soil borings and collection of sludge, soil liner, and vadose zone soil samples, and installation and sampling of five temporary monitoring wells within the Sludge Holding Basin limits. In addition, approximately 30 soil

borings were advanced within SWMU 22 as part of the 2015 RFI for SWMU 130, which encroaches into the southeastern corner of SWMU 22.

The 2016 sludge analytical results indicate that benzene and arsenic were the only constituents that exceed EPA Industrial RSLs. Several VOCs including 1,2,4-trimethylbenzene (1,2,4-TMB), 1,2-dibromo-3- chloropropane (DBCP), 1,3,5-TMB, acetone, benzene, ethylbenzene, isopropyl benzene, m&p xylene, n-butylbenzene, o-xylene, toluene, vinyl acetate, and total xylene were detected in sludge at concentrations that exceed EPA Protection of Groundwater SSLs. Based on TCLP results, the sludge that occupies the SWMU 22 is characteristically non-hazardous.

The analytical results for samples from the soil liner below the sludges indicate that lower VOC and metal concentrations were present in the soil liner when compared to the overlying sludge. Soil liner sample results indicate that DBCP was the only VOC detected in the soil liner at a concentration that exceeds its Industrial RSL. Several VOCs including 1,2,4-TMB, 1,3,5-TMB, 2-chlorotoluene, 4-chlorotoluene, n- butylbenzene, n-propylbenzene, o-xylene, and toluene were detected in the soil liner at concentrations that exceed SSLs. Several additional compounds including 2-butanone, MIBK, benzene, m&p xylene, methylene chloride, and xylene exhibited estimated J-flag concentrations that exceed SSLs. SVOCs aniline and phenol were detected in soil liner samples at concentrations that exceed SSLs. Metal compounds were not detected in the soil liner at concentrations that exceed Industrial RSLs. Antimony, arsenic, cobalt, iron, manganese, and mercury were detected in the soil liner at concentrations that exceed SSLs. Similar to soil liner results, contaminants detected in the vadose zone soil below the liner were consistent with contaminants detected in overlying sludges.

Following the approval of the RFI Report for SWMU 22, a CMS was conducted for the SWMU. This CMS included conducting additional assessment and treatability testing activities. These activities were conducted in accordance with the *Treatability Test Plan* for SWMU 22, submitted to DHEC on March 18, 2018. The results of this testing were documented in the

Treatability Study Report, included as Appendix E to the *Corrective Measure Study – SWMU 22 – Old Holding Area*, submitted to DHEC on April 10, 2019. The activities conducted as part of this assessment include treatability tests to evaluate in-situ stabilization, permeable reactive barrier, and solidification of SWMU 22 sediments. Additionally, an intermediate dike location assessment was conducted to delineate the impacts of SWMU 130 and ensure proper positioning of an intermediate dike which would ensure access to SWMU 130 impacts for future corrective measure activities following the implementation of a corrective measure at SWMU 22. Finally, a geotechnical assessment was conducted for the Sludge Holding Basin to guide CMS activities.

The results of the treatability testing demonstrated that neither in-situ stabilization nor in-situ treatment with a permeable reactive barrier would be feasible alternatives to address contamination associated with SWMU 22. Approximately 104 bench scale stabilization tests and 4 column tests were conducted using various designs; however, none were able to meet the remedial goals for a corrective measure. The results of the solidification testing demonstrated that among the multiple solidification reagents tested, only Portland Cement was able to suitably solidify the SWMU 22 sediments to the extent necessary for the corrective measure.

To complete the intermediate dike location assessment, 11 soil borings and one temporary well were installed to further define the upgradient extent of SWMU 130 impacts to assist in placing an intermediate dike which would separate the northern portion of SWMU 22 from its southern portion, which overlies the SWMU 130 impacts. The analytical results of the assessment provided adequate delineation and the intermediate dike was installed such that the impacts of SWMU 130 remain accessible for future corrective measure activities.

Corrective Measures

An early evaluation of remedial alternatives for the Sludge Holding Basin and Sandbeds was conducted and findings are presented in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992. The recommendation from the 1992 *Site Assessment and Evaluation of Remedial Alternatives Report* was to replace the subject SWMUs with mechanical filtration. Belt presses were subsequently installed but continued operation of

the Sandbeds was required to keep up with filtration loads. Sandbed operations were switched to Geotube dewatering devices in 2004 and a centrifuge was installed in 2014 to further supplement dewatering operations. The Sludge Holding Area remained in occasional service through 2015, at which time DHEC Bureau of Water restricted its use for sludge dewatering in the wastewater NPDES permit renewal.

In addition to the filtration considerations described above, site-wide groundwater remedial evaluations were conducted in 1999 as described in Groundwater *Flow and Recovery Modeling Area C and South Swamp Drain Areas* dated January 22, 1999. This remedial evaluation recommended installation of a Groundwater Interceptor to supplement site-wide downgradient groundwater recovery. An expanded groundwater interceptor system was installed in the southern portion of the site in 2015, spanning the distance between SWMU 130 and AOC E / SWMU 9 (see SWMU 130 discussion).

As discussed above, a CMS was conducted for SWMU 22 throughout 2018 and 2019. This CMS recommended a source removal action be undertaken to address impacts at SWMU 22. This recommendation was approved by DHEC in their approval letter dated April 30, 2019, and an Interim Measure plan was developed and submitted to DHEC on May 8, 2019. DHEC later approved this plan on May 24, 2019, and the source removal interim measure was conducted from June 2019 through February 2020.

The SWMU 22 interim measure remedy successfully removed 48,380 tons of exposed source sediment and impacted soils. The disposed material consisted of a total of 26,203 tons of solidified source sediment and 19,706 tons of impacted soils. An additional 2,521 tons of impacted soils were excavated during installation of the French drain. The French drain groundwater collection system was installed along the northern and western sides of SWMU 22 to intercept potentially contaminated groundwater from upgradient sources. Following removal of the source material, post-excavation base and sidewall sample results indicate notably lower

concentrations in remaining soils than previously detected in the source materials and it is expected that groundwater quality will improve over time.

An intermediate dike was constructed across the OHA to separate the SWMU 130 Source Area that overlaps the southern section of the OHA (Southern Portion) from the northern section (Northern Portion) to allow for a future remedy at the SWMU 130 Source Area after completion of the OHA remedy. After removal of source material, the basin was restored with clean backfill soil, and a geomembrane liner was installed on the northern portion which will serve as an emergency stormwater basin.

An Interim Measure Report detailing the implementation of this corrective measure is currently being drafted at the time of this permit application.

Groundwater monitoring downgradient of the Sludge Holding Basin will be performed during semi-annual site-wide groundwater monitoring events.

POND 1 (SWMU 24) AND POND 3 (SWMU 26)

General Description

Process wastewater generated at the plant was historically equalized in Pond No. 1, treated in Pond No. 2, and Pond No. 3 was used for final settling. The three ponds began operating in the early 1950s. Ponds No. 1 and No. 3 are no longer in service, while Pond 2 remains in service. Descriptions of the ponds are provided in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002 and the *RCRA Facility Assessment* dated February 1993.

Pond No. 1 (SWMU 24) is an inactive pond covering approximately one acre. It was constructed in the early 1950s and served as an equalization pond for wastewater received from the Former Industrial Sewer System (SWMU 12). The wastewater entered the unit from the Former East-West Ditch (SWMU 14). The wastewater contained organic compounds including toluene, methylene chloride, acetone, phenol, and alkyl phenols. In 1987, Pond No. 1 was taken out of service and was replaced with a sub-grade concrete Primary Clarifier (SWMU 16) and an above ground 1,000,000-gallon Equalization Tank. By virtue of its location, Pond 1 currently accumulates only surface water run-off and groundwater.

The Former Pond 1 Outlet Ditch (also SWMU 24) is an inactive 200 ft long x 20 ft wide x 3 ft deep ditch, formerly carried effluent from Pond No. 1 into Pond No. 2 for treatment. This ditch was taken out of service and has been replaced by a new concrete lined inlet to Pond No. 2.

Pond No. 3 (SWMU 26) is an inactive pond covering an area of approximately 1.5 acres. It operated from the early 1950s to 1975 when it was replaced with a sub-grade concrete Secondary Clarifier (SWMU 27). Since Pond No. 3 received treated industrial wastewater from Pond No. 2, the organic constituents were removed prior to entering Pond No. 3. By virtue of its location, Pond 3 currently accumulates only surface water run-off and groundwater. The pond accumulates rainwater and drains into the inlet of the NPDES monitoring station, which then releases into the North Fork Edisto River. This unit discharges to the North Fork Edisto River under the wastewater NPDES permit.

Assessment History and Results

In 2001/2002 a Confirmatory Sampling (CS) investigation was conducted at the subject SWMUs. During CS activities, samples were collected from firm soil at the base of the ponds and ditches, referred to as subsediment samples. In addition, surface water samples were collected from the ponds and associated ditches. Groundwater samples were collected from temporary monitoring wells installed downgradient of these units. Results of 2002 CS sampling are available in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002. Brief summaries of the 2015 RFI activities conducted for Pond 1 and Pond 3 are provided below.

Pond 1 and Former Pond 1 Outlet Ditch:

An RFI was conducted at Pond 1 and the Former Pond 1 Outlet Ditch in 2015 and included collection of five soil samples, two groundwater samples, 18 sediment samples, and five surface water samples. Results indicate Pond 1 held approximately 9,500 cubic yards of sediments and the Former Outlet Ditch held approximately 6 cubic yards of sediments. Soil data indicated the presence of ethylbenzene above its Industrial RSL. Several VOCs were detected at concentrations that exceed SSLs, including benzene, chlorobenzene, 1,2-DCB, 1,4-DCB, 1,2-DCP, ethylbenzene, isopropylbenzene, methylene chloride, methyl-tert-butyl ether (MTBE), naphthalene, toluene, 1,2,3-TCB, 1,2,4-TCB, 1,2,4-TMB, 1,3,5-TMB, and xylene.

The SVOCs diethyl hexyl phthalate (DEHP), pyrene, 1,2,4-TCB, 2,4,5-TCP, and 2,4,6-TCP were detected at concentrations that exceed SSLs. Arsenic and mercury were detected at concentrations that exceeded EPA Industrial RSLs. Elevated mercury detected at a single Former Outlet Ditch soil boring was unique in comparison to other results. Other metal compounds detected in the soil samples that exceed SSLs include cobalt, copper, lead, and manganese.

Pond 1 sediment analytical results indicated that ethylbenzene and TCE were the only VOCs detected at concentrations that exceed Industrial RSLs. No VOCs were detected at concentrations above Industrial RSLs in the Former Outlet Ditch sediment. Several VOCs were detected at concentrations that exceed SSLs including acetone, benzene, n-butylbenzene,

chlorobenzene, chloroform, 1,4-DCB, ethylbenzene, isopropylbenzene, methylene chloride, naphthalene, n-propylbenzene, toluene, 1,2,4-TMB, 1,3,5-TMB, and xylene.

SVOC phenol was detected in sediment at concentrations that exceed SSLs. Arsenic was detected in Pond 1 sediment and the Former Outlet Ditch sediment at concentrations that exceeds its Industrial RSL. Metals aluminum, antimony, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc were detected in sediment at concentrations that exceed SSLs.

VOC methylene chloride and metals antimony, arsenic, lead, and mercury were detected in surface water at concentrations that exceed MCLs. VOC naphthalene detected in surface water at an estimated J-flag concentration, and metals aluminum, cobalt, iron, and manganese were detected at concentrations that exceed Tapwater RSLs. SVOCs were not detected above laboratory reporting limits.

Groundwater samples collected from downgradient monitoring well MW-75 indicate that no VOCs or SVOCs were detected at concentrations above screening levels. Mercury was detected at a concentration that exceeds its MCL, and iron and manganese were detected at concentrations that exceed their Tapwater RSLs. Constituent concentrations in groundwater were generally higher in the Pond 1 upgradient well MW-76, as compared to the Pond 1 downgradient well MW-75. Methylene chloride, antimony, arsenic, and mercury were detected at concentrations that exceed their MCLs in upgradient monitoring well MW-76. SVOC aniline and manganese were detected in MW-76 at concentrations that exceed their Tapwater RSLs. The impacts observed at MW-76 are believed to be attributable to upgradient groundwater conditions relating to other SWMUs (Old Spoils Area and East-West Ditch).

Pond 3:

An RFI was conducted at Pond 3 in 2015 and included collection of 12 soil samples, three groundwater samples, 12 sediment samples, and three surface water samples. Results indicate Pond 1 held approximately 8,000 cubic yards of sediments.

Pond 3 soil analytical results indicate that no VOCs were detected at concentrations that exceed Industrial RSLs. SVOC pentachlorophenol was detected in one soil boring at an estimated J-flag concentration that exceeds its SSL. No metals in soil exceeded Industrial RSLs. Arsenic, cobalt, manganese, and mercury were detected in soil samples collected from several borings at concentrations that exceed SSLs.

Pond 3 sediment analytical results indicate that no VOCs were detected at concentrations that exceed Industrial RSLs. Several VOCs were detected at concentrations that exceed SSLs including acetone, benzene, 2-butanone, chlorobenzene, 1,2-DCB, 1,4-DCB, 1,2-DCP, ethylbenzene, methylene chloride, naphthalene, toluene, 1,2,4-TCB, 1,2,4-TMB, and xylene. SVOC di-n-butyl-phthalate was detected in one sediment sample at a concentration that exceeds its SSL. SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, 4-chloroaniline, di-n-butyl-phthalate, and pentachlorophenol exhibited estimated J-flag concentrations that exceed SSLs. Arsenic and mercury were detected in sediment samples at concentrations that exceed Industrial RSLs. Metals in sediment samples that exceed SSLs include aluminum, cobalt, iron, lead, manganese, and silver.

There were no VOC exceedances in surface water samples, and SVOCs were not detected above laboratory reporting limits. Manganese was detected in a duplicate sample at a concentration that exceeds its RSL, and mercury was detected at concentrations below its MCL but above DHEC's surface water standard.

Groundwater samples collected from downgradient and cross-gradient monitoring wells indicate that no VOCs were detected at concentrations that exceed screening levels. SVOC 4-chloroaniline was detected at an estimated J flag concentration that exceeds its Tapwater RSL. Antimony was detected at a concentration that exceeds its MCL in the groundwater sample collected from downgradient and manganese was detected in cross-gradient/down-gradient monitoring wells at concentrations that exceed its RSL. Sampling results for wells situated upgradient to Pond 3, indicate detections of antimony and manganese at concentrations similar to

those observed downgradient of Pond 3. Based on this upgradient data, the presence of antimony and manganese downgradient of Pond 3 may be attributable to conditions upgradient of Pond 3.

Corrective Measures

Pond No. 1 was taken out of service in 1987 and was replaced with a sub-grade concrete Primary Clarifier (SWMU 16) and an above ground 1,000,000-gallon Equalization Tank. Pond No. 3 is no longer in operation. Neither pond receives any wastewater.

Based on the 2015 RFI results, the *RCRA Interim Measures Plan and Bureau of Water Closure Plan, SWMU 24 & SWMU 26, Pond 1 & Former Outlet Ditch and Pond 3* dated May 3, 2017 specified removal and off-site disposal of sediments from Pond 1, Former Pond 1 Outlet Ditch, and Pond 3. This interim measure was completed in 2017, and documented in the *RCRA Interim Measures Report and Bureau of Water Closure Report – SWMU 24 & SWMU 26 Pond 1 & Former Outlet Ditch and Pond 3*, submitted to DHEC on February 23, 2018, and approved by DHEC on May 22, 2018. A brief description of the interim measures is provided below.

Pond 1 and Former Outlet Ditch

Pond sediments were solidified using bed ash and disposed of at an off-site permitted landfill. Approximately 11,576 of solidified sediments and 1,996 tons of impacted native soils were excavated and disposed from Pond 1 and 1,049 tons of solidified sediment and 647 tons of impacted native soils were excavated and disposed from the Former Outlet Ditch. Following the removal of the solidified sediment and impacted native soils, the Former Outlet Ditch was backfilled to grade with clean fill material, and the area was seeded with grass. The footprint of the Former Outlet Ditch is currently a grassy area level with its surroundings. The sidewalls of Pond 1 were backfilled following the interim measure to increase slope stability.

In addition to the excavation of the sediment and impacted soils, an area of approximately 10 ft by 10 ft was excavated adjacent to the Former Outlet Ditch where high mercury impacts were

previously observed. Similarly, an area of free phase product was identified adjacent to Pond 1 along the facility road (subsequently identified as AOC G), and soil from this area was excavated as part of the interim measure. A total of 413 tons of soil were excavated from these two areas, which were subsequently backfilled.

The excavation of the free phase product near Pond 1 was unable to completely address impacts from the free phase product, and therefore, following the interim measure, this area was incorporated into the RCRA Permit as AOC G. Additional details about this area are provided in under the description for AOC G.

Groundwater monitoring downgradient of Pond 1 and the Former Outlet Ditch will be performed during semi-annual site-wide groundwater monitoring events.

Pond 3

Similar to Pond 1, sediments at Pond 3 were solidified using bed ash and disposed of at an off-site permitted landfill. Approximately 16,145 of solidified sediments and 2,630 tons of impacted native soils were excavated and disposed from Pond 3. As part of the interim measure, the western extent of Pond 3 was partially backfilled to allow for the widening of the facility haul road located between Ponds 2 and 3.

In addition to the excavation of the sediment and impacted soils, an area of free phase product was identified adjacent to Pond 3 to the northeast, and soil from this area was excavated as part of the interim measure. The amount of soil excavated from this area was not documented separately from excavation of other native soils as it was in close proximity to the sidewall to Pond 3. Similar to the area of free product identified near Pond 1, the excavation of material near Pond 3 was unable to completely address impacts from the free phase product, and therefore, following the interim measure, this area was incorporated into the RCRA Permit as AOC H. Additional details about this area are provided under the section for AOC H.

Groundwater monitoring downgradient of the Pond 3 will be performed during semi-annual site-wide groundwater monitoring events.

EASTERN DEBRIS AREA (AOC F)

General Description

The Eastern Debris Area was not identified at the time of the 1993 RFA, but was discovered in 2007 by former Albemarle Corporation personnel during a review of aerial photographs of the property. Field personnel conducted a visual inspection of the area in April 2007 and in May 2007, former Albemarle Corporation personnel notified DHEC of the discovery of the area as required by Module V.B. of their Hazardous Waste Management Permit. It was subsequently named by DHEC as AOC F.

The EDA is located along SI Group's eastern property boundary and within 75 ft of the North Fork Edisto River. The EDA is located outside of SI Group's fence line in a predominantly wooded and overgrown area of the site. Based on review of historical aerial photographs, it appears that the debris area was active from the early 1940s through the late-1970s. From the late 1970s the area had become overgrown with vegetation.

The EDA is generally defined by a short steep slope that ranges in height from 5 to 8 ft and the raised area measures approximately 480 ft in length by 60 to 160 ft in width. A flat lowland area is situated between the EDA and the North Fork Edisto River and is located within the designated 100-year floodplain of the North Fork Edisto River. The estimated water table depth is approximately one ft below ground surface in the lowland area.

Assessment History and Results

An April 2007 inspection identified piles of concrete rubble, bricks, scrap metal, and drum carcasses located mainly along the steeply sloped edges of the debris mound. Approximately 15-20 drum carcasses were observed in various locations along the edge of the debris pile and in the adjacent drainage area. No identifiable labels were noted on the drums. No evidence of staining, residue or hazardous materials were observed within the areas of the containers. The debris appeared to predominantly consist of concrete.

In May 2007, assessment activities included collection of soil samples at eight boring locations spaced across the debris area, two biased to locations of potential impact based on debris observed and the remaining six boring were advanced at accessible locations across the EDA. As reported in the Revision 1 of the *Assessment Report – Eastern Debris Area* dated July 29, 2009, VOCs and SVOCs were not detected in soil at concentrations above Industrial RSLs. Several VOCs including benzene, ethylbenzene, 1,2,3-TCB, 1,2,4-TCB, 1,4-DCB, MTBE, and naphthalene were detected in soil at concentrations that exceed SSLs. In addition, SVOCs dibenzofuran, naphthalene, and phenol were detected in soil boring HA-8 at concentrations that exceed SSLs. Arsenic, manganese, cobalt, copper, lead, mercury, and selenium were detected in soil at concentrations exceeding their respective SSLs.

An RFI was conducted at the EDA in 2015 and 2016, as reported in the *RCRA Facility Investigation AOC F – Eastern Debris Area* dated December 13, 2016. The RFI was comprised of 30 soil boring, 10 temporary wells, and 4 test pits. The RFI determined the EDA contains an estimated 14,000 cubic yards of soil and debris material. The debris is intermixed with silty sands which overlie native surficial soils and ranges in thickness from 3.5 to 8 ft. The base of the debris deposit is approximately level with the current floodplain of the North Fork Edisto River and the shallow water table is generally within 1 to 2 ft below the base of the debris pile. The exposed and buried debris consists primarily of soil, concrete rubble, bricks, metal rebar, industrial hoses and piping, drum carcasses, and trash. Based on TCLP results, the soil/debris matrix at the EDA is considered to be characteristically non-hazardous.

Detections greater than Industrial RSLs in EDA soil include ethylbenzene and arsenic. Several additional VOCs and metal compounds were detected in soil at concentrations that exceed SSLs. Of these compounds in soil that exceed SSLs, manganese, benzene, chlorobenzene, naphthalene, and m&p xylene were detected in downgradient groundwater at concentrations that exceed groundwater screening levels.

Antimony, benzene, and chlorobenzene were detected in EDA downgradient shallow groundwater at concentrations above their MCLs. Antimony does not appear to be originating

from the EDA but rather from an upgradient contribution (Sludge Holding Basin) from migrating shallow groundwater, while concentrations of benzene, chlorobenzene, naphthalene and m&p xylene appear to be attributable to soil impacts identified in the northern portion of the EDA. Manganese was detected in 6 of 7 downgradient wells at concentrations that exceed its Tapwater RSL, and manganese is present in soil at multiple locations at concentrations that exceed its SSL. Although arsenic and cobalt are present in EDA soils at concentrations above SSLs, the absence of these constituents in downgradient groundwater indicate EDA soils are not sources of leaching to groundwater at the EDA.

Corrective Measures

A Corrective Measures Study was conducted in 2017 that concluded a source removal action was appropriate for AOC F. This CMS was approved by DHEC on March 2, 2018 and an Interim Measure Plan was submitted and approved by DHEC on June 1, 2018.

The interim measure activities were completed from June to November of 2018, and final grading and seeding activities were completed in March 2019. The interim measure activities are documented in the *Interim Measure Report – AOC F – Eastern Debris Area*, submitted to DHEC on May 27, 2019 and approved by DHEC on November 27, 2019.

The objective of the Interim Measure was to mitigate direct exposure risks and continuing releases of constituents of interest to groundwater from EDA impacted soils and debris. Approximately 28,380 tons of source material, consisting of debris, product saturated soils, impacted native soils, and impacted detritus, were removed from the EDA. The post-excavation base and sidewall soil samples indicate significantly lower impacts remain in comparison to the level of impacts in source material that was removed. After removal of the impacted soil and debris, an approximate 1 ft to 5 ft cap of clean backfill soil and topsoil was placed across the excavation.

The Eastern Debris Area remedy successfully restored approximately 1.5-acres of the natural floodplain by removing a large pile of source debris material containing drum carcasses, piping,

laboratory waste, various industrial debris, asbestos containing materials (ACMs), product-saturated soil, and associated impacted soil. Following removal of source material, post-excavation base sample results indicate notably lower concentrations and it is expected that groundwater quality will improve over time. After removal of the impacted soil and debris, the floodplain was restored by backfilling the excavated areas within the water table with clean backfill soil, thus mitigating the potential for direct exposure risks to remaining soils left in place below the water table. Lastly, vegetation was established across the former footprint of the EDA and within the floodplain area by planting native wetland grasses and trees.

Groundwater monitoring at the Eastern Debris Area is scheduled to begin in 2021, in accordance with DHEC's approval of the IM Report.

Table A-9 SWMUs and AOCs Transferred to Another Environmental Program

The SWMUs/AOCs listed in this section have been transferred to another DHEC environmental program (Solid Waste or Bureau of Water) and these units remain subject to RCRA Corrective Action while they are active and following any closure activities that are completed pursuant to other environmental permits (e.g. NPDES Permit, Non-Hazardous Solid Waste Landfill Permit).

NON-HAZARDOUS WASTE LANDFILL (SWMU 1)

General Description

The on-site Non-Hazardous Waste Landfill (SWMU 1) covers approximately 16 acres in the northeast portion of the site. The landfill was constructed and permitted in 1981 by SCDHEC Solid Waste Division (Permit No. IWP-178) primarily for disposal of non-hazardous process solids generated at the main plant. Descriptions of the landfill and associated operations are provided in the Site Assessment and Evaluation of Remedial Alternatives Report dated February 14, 1992 and the RCRA Facility Assessment dated February 1993.

The landfill receives approximately 10,000 to 15,000 cubic yards of solid waste annually in the form of dewatered process solids and dewatered Pond 2 aerobic wastewater sludge from the dewatering building and from the Sandbeds (SWMUs 22 and 23). The landfill has a 3-foot thick compacted soil liner and is surrounded by a compacted soil dike. The southeast corner of the landfill contains a 1.5-acre, soil-lined stormwater basin for collecting rain falling within the landfill dike and leachate from beneath the landfilled solids. Water collected in the storm water basin flows to a concrete sump and is pumped to the on-site wastewater treatment system.

While the landfill has predominantly received non-hazardous wastes generated from on-site operations, approximately 6,500 cubic yards of similar process waste was received from the Hardwicke MTM chemical plant in the early 1990's. The Hardwicke plant, located in Elgin, South Carolina, was owned by Albemarle's former parent company Ethyl Corporation. A description of this disposal activity is included in EPA's 1993 RCRA Facility Assessment.

Assessment History and Results

Descriptions of assessment activities and findings associated with the landfill are provided in the *Site Assessment and Evaluation of Remedial Alternatives Report* dated February 14, 1992, the *RCRA Facility Assessment* dated February 1993, 1998 waste characterization data, and representative historical groundwater data for the landfill. Results of more recent assessment activities at the landfill are presented in the *Landfill Groundwater Quality Assessment Report* dated August 27, 2012.

Investigation at this SWMU conducted between August and October 1991 included the collection of 25 waste samples within and around the landfill. Of these, 14 were completed along the perimeter of the landfill; 9 were completed inside the landfill; and 2 were completed inside the stormwater basin.

Consistent with the processes where the waste is generated, results of waste analyses indicate detections of toluene, xylene, and phenol, as well as inorganic compounds such as aluminum, calcium, sodium, sulfur, magnesium, and manganese. TCLP testing has been performed on the landfill waste periodically via the Solid Waste Analysis and Implementation Plan (SWAIP) dated October 12, 2015, and results of these tests consistently confirm the waste is non-hazardous.

To better define the depth and continuity of a clay layer found beneath the Landfill, 38 geotechnical borings were completed at the landfill perimeter in December 1991. These borings defined the depth and confirmed continuity of the naturally-occurring confining clay layer in the vicinity of the landfill.

Groundwater quality at the landfill was originally assessed in 1980, assessed again in June 2012, and is now monitored and reported semi-annually. Groundwater data from the June 2012 Assessment of Groundwater Quality, which included permanent monitoring wells and 4 temporary wells downgradient of the permanent wells, indicated the presence of a limited number of metals, SVOCs, and pesticide/herbicide constituents above screening levels. Of these

detections, only manganese and cobalt are believed to be associated with the landfill itself. Iron is present in groundwater as a result of the reducing geochemical conditions downgradient of the landfill. Other detected constituents are believed to be associated with historical sawmill operations which occurred at the site prior to the plant being constructed. These historical constituents which are not associated with landfill operations include pentachlorophenol, arsenic, lead, and part per trillion levels of select pesticides/herbicides. No VOCs have been detected above generic screening levels in landfill groundwater. Monitoring data for deeper landfill monitoring wells indicates no detections above screening levels at this SWMU.

Corrective Measures

An evaluation of remedial alternatives for groundwater at the landfill was conducted and submitted to DHEC in December 2017. The conclusion of the evaluation determined that the utilization of institutional and engineering controls and natural attenuation is the most suitable alternative to address cobalt and manganese in groundwater associated with the landfill. This conclusion was accepted by DHEC in July 2018. The next step that shall be taken is a public meeting to discuss the proposed remedial options.

STORMWATER OUTFALL DITCHES (SWMU 11)

General Description

The Stormwater Outfall Ditches designated as SWMU 11 gather non-contact stormwater from parking lots, office areas, and outlying site areas, and routes it by way of earthen and concrete-lined ditches to one of two outfalls to the North Fork Edisto River. Stormwater run-off from the southern boundary is routed to Albemarle's General NPDES permitted Outfall 01 by way of concrete-lined ditches. Run-off from northern site areas and run-on from off-site areas to the north of the site are routed to the river by way of an earthen ditch. Off-site contributions to this northern ditch from neighboring operations are known to exist. Further description of the Stormwater Outfall Ditches is provided in the RCRA Facility Assessment dated February 1993.

Assessment History and Results

Data collected in association with the Stormwater Outfall Ditches includes NPDES surface water sample data for Albemarle's southern Outfall 01. Full suite analyses including metals, pesticides, PCBs, VOCs, and SVOCs. These data indicate no detections of concern.

The RFA indicates surface water samples were collected from the northern ditch on October 21, 1990 but no copies of this data are available in the RFA or in site archives. The RFA indicates results of October 1990 surface water sampling in the northern ditch indicated the presence of part per billion concentrations of carbon tetrachloride, 1,1-dichloroethane, toluene, and 1,1,1-trichloroethane.

The former site owner Albemarle previously advised run-off sampling was conducted by Council Lumber located to the north of the northern stormwater ditch but this data was not made available to Albemarle. SI Group understands results of Council Lumber's sampling data resulted in DHEC requiring Council Lumber to obtain an NPDES discharge permit for their outfall to the northern boundary ditch.

No available groundwater monitoring data is close enough to the northern stormwater ditch to determine if it may be associated with groundwater impacts. Because the southern SWMU 11 stormwater ditch is in close proximity SWMUs 22 and 23, it is indeterminate if the southern SWMU 11 ditch is a potential source of contaminants in groundwater. However, the absence of VOCs and SVOC groundwater impacts associated with the Stormwater Impoundment Basin (SWMU 10), which receives contact water from plant operations areas, provides an indication that SWMU 11 ditches do not likely represent a notable environmental concern.

Corrective Measures

The SWMU 11 Stormwater Outfall Ditches handle only non-contact stormwater and no evidence of a release attributable to the ditches has been observed. Annual NPDES discharge monitoring is ongoing. In a July 2004 meeting with DHEC and EPA, it was agreed that the possible need for Confirmatory Sampling at the Stormwater Outfall Ditches will be determined at the time the ditches are taken out of service. These units were transferred to Bureau of Water, as indicated in the 2008 permit.

PRIMARY CLARIFIER (SWMU 16)

General Description

The Primary Clarifier is an approximate 60 ft long x 20 ft wide sub-grade concrete structure equipped with sludge rakes, and is used to remove solids from process wastewaters received from the Industrial Sewer System (SWMU 12). The unit operates under the DHEC wastewater program within the Bureau of Water and after treatment in downstream units, discharges via a permitted NPDES outfall. Further description of the Primary Clarifier is provided in the RCRA Facility Assessment dated February 1993.

Assessment History and Results

No evidence of a release has been observed at this SWMU. The Primary Clarifier is sometimes emptied periodically for maintenance and inspection, with the most recent maintenance event occurring in 2018. No groundwater monitoring data is available in close proximity to the Primary Clarifier.

Corrective Measures

No evidence of a release has been observed. This unit, which remain in active service, was transferred to the DHEC Bureau of Water and in a July 2004 meeting with DHEC and EPA, it was agreed that the possible need for further action will be determined by DHEC's wastewater program at the time the unit is taken out of service.

DEEP SUMP (SWMU 18)

General Description

The Deep Sump is an approximate 20 ft x 15 ft x 13 ft deep sub-grade concrete structure situated east of the Primary Clarifier (SWMU 16). SWMU 18 receives process wastewater from the treatment system headworks and discharges it to the 1,000,000-gallon equalization tank (SWMU 19). The unit operates under the DHEC wastewater program within the Bureau of Water and after treatment in downstream units, discharges via a permitted NPDES outfall. Further description of the Deep Sump is provided in the RCRA Facility Assessment dated February 1993.

Assessment History and Results

The Deep Sump has not been the subject of assessment. No groundwater monitoring data is available in close proximity to the Deep Sump. This unit, which remains in active service, was transferred to the DHEC Bureau of Water and in a July 2004 meeting with DHEC and EPA, it was agreed that the possible need for further action will be determined by DHEC's wastewater program at the time the unit is taken out of service.

POND 2 (SWMU 25)

General Description

Process wastewater generated at the plant was historically equalized in Pond No. 1, treated in Pond No. 2, and Pond No. 3 was used for final settling. The three ponds began operating in the early 1950s. Ponds No. 1 and No. 3 are no longer in service, and Pond 2 remains in service as a treatment pond. Pond No. 2 (SWMU 25) is an active aerated, activated sludge lagoon covering approximately two acres. Description of the pond is provided in the *Confirmatory Sampling Report Revision 0* dated October 9, 2002 and the *RCRA Facility Assessment* dated February 1993.

Pond 2 began operating in the early 1950s and received wastewater from Pond No. 1 until 1987, and since 1987 receives wastewater from the Equalization Tank. The wastewater contains organic compounds including toluene, methylene chloride, acetone, phenol, and alkyl phenols. The influent wastewater is aerated by eight high-speed floating aerators. Discharge from Pond No. 2 is presently directed to a Secondary Clarifier for sludge removal, before being discharged to the North Fork Edisto River through an NPDES-permitted outfall. Biological sludge is recycled to Pond 2 from the Secondary Clarifier. EPA's 1993 RFA indicates Pond No. 2 has been dredged in its early years of operation and at that time, the waste was reportedly disposed in the Old Spoils Area (SWMU 2).

Assessment History and Results

In 2001/2002 a Confirmatory Sampling (CS) investigation was conducted at the subject SWMU. During CS activities, samples were collected from firm soil at the base of the pond, referred to as subsediment samples. In addition, surface water samples were collected from the pond. Groundwater samples were also collected from downgradient monitoring wells. Results of 2002 CS sampling for Pond 2 are discussed briefly below.

2002 sampling at Pond No. 2 included the collection of three subsediment samples. Metals and VOC concentrations did not exceed screening levels in Pond No. 2 subsediments. Detections of

4-chloroaniline at two subsediment locations exceeded screening levels. A composite surface water sample was collected from Pond No. 2 and no VOCs or SVOCs were detected at concentrations above screening levels in surface water from Pond No. 2. Aluminum, manganese, and nickel were detected in surface water at concentrations above screening levels, but these detections are consistent with the influent wastewater stream. Groundwater data downgradient of Pond No. 2 is routinely monitored at MW-73 during the semi-annual site-wide groundwater monitoring events. Recent data from MW-73 (2017 through 2019) frequently indicated the presence of antimony above screening criteria, and the compounds cobalt, manganese, and nitrate, were each detected above screening criteria in one recent groundwater sample.

Corrective Measures

Pond No. 2 is currently in operation as an aeration lagoon and further assessment and corrective measures, if needed, will be addressed at the time it is taken out of service.

SECONDARY CLARIFIER (SWMU 27)

General Description

The Secondary Clarifier is an approximate 90 ft long x 30 ft wide sub-grade concrete structure equipped with sludge rakes, and is used to remove solids from treated process wastewaters received from the wastewater aeration pond (Pond No. 2, SWMU 25). The Secondary Clarifier operates under the DHEC Bureau of Water wastewater program and discharges via the facility's permitted wastewater NPDES outfall.

Further description of the Secondary Clarifier is provided in the RCRA Facility Assessment dated February 1993.

Assessment History and Results

No evidence of a release has been observed at this SWMU. No downgradient groundwater monitoring data is available in close proximity to the Secondary Clarifier. A downgradient to cross-gradient well (MW-65) indicates no exceedances of groundwater screening criteria.

Corrective Measures

No evidence of a release has been observed and no evaluation of remedial alternatives has been conducted. In a July 2004 meeting with DHEC and EPA, it was agreed that the possible need for further action will be determined by DHEC's Bureau of Water wastewater program at the time the unit is taken out of service.

Table A-10 SWMUs and AOCs Under DHEC Review to Determine CA Status

NORTH FORK EDISTO RIVER (AOC A)

General Description

The *RCRA Facility Assessment* dated February 1993 named the North Fork Edisto River, situated along the eastern boundary of the plant, as Area of Concern A (AOC A). Two permitted stormwater outfalls and one NPDES-permitted wastewater outfall discharge to the river. The 1993 RFA notes that SWMUs in close proximity to the river such that groundwater from these units discharge to the river include South Swamp (SWMU 9 / AOC E), Pond 3 (SWMU 26), Former Burn Pit (SWMU 130), and Stormwater Outfall Ditches (SWMU 11).

Assessment History and Results

Sampling of the surface water in AOC A was conducted by Albemarle in April 2014 at three locations. Data indicate no detections of VOCs or SVOCs, and no detections of metals above screening levels. Based on these findings, interim measures in place at other SWMUs to reduce migration of groundwater constituents to the river, and regular NPDES monitoring at SWMU 11, SI Group concludes no further assessment is warranted for AOC A.

SOUTH SANDBLAST AREA (SWMU 152S)

General Description

At the time of EPA's 1993 RFA, there were two Sand Blasting Areas at the site. The sandblast area formerly located in the southern portion of the site is referred to as the South Sandblast Area (SWMU 152S). Corrective action for the South Sandblast Area was addressed using a risk-based analysis in 1994 and an EPA-approved plant expansion was completed at this southern location to build the BIF Load / Unload Area (SWMU 139). The BIF Load/Unload Area is an approximate 90 ft x 70 ft concrete-paved containment pad for unloading combustible fluids into above ground storage tanks located in a containment area adjacent to the BIF Load/Unload Area. Descriptions of the South Sandblast Area (SWMU 152N) are provided in EPA's *RCRA Facility Assessment* dated February 1993. The South Sandblast Area is now located beneath the paved BIF Load/Unload Area (SWMU 139) as described below.

Assessment History and Results

In preparing for construction of the BIF Load/Unload Area, the former underlying sandblast area was assessed in 1992, as noted in the *Soil Sampling and Analysis Sandblasting Material Areas* by Dames and Moore dated November 18, 1994. The assessment included analysis of 24 soil samples for VOCs, SVOCs, and metals. Results indicated detections of several metals above background levels, and trace levels of acetone and butyl benzyl phthalate. Risk assessments were conducted as presented in the November 1994 report and the December 1994 and March 1995 risk assessment letters. These risk analyses confirmed that the potential risk to future workers and hypothetical future residents was within an acceptable range and no remedial action was required.

Groundwater in the vicinity of SWMU 152S is routinely monitored at downgradient well MW-11R. Recent groundwater monitoring data (2017 through 2019) at MW-11R indicates no detections of VOCs or SVOCs, and no detections of metals above screening levels.

Corrective Measures

Prior to construction of the BIF Load/Unload Area, the 1994 risk assessment concluded that no remedial action was required at the former sandblast area / SWMU 152S. The BIF Load/Unload Area remains in service and the integrity of the unit is routinely inspected. In a July 2004 meeting with DHEC and EPA, it was agreed that EPA & DHEC will review the data from the 1994 sandblast area risk assessment to determine if further action is required. At the time of preparing this permit renewal, it was discussed with DHEC that the 1994 sandblast area risk assessment data will be reviewed to determine if further action is required. If additional action is warranted, it will be performed at the time the unit is taken out of service.

NOTE: BASE MAP REFERENCES

1. ALBEMARLE CORPORATION'S GROUND WATER MONITORING WELLS AND BORINGS LOCATION MAP, UPDATED 4-94 (DWG. 0BH00A056)
2. EDISTO SURVEYER'S DETAILED BASE MAP, CREATED MARCH 2002 AND UPDATED MAY AND JUNE 2012, MARCH AND APRIL 2013, SEPTEMBER 2015, AND JULY 2016.

AREA EAST OF THE LANDFILL (AOC B)
POND NO. 3 (SWMU 26)
EASTERN DEBRIS AREA (AOC F)
FORMER BURN PIT (SWMU 130)
OLD HOLDING AREA (SWMU 22)
SOUTH STORMWATER OUTFALL DITCH (SWMU 115)
POND NO. 1 (SWMU 24)
SAND BEDS (SWMU 23)
SOUTH SWAMP (AOC E)
PRIMARY CLARIFIER (SWMU 16)
FORMER HI-TOC LAGOON (SWMU 3)
CURRENT NORTH-SOUTH DITCH (SWMU 15)
FORMER NORTH-SOUTH DITCH (SWMU 13S/13N)
FORMER GROUND BURNER UNIT (SWMU 131)
SOUTH SANDBLAST AREA (152S)
HAZARDOUS WASTE FUEL TANKS (SWMUS 108-111)
BOILER #4 (SWMU 125)
NORTH FORK EDISTO RIVER (AOC A)
NON-HAZARDOUS WASTE LANDFILL (SWMU 1)
LANDFILL STORMWATER BASIN
DRAIN B (INACTIVE) (SWMU 5)
SECONDARY CLARIFIER (SWMU 27)
STORMWATER IMPOUNDMENT BASIN
POND #2
C-D LAGOON
DRAIN A (SWMU 4)
DRAIN C (SWMU 6)
DRAIN F
DRAIN G
EAST-WEST DRAIN/ DRAIN E (SWMU7)
SOUTH SWAMP DRAIN/ DRAIN D
NORTH STORMWATER OUTFALL DITCH (SWMU 11N)
FIRE TRAINING AREA (AOC D)
POND #2 (SWMU 25)
DEEP SUMP (SWMU 18)
OLD SPOILS AREA (SWMU 2)
FORMER EAST WEST DITCH (SWMU 14)
FORMER NORTH SANDBLAST AREA (SWMU 152N)
FORMER ALUMINUM ALKYL BURN PIT (SWMU 132)
FORMER INDUSTRIAL SEWER (SWMU 12)
NORTH SPOIL
SOUTH SPOIL
E.AL. OXIDE
A-B LAGOON
NORTH ALUMINUM OXIDE
SOUTH ALUMINUM OXIDE
CONTRACTOR'S WORK AREA
OFFICES
CSX RAILROAD
CANNON BRIDGE ROAD
MW-1R, MW-2R, MW-3R, MW-4R, MW-5R, MW-6, MW-7, MW-8, MW-9 (ABANDONED), MW-10S, MW-11R, MW-12, MW-13, MW-14, MW-15, MW-16R, MW-17, MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24, MW-25, MW-27, MW-28, MW-29, MW-40 ABANDONED, MW-41, MW-42, MW-43, MW-44, MW-45, MW-48, MW-49, MW-50, MW-51, MW-52, MW-53 NOT LOCATED, MW-54, MW-58, MW-59, MW-60, MW-61, MW-62, MW-63, MW-64, MW-65, MW-66, MW-67, MW-68, MW-69, MW-70, MW-71, MW-72, MW-73, MW-74, MW-75, MW-76 A-B, MW-77
TW-1, TW-2, TW-3, TW-4, TW-5
TMW-1, TMW-2, TMW-3, TMW-4, TMW-5, TMW-6, TMW-7, TMW-8, TMW-9, TMW-10, TMW-11, TMW-12, TMW-22-1, TMW-22-2, TMW-22-3, TMW-22-4, TMW-22-5
P-1, P-2 DAMAGED, P-3 NOT LOCATED, P-4/RW-3, P-5, P-6, P-7 NOT LOCATED, P-8 NOT LOCATED, P-9 NOT LOCATED
RW-1, RW-2 ABANDONED

LEGEND

- TEMPORARY MONITORING WELL LOCATION (ACTIVE)
- TEMPORARY MONITORING WELL (ABANDONED)
- PIEZOMETER LOCATION (SHALLOW)
- SHALLOW MONITORING WELL LOCATION
- INTERMEDIATE MONITORING WELL LOCATION
- DEEP MONITORING WELL LOCATION
- RECOVERY WELL
- WOOD LINE
- LANDFILL MONITORING WELL LOCATIONS SAMPLED SEMI-ANNUALLY
- SITEWIDE MONITORING WELL LOCATIONS SAMPLED SEMI-ANNUALLY
- DRAIN — FRENCH DRAIN SAMPLED SEMI-ANNUALLY
- DRAIN
- PROCESS SEWER (SWMU 12)

NOTE:

THE LIST OF SWMU'S AND AOC'S DEPICTED ON THIS FIGURE ARE FROM APPENDIX A-2 AND A-4 THROUGH A-11 OF THE HAZARDOUS WASTE PERMIT.

APPROXIMATE
0 400 800
SCALE IN FEET

TITLE
SWMU & AOC LOCATIONS

PROJECT
SI GROUP INC.
ORANGEBURG, SOUTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
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DATE: 9-5-17 | REVISION NO.
JOB NO: SGI-001 | FIGURE: 1

S:\AAA-Master Projects\SI Group - SGI\Part B Permit App Response 2017\Figures\SWMU & AOC Locations.dwg, Fig 2 Site Map, 9/5/2017 9:55:09 AM, zbarlow

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SECTION K
CONSIDERATIONS UNDER FEDERAL LAW
[40 CFR 270.3; SC R.61-79.270.3]

This information has been provided in accordance with the requirements of 40 CFR Part 270.3. Treatment of hazardous waste by burning in boilers is a multidisciplinary issue, potentially spanning a number of federal and state regulations. In addition to the hazardous waste permitting requirements set forth under RCRA (40 CFR 270.66), other federal and state laws must be reviewed to determine if they are relevant to the permitting process including, but not limited to, the CAA, Coastal Zone Management Act, Endangered Species Act, Fish and Wildlife Coordination Act, National Historic Preservation Act, the Clean Water Act, Wetlands and Wild and Scenic Rivers Act.

K.1 Clean Air Act

SI Group is considered a major source of air pollutants subject to monitoring, recordkeeping, and reporting under Title V of the Clean Air Act Amendments of 1990. The facility operates under Title V operating permit #1860-0004, which was issued in July 2001 and expired in June 2004. A timely renewal application was submitted in November 2003. SI Group is currently waiting for a new permit to be issued. Until a new permit is issued, the facility will continue to operate under the expired permit. Section N of this application discusses the applicability of the 40 CFR 264, Subpart BB "Air Emission Standards for Equipment Leaks," and Section O discusses the applicability of 40 CFR 264, Subpart CC "Air Emission Standards for Tanks, Surface Impoundments, and Containers."

K.2 Clean Water Act

SI Group discharges storm water associated with industrial activity as defined in the U.S. EPA NPDES program established pursuant to the Federal Water Pollution Control Act, as amended by the Clean Water Act (33 United States Code [U.S.C.] 1251 et seq.), and codified in 40 CFR Part 122. South Carolina is a delegated state with NPDES permitting authority. The state's NPDES program is administered by the SCDHEC Bureau of Water.

The facility's current storm water permit No. SCR000000 was issued on September 1, 2016, and expires on September 30, 2021. The facility's current NPDES permit for wastewater discharges (SC0001180) had an effective date of March 1, 2014, and expired on May 31, 2018; however, a new NPDES Permit has not been issued as of the date of this Permit Application.

The facility also has a NPDES permit (Permit No. SCG160000) that allows for discharges from the application of pesticides to surfaces wasters of the State of South Carolina. The permit was renewed on March 22, 2016, and expires on March 31, 2021.

K.3 Resource Conservation and Recovery Act

SI Group is considered a Large Quantity Generator of hazardous waste because they generate more than 2,200 pounds of hazardous waste per month. SI Group is considered a hazardous waste treatment facility due to the burning of hazardous wastes in Boiler No. 4. The RCRA facility identification number is SCD043384072. The SIC Codes for facility operations include 2869 (Industrial Organic Chemicals, Not Elsewhere Classified) and 2834 (Pharmaceutical Preparations).

K.4 Industrial Wastes

The SI Group has one onsite landfill (Class 3 landfill) for the sludge generated at the onsite wastewater treatment plant. The current permit for the landfill (No. 383345-1601) was issued on January 12, 1981, by the South Carolina Office of Environmental Quality Control, Bureau of Land and Waste Management, and modified on March 17, 2015.

K.5 Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act (16 U.S.C. 1273, et seq.) does not apply to the SI Group facility since its hazardous waste treatment operations will not impact water bodies designated as wild and scenic rivers.

K.6 National Historic Preservation Act

The National Historic Preservation Act of 1966 (16 U.S.C 470, et seq.), includes a federal review process pertaining to activities that may affect cultural resources. The regulations ensuring compliance with the provisions of the act are described in 36 CFR 800. The National Register of Historic Places, National Register Information System identifies 41 properties and districts in Orangeburg County. A List of the National Register of Historic Places, representing a snapshot at the time of submittal of this Application, can be found in Appendix K-1. Over 20 of the properties listed on the National Register of Historic Places are within 10 miles of the SI Group facility; however, the operation of Boiler No. 4 is substantially similar to the operation of traditional industrial fuel-fired boilers, and will have no significant impact on nearby properties. The boiler produces no visible emissions.

K.7 Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS), under the Endangered Species Act (16 U.S.C. 1531, et seq.), must survey the land for "species of concern" and endangered species. Regulations governing the provisions of this act are in 50 CFR 402. According to the USFWS Threatened and Endangered Species Listing for Orangeburg County, South Carolina, the Red-Cockaded Woodpecker (*Picoides borealis*), the Shortnose Sturgeon (*Acipenser brevirostrum*), and the Canby's Dropwort (*Oxypolis canbyi*) are listed as endangered species and the Frosted Flatwoods Salamander (*Ambystoma cingulatum*) and Wood Stork (*Mycteria americana*) are listed as threatened species. Specific data from the USFWS website is in Appendix K-2. There are no potential habitats on the facility property or in the immediate vicinity of the facility. The operation of Boiler No. 4 does not impact any potential habitats associated with the listed species.

Appendix K-3 identifies species in Orangeburg County identified on the state of South Carolina Rare, Threatened & Endangered Species Inventory Web Site (i.e., state-listed species).

K.8 Coastal Zone Management Act

The Coastal Zone Management Act (16 U.S.C. 1451, et seq.) and the regulations regarding its implementation (15 CFR 930) do not apply to the SI Group facility since the facility does not lie in a coastal zone as defined in Section 304(1) of 16 U.S.C. 1453. Orangeburg County is located approximately 75 miles northwest of the nearest point on the South Carolina Coast.

K.9 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.) pertains to activities that might adversely affect fish and wildlife, such as diverting, impounding, or controlling waters. There are no operations at the facility that impound, divert, control, or modify surface water.

The SI Group has a surface water withdrawal permit which allows the facility to withdraw water from the Edisto River. The current permit (No. 38IN002), was issued in 2013, by the South Carolina Office Of Environmental Quality Control, Bureau of Land and Waste Management, and expires in 2043.

K.10 Wetlands

The federal law that governs wetland issues is the Clean Water Act 33 U.S.C. 1251. According to the USFWS National Wetlands Inventory (NWI) there are five freshwater ponds on the SI Group site, located on the northeastern portion of the property. The ponds are man-made, and are not identified as jurisdictional wetlands on the NWI map. An approximately 16-acre wetland is present on the northern portion of the property, classified as a Palustrine freshwater forested/shrub area.

Similar Palustrine freshwater forested wetland areas are present near the eastern property boundary, near the north fork of the Edisto River. The Wildlife Habitat area in the southern portion of the site also contains wetlands. A copy of the USFWS NWI map is included in Appendix K-4. Given that the RCRA facility does not operate within jurisdictional wetlands areas, the operation of Boiler No. 4 does not impact identified or jurisdictional wetlands on, or in the vicinity of, the facility property.

Appendix K-1
National Register of Historic Places — Orangeburg County, South Carolina

	Ref#	Property Name	Status	Listed Date	State	County	City	Street & Number	Other Names	Park Name
1	73001723	Southern Railway Passenger Depot	Listed	4/23/1973	SOUTH CAROLINA	Orangeburg	Branchville	110 N. Main St.	Branchville Railroad	
2	01000298	Cope Depot	Listed	3/29/2001	SOUTH CAROLINA	Orangeburg	Cope	Cope Rd.	Manchester and Augusta Railroad Station in Cope	
3	08000721	Trinity Lutheran Church	Listed	8/1/2008	SOUTH CAROLINA	Orangeburg	Elloree	390 Hampton St.		
4	70000593	Eutaw Springs Battleground Park	Listed	6/5/1970	SOUTH CAROLINA	Orangeburg	Eutawville	2 mi. E of Eutawville on SC 6 and 45		
5	82003898	Numertia Plantation	Listed	3/19/1982	SOUTH CAROLINA	Orangeburg	Eutawville	E of Eutawville		
6	80003693	St. Julien Plantation	Listed	11/28/1980	SOUTH CAROLINA	Orangeburg	Eutawville	SC 6		
7	07000098	Dantzler Plantation	Listed	3/1/2007	SOUTH CAROLINA	Orangeburg	Holly Hill	2755 Vance Rd.	Four Hole Plantation House; SunnySide House	
8	100003315	McCoy Farmstead	Listed	1/22/2019	SOUTH CAROLINA	Orangeburg	Holly Hill	307 Boyer Rd.		
9	08001395	Providence Methodist Church	Listed	9/25/2009	SOUTH CAROLINA	Orangeburg	Holly Hill	4833 Old State Rd.	Providence United Methodist Church	
10	06000581	Willow Consolidated High School	Listed	7/11/2006	SOUTH CAROLINA	Orangeburg	Norway	2750 Cope Rd.	Norway Consolidated High School;Norway Junoir High School; Norway Middle School	
11	96000837	All Star Bowling Lane	Listed	8/7/1996	SOUTH CAROLINA	Orangeburg	Orangeburg	559 E. Russell St.	All Star Triangle Bowl	
12	85002322	Amelia Street Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Amelia St. between Treadwell St. & Summers Ave.		
13	85002337	Briggman, F. H. W., House	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	156 Amelia St.		
14	78002528	Bruce, Donald, House	Listed	12/1/1978	SOUTH CAROLINA	Orangeburg	Orangeburg	SE of Orangeburg on U.S. 301	Middlepen Plantation	
15	85002324	Claflin College Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	On a portion of Claflin College campus	See Also:Tingley Memorial Hall	
16	85002336	Dixie Library Building	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Bull St.		
17	85002321	Dukes Gymnasium	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	South Carolina State College campus		
18	85002335	East Russell Street Area Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Along sections of E. Russell St. between Watson & Clarendon Sts. and along portion of Oakland Pl.		
19	85002327	Ellis Avenue Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Dickson & Whitman Sts. Along portion of Ellis Ave. between Summers Ave. & Wilson St.		
20	85002340	Enterprise Cotton Mills Building	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	U.S. 21	Zeus Industrial Products	
21	85002341	Fordham, Maj. John Hammond, House	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	415 Boulevard		
22	07001112	Great Branch Teacherage	Listed	10/24/2007	SOUTH CAROLINA	Orangeburg	Orangeburg	2890 Neeses Hwy.	Great Branch Rosenwald School Teacherage	
23	85002320	Hodge Hall	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	South Carolina State College campus		
24	85002318	Hotel Eutaw	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Russell & Centre Sts.	East Russell Street Inn	
25	85002346	Lowman Hall, South Carolina State College	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	South Carolina State College campus		
26	86000044	Mack, Alan, Site (38OR67)	Listed	1/6/1986	SOUTH CAROLINA	Orangeburg	Orangeburg	Address Restricted	38 OR 67	
27	85002342	Mt. Pisgah Baptist Church	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	310 Green		
28	96001025	Orangeburg City Cemetery	Listed	9/27/1996	SOUTH CAROLINA	Orangeburg	Orangeburg	Jct. of Bull and Windsor Sts.		
29	85002344	Orangeburg County Fair Main Exhibit Building	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	U.S. 21		
30	73001724	Orangeburg County Jail	Listed	10/2/1973	SOUTH CAROLINA	Orangeburg	Orangeburg	44 Saint John St.	Pink Palace	
31	85002317	Orangeburg Downtown Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Along sections of Russell, Broughton, Middleton, Church, Meeting, St. John, Hampton & Amelia Sts. around the public square		
32	96001024	South Carolina State College Historic District	Listed	6/19/1997	SOUTH CAROLINA	Orangeburg	Orangeburg	300 College St.	See Also:Lowman Hall;Hodge Hall	
33	96000836	Stroman, William P., House	Listed	8/1/1996	SOUTH CAROLINA	Orangeburg	Orangeburg	1017 N. Boulevard		
34	83002205	Tingley Memorial Hall, Claflin College	Listed	8/4/1983	SOUTH CAROLINA	Orangeburg	Orangeburg	College Ave.	See Also:Claflin College Historic District (Orangeburg MRA)	
35	85002315	Treadwell Street Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Along portions of Treadwell & Amelia Sts.		
36	94001053	Trinity Methodist Episcopal Church	Listed	8/26/1994	SOUTH CAROLINA	Orangeburg	Orangeburg	185 Boulevard NE.	Trinity United Methodist Church	
37	74001872	White House United Methodist Church	Listed	5/13/1974	SOUTH CAROLINA	Orangeburg	Orangeburg	N of Orangeburg on U.S. 301	White Meeting House; White Church	
38	85002326	Whitman Street Area Historic District	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	Along sections of Whitman, Elliot, and E. Russell Sts.		
39	85002345	Williams Chapel A.M.E. Church	Listed	9/20/1985	SOUTH CAROLINA	Orangeburg	Orangeburg	1908 Glover St.		
40	83002204	Cattle Creek Campground	Listed	5/19/1983	SOUTH CAROLINA	Orangeburg	Rowesville	Off SC 210	Cattle Creek United Methodist Church and Camp Ground	
41	01000313	Springfield High School	Listed	3/29/2001	SOUTH CAROLINA	Orangeburg	Springfield	Brodie St., bet. SC 4 and Georgia St.		

Appendix K-2
Endangered Species —
Orangeburg County, South Carolina

Species By County Report

The following report contains Species that are known to or are believed to occur in this county. Species with range unrefined past the state level are now excluded from this report. If you are looking for the Section 7 range (for Section 7 Consultations), please visit the IPaC application.

County: Orangeburg, South Carolina

CSV

Need to contact a FWS field office about a species? Follow this link to find your local FWS Office.

Group	Name	Population	Status	Lead Office	Recovery Plan	Recovery Plan Action Status	Recovery Plan Stage
Amphibians	Frosted Flatwoods salamander (*Ambystoma cingulatum*)	Wherever found	Threatened	Panama City Ecological Services Field Office			
Birds	Bald eagle (*Haliaeetus leucocephalus*)	lower 48 States	Recovery	Illinois-Iowa Ecological Services Field Office	Recovery Plan for the Pacific Bald Eagle	Implementation Progress	Final
Birds	Bald eagle (*Haliaeetus leucocephalus*)	lower 48 States	Recovery	Illinois-Iowa Ecological Services Field Office	Northern States Bald Eagle Recovery Plan	Implementation Progress	Final
Birds	Bald eagle (*Haliaeetus leucocephalus*)	lower 48 States	Recovery	Illinois-Iowa Ecological Services Field Office	Southeastern States Bald Eagle Recovery Plan	Implementation Progress	Final Revision 1
Birds	Bald eagle (*Haliaeetus leucocephalus*)	lower 48 States	Recovery	Illinois-Iowa Ecological Services Field Office	Southwestern Bald Eagle Recovery Plan	Implementation Progress	Final

Group	Name	Population	Status	Lead Office	Recovery Plan	Recovery Plan Action Status	Recovery Plan Stage
Birds	Bald eagle (*Haliaeetus leucocephalus*)	lower 48 States	Recovery	Illinois-Iowa Ecological Services Field Office	Chesapeake Bay Bald Eagle Recovery Plan	Implementation Progress	Final Revision 1
Birds	Red-cockaded woodpecker (*Picoides borealis*)	Wherever found	Endangered	Mississippi Ecological Services Field Office	Red-cockaded Woodpecker Recovery Plan, Second Revision	Implementation Progress	Final Revision 2
Flowering Plants	Canby's dropwort (*Oxypolis canbyi*)	Wherever found	Endangered	South Carolina Ecological Services	Canby's Dropwort	Implementation Progress	Final

Appendix K-3
Rare Species —
Orangeburg County, South Carolina

Rare, Threatened, and Endangered Species and Communities Known to Occur in Orangeburg County
June 11, 2014

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Vertebrate Animals					
Acipenser brevirostrum	Shortnose Sturgeon	LE: Endangered	SE: Endangered	G3	S3
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat		SE: Endangered	G3G4	S2?
Haliaeetus leucocephalus	Bald Eagle		ST: Threatened	G5	S2
Myotis austroriparius	Southeastern Bat			G3G4	S1
Picoides borealis	Red-cockaded Woodpecker	LE: Endangered	SE: Endangered	G3	S2
Pituophis melanoleucus	Pine or Gopher Snake			G4	S3S4
Pseudobranchus striatus	Dwarf Siren		ST: Threatened	G5	S2
Rana capito	Gopher Frog		SE: Endangered	G3	S1
Sciurus niger	Eastern Fox Squirrel			G5	S4
Invertebrate Animals					
Elliptio congaraea	Carolina Slabshell			G3	S3
Pyganodon cataracta	Eastern Floater			G5	SNR
Toxolasma pullus	Savannah Lilliput			G2	S1
Utterbackia imbecillis	Paper Pondshell			G5	SNR
Villosa delumbis	Eastern Creekshell			G4	S4
Animal Assemblage					
Waterbird Colony				GNR	SNR
Vascular Plants					
Agrimonia incisa	Incised Groovebur			G3	S2
Amphicarpum muehlenbergianum	Blue Maiden-cane			G4	S2S3
Aristida condensata	Piedmont Three-awned Grass			G4?	S2
Asplenium heteroresiliens	Wagner's Spleenwort			G2	S1
Asplenium resiliens	Black-stem Spleenwort			G5	S1
Bacopa cyclophylla	Coastal-plain Water-hyssop			G3G5	S1
Carex amphibola	Narrowleaf Sedge			G5	SNR
Carex basiantha	Widow Sedge			G5	S2
Carex decomposita	Cypress-knee Sedge			G3G4	S2
Carex granularis	Meadow Sedge			G5	S2
Helenium pinnatifidum	Southeastern Sneezeweed			G4	S2
Ilex amelanchier	Sarvis Holly			G4	S3
Isoetes riparia	River Bank Quillwort			G5	S2
Litsea aestivalis	Pondspice			G3?	S3

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Lobelia boykinii	Boykin's Lobelia			G2G3	S3
Myriophyllum laxum	Piedmont Water-milfoil			G3	S2
Nolina georgiana	Georgia Beargrass			G3G5	S3
Oxypolis canbyi	Canby's Dropwort	LE: Endangered		G2	S2
Plantago sparsiflora	Pineland Plantain			G3	S2
Potamogeton foliosus	Leafy Pondweed			G5	SNR
Quercus similis	Bottom-land Post Oak			G4	S1
Rhexia aristosa	Awned Meadowbeauty			G3G4	S3
Rhododendron flammeum	Piedmont Azalea			G3	S3
Rhynchospora harperi	Harper Beakrush			G4?	S1
Rhynchospora tracyi	Tracy Beakrush			G4	S3
Schoenoplectus erectus ssp. *raynalii*	Sharp-scale Bulrush			G4G5T4T5	SNR
Scleria baldwinii	Baldwin Nutrush			G4	S2
Tradescantia virginiana	Virginia Spiderwort			G5	S1
Tridens carolinianus	Carolina Fluff Grass			G3G4	S1
Utricularia olivacea	Piedmont Bladderwort			G4	S2
Communities					
Fagus grandifolia - *quercus alba* - (*acer barbatum*) / mixed herbs forest	Atlantic Coastal Plain Mesic Mixed Hardwood Forest			G4	SNR
Fagus grandifolia - *quercus nigra* forest	Coastal Plain Mesic Beech - Water Oak Forest			G3	SNR
Limestone sink				G3	S1S2
Limestone sinkhole				GNR	SNR
Pond cypress pond				G4	S4
Pond cypress savanna				G3	S2
Pond pine woodland				G4G5	S3
Quercus hemisphaerica - *carya glabra* - (*fagus grandifolia*) forest				G4?	SNR
Small stream forest				G5	S5
Swamp tupelo pond				G3	S3
Xeric sandhill scrub				G5	S3
Geological					
Carolina bay				GNR	SNR

Global Conservation Status Definitions

Listed below are definitions for interpreting NatureServe global conservation status ranks (G-ranks). These ranks reflect an assessment of the condition of the species or ecological community across its entire range. Where indicated, definitions differ for species and ecological communities.

NatureServe Global Conservation Status Ranks

Basic Ranks

Rank	Definition
GX	**Presumed Extinct** (species)— Not located despite intensive searches and virtually no likelihood of rediscovery. **Eliminated** (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	**Possibly Extinct** (species)— Missing; known from only historical occurrences but still some hope of rediscovery. **Presumed Eliminated**— (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut (Forest).
G1	**Critically Imperiled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperiled**—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.

Variant Ranks

Rank	Definition
G#G#	**Range Rank**—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	**Unrankable**—-Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the limits (range) of uncertainty.
GNR	**Unranked**—Global rank not yet assessed.
GNA	**Not Applicable**—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Rank Qualifiers

Rank	Definition
?	**Inexact Numeric Rank**—Denotes inexact numeric rank (e.g., G2?)
Q	**Questionable taxonomy**—Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
C	**Captive or Cultivated Only**—At present extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific Taxon Conservation Status Ranks

Infraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Infraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.

Rank	Definition
T#	**Infraspecific Taxon** (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole-for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under under the U.S. Endangered Species Act, may be considered an infraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

SC Rare, Threatened & Endangered Species Inventory

State Rank - NatureServe National (N) and Subnational (S) Conservation Status Rank Definitions

Listed below are definitions for interpreting NatureServe national and sub-national conservation status ranks. These ranks reflect an assessment of the condition of the species or ecological community across a national or sub-national geo-political boundary. Where indicated, definitions differ for species and ecological communities.

Basic Ranks

Status	Definition
NX SX	**Presumed Extirpated**—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
NH SH	**Possibly Extirpated** (Historical)—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
N1 S1	**Critically Imperiled**—Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
N2 S2	**Imperiled**—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
N3 S3	**Vulnerable**—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
N4 S4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
N5 S5	**Secure**—Common, widespread, and abundant in the nation or state/province.
NNR SNR	**Unranked**—Nation or state/province conservation status not yet assessed.
NU SU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNA SNA	**Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
N#N# S#S#	**Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
Not Provided	Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.

Breeding Status Qualifiers

Qualifier	Definition
B	**Breeding**—Conservation status refers to the breeding population of the species in the nation or state/province.

Qualifier	Definition
N	**Nonbreeding**—Conservation status refers to the non-breeding population of the species in the nation or state/province.
M	**Migrant**—Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.

Note: A breeding status is only used for species that have distinct breeding and/or non-breeding populations in the nation or state/province. A breeding-status S-rank can be coupled with its complementary non-breeding-status S-rank if the species also winters in the nation or state/province, and/or a migrant-status S-rank if the species occurs regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. The two (or rarely, three) status ranks are separated by a comma (e.g., "S2B,S3N" or "SHN,S4B,S1M").

Other Qualifiers

Rank	Definition
?	**Inexact or Uncertain**—Denotes inexact or uncertain numeric rank. (The ? qualifies the character immediately preceding it in the S-rank.)

For additional information about rare and endangered species or questions about these lists, please contact Julie Holling.

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Information

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State Rank Definitions
Legal Status
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SC Rare, Threatened & Endangered Species Inventory

US Endangered Species Act (USESA) Designation

Rank	Meaning
LE: Endangered	A species "in danger of extinction throughout all or a significant portion of its range."
LT: Threatened	A species "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."
C: Candidate	A species under consideration for official listing for which there is sufficient information to support listing.
SC: Species of Concern	Species that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

State Protection Definitions

Rank	Meaning
SE: Endangered	Any species or subspecies of wildlife whose prospects of survival or recruitment within the State are in jeopardy or are likely within the foreseeable future to become so.
ST: Threatened	A species that is likely to become endangered and in need of management.

All species and communities that have no information in the USESA Designation and State Protection columns are considered rare or in need of additional study, but have no legal protection under the federal or state endangered species laws. They are being tracked by our program at the request of our biologists.

For additional information about rare and endangered species or questions about these lists, please contact Julie Holling.

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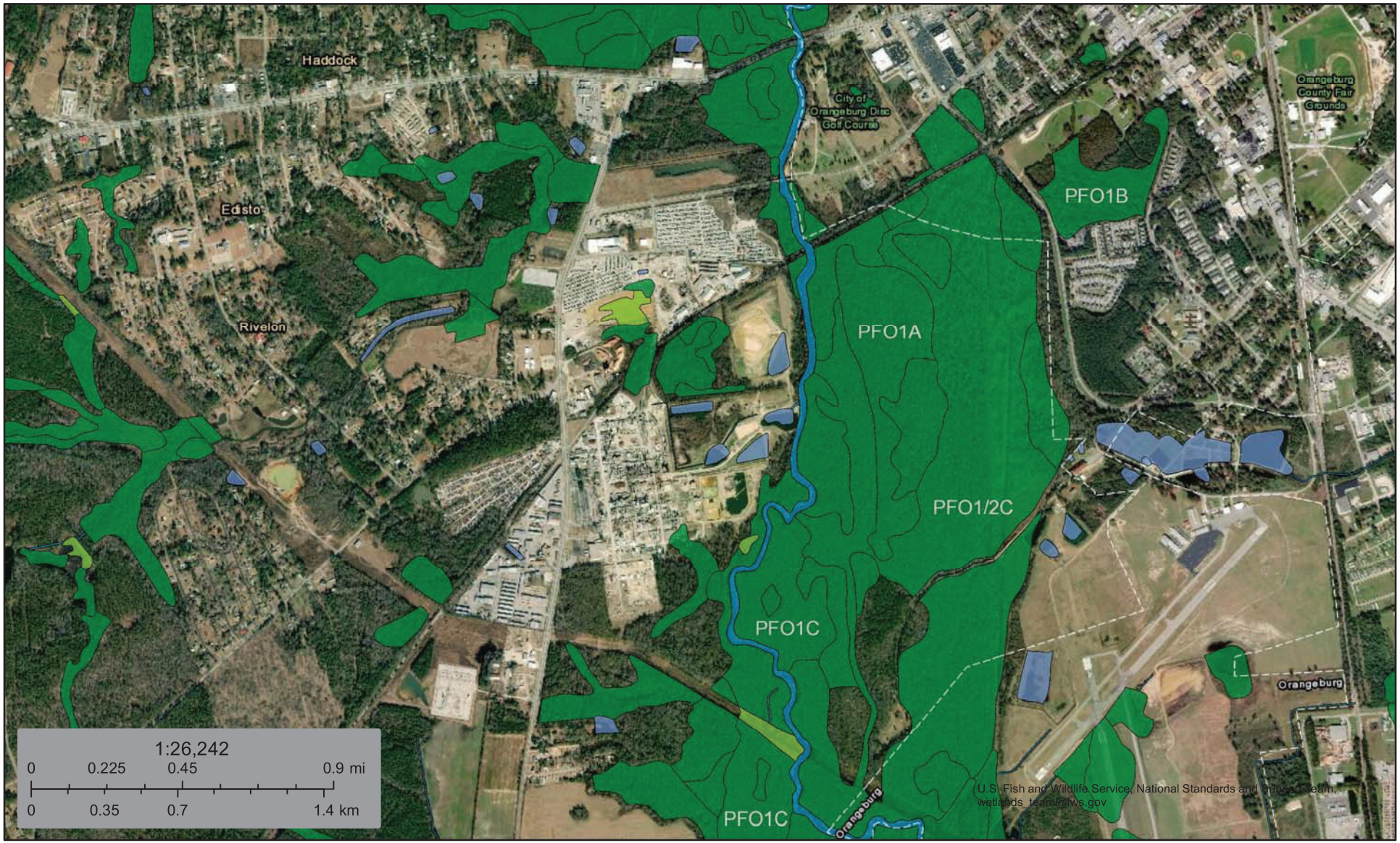
Appendix K-4
USFWS Wetlands Map

U.S. Fish and Wildlife Service

National Wetlands Inventory

Si Group Facility - Orangeburg, SC



July 26, 2018

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

SECTION L
PART B PERMIT APPLICATION CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Mr. Jon Kimmel
Vice President Manufacturing – Americas

10/1/2020
Date

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SECTION M
AIR EMISSION STANDARDS FOR PROCESS VENTS
[40 CFR 264 Subpart AA, §264.1030-§264.1036]

M.1 Applicability (40 CFR 264.1030)

The regulations in Subpart AA of 40 CFR 264 apply to process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations that manage hazardous wastes with organic concentrations of at least 10 parts per million by weight, if these operations are conducted in one of the following: a unit that is subject to permitting requirements of 40 CFR 270; a unit (including a hazardous waste recycling unit) that is not exempt from permitting under the provisions of 40 CFR 262.17 and that is located at a hazardous waste management unit subject to permitting; or a unit that is exempt from permitting under the provisions of 40 CFR 262.34(a) (i.e., a "90-day" tank or container) and is not a recycling unit under the provisions of 40 CFR 261.6.

The SI Group facility does not have process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations that manage hazardous waste. Documentation to determine applicability is maintained in a log that is kept in the facility's operating record [§264.1035(f)]. Details regarding monitoring and record keeping requirements for Flare E-8332 pursuant to §264.1087(b)(4) and §264.1033(l) are presented in the plantwide procedures in Appendix N-1.

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Appendix N-3 Pressure Safety Valve Operational Set Points
Appendix N-4 Historical Sampling Results

SECTION N
AIR EMISSION STANDARDS FOR EQUIPMENT LEAKS
[40 CFR 264 Subpart BB, §264.1050-§264.1065]

N.1 Applicability (40 CFR 264.1050)

SI Group has implemented an equipment leak detection and repair (LDAR) program for the hazardous waste system supplying waste fuel to Boiler No. 4 in compliance with U.S. EPA regulation 40 CFR 264 Subpart BB, "Air Emission Standards for Equipment Leaks." SI Group takes a conservative approach that all equipment in hazardous waste service has an organic concentration of more than 10 percent by weight VOCs and are therefore included in the program. This includes all equipment items associated with the less than 90-day tanks and the piping that transmits the hazardous waste to the waste tanks supplying Boiler No. 4. Process and Instrumentation Drawings (P&IDs), are located in Appendix D-2 of this application and have not changed since the previous application. The drawings show those equipment items that are in the Boiler No. 4 waste tank area. Copies of the Plantwide Procedures for SI Group's LDAR program are in Appendix N-1.

Because the vapor pressure of the majority of the constituents is greater than 0.3 kilopascals (0.044 pounds per square inch) and the concentration of the constituents can vary, SI takes a conservative approach that all components are in light liquid service.

Tanks and lines are marked with words "Hazardous Waste". A site map is maintained that identifies the hazardous waste tanks — which are highlighted in color. Plantwide Procedure OB63720 discusses how the P&IDs are designated.

The only equipment at the facility that is in contact with hazardous waste with organic concentration of at least 10 percent for less than 300 hours is the transfer lines for tank trucks. In LeakDAS, the equipment is identified as < 300 hours on contact. Additional information regarding the equipment at the facility with < 300 contact hours/year is maintained within LeakDAS.

N.2 Overview of Equipment and Periodic Monitoring

A list of the components monitored presented in Appendix N-2. Operational set point information for the Pressure Safety Valves associated with the Tank Farm System is presented in Appendix N-3. Components included in the SI Group fugitive program include valves, pumps, pressure relief valves, and sample ports. No compressors, open-ended valves, or open-ended lines subject to these regulations are currently in use at the facility.

Any leaking component that is detected by sight, sound, smell, or other detection method has a first attempt at repair within 5 days of detection. Repairs are completed within 15 days after detection. If the final repair cannot be completed within 15 days of first being detected, an incident report is entered into the sites RIVO incident reporting system for tracking and reporting. Repairs not made within 15 days are reported semi-annually to the EPA and SCHDEC per the requirements of 264.1064.

The leak definitions under 40 CFR Part 264, Subpart BB/CC are as follows

Equipment Type	Leak Definition
Pump	**10,000 ppm**
Valve	**10,000 ppm**
Pressure Safety Valve	**500 ppm**

SI Group utilizes a third-party contractor to manage the LDAR program. Plantwide Procedure OB63715 provides details on the requirements that the contractors must meet in order to manage the LDAR program.

N.3 Standards

N.3.a Pumps In Light Liquid Service (40 CFR 264.1052)

As stated above, the facility takes a conservative approach and assumes that all hazardous waste lines and equipment are in light liquid service. Per Plantwide Procedure OB63720 in Appendix N-1, equipment in light liquid service is highlighted in yellow on the P&IDs.

Per Plantwide Procedure OB63720, the Lube Crew (also known as the Rotator Crew) visually inspects all Subpart BB pumps for any visible signs of leakage that would indicate a leak on a weekly basis. If a pump appears to be leaking, the inspector contacts the crew to conduct a Method 21 verification test and also submits an email to the LDAR Technician for documentation.

The Leak Crew or contractor documents leaks/no leaks within the LubeIt software. Hard copies of the reports are filed in the South Maintenance complex, second floor, West wing.

If a leak is found via confirmation with Method 21 (i.e., reading at or above 10,000 parts per million [ppm]), a work order is created by the LDAR Technician within Maintenance Connect. The results of the Method 21 monitoring and the work order are documented within LeakDAS.

A first attempt to repair the leak must be made within 5 days of initial discovery. The final repair must be made within 15 days of initial discovery. If the final repair cannot be completed within 15 days of first being detected, an incident report is entered into the incident reporting software. The incident is then reported to South Carolina Department of Health and Environmental Control in the semi-annual report. The repair timeline is tracked by the LDAR Technician.

The majority of the Subpart BB pumps are dual mechanical seals system; however, the pumps do not meet all the exemption criteria, therefore they are monitored monthly with all other pumps.

N.3.b Compressors (40 CFR 264.1053)

There are no compressors in Subpart BB service at the facility.

N.3.c Pressure Relief Devices in Gas/Vapor Service (40 CFR 264.1054)

Except when a pressure release occurs, the pressure relief valves are not opened. All Subpart BB pressure relief valves (PRVs) release back to the process and are therefore not monitored unless the PRV is opened for repair. If there are any visual indications of dripping liquid around seals, repairs will be made to the defective unit within 15 calendar days, with the first attempt at repair occurring no later than 5 calendar days after the leak is detected.

N.3.d Sampling Connection Systems (40 CFR 264.1055)

Each sampling connection is designed to collect and recycle purged process liquid. Tanks T-30M-61, T-100M-5, T-30M-66, and T-10-32 have Strahman sample valves. These valves allow a representative sample to be collected without purging through the valve. These valves have plugs that extend into the flowing stream, therefore, there is no hold up in the valve and no requirement to flush through the valve to obtain a representative sample.

There are no Subpart BB -situ sampling systems at the site.

SI Group monitors all sample ports in the hazardous waste storage tanks area daily as part of the routine monitoring of this area. If there are any visual indications of dripping liquid around seals, repairs will be carried out within 15 calendar days, with the first attempt at repair occurring no later than 5 calendar days after the leak is detected.

N.3.e Open-Ended Valves or Lines (40 CFR 264.1056)

There are no open ended valves or lines in Subpart BB service at the site. All open-ended valves and lines terminate with either a blind flange or plug.

Tank T-100M-5 has a sample pot with two valves off the discharge side of the pump (before the pot) to meet the requirements of open ended lines.

N.3.f Valves in Gas/Vapor Service or in Light Liquid Service (40 CFR 264.1057)

Initially, SI Group monitored all valves monthly via Method 21. For valves where leaks were not detected for two consecutive months, the monitoring frequency changed to quarterly as allowed by 40 CFR 264.1057(c)(1), which states, "any valve for which a leak is not detected for two successive months may be monitored the first month of every succeeding quarter, beginning with the next quarter, until a leak is detected."

SI Group currently monitors all valves on an annual basis (in April), skipping three quarterly periods in accordance with 40 CFR 264.1062(b)(3), which states "After five consecutive quarterly leak detection periods with the percentage of valves leaking equal to or less than 2 percent, the owner or operator may begin to skip three of the quarterly leak detection periods (i.e., monitor for leaks once every year) for the valves subject to the requirements in 40 CFR 264.1057." Appendix N-4 provides a summary of the valves that have not had any readings greater than 10,000 ppm for the last two years.

Although there have been no leaks recorded for any valves, if a leak were to be found on a valve during the monitoring (by audio, visual, or olfactory means), then that valve would be monitored monthly until the leak is no longer detected. The site does not currently utilize the alternative standard for leaking valves per 40 CFR 264.1061.

If a leak is found via confirmation with Method 21 (reading exceeds 10,000 ppm), a work order is created by the LDAR Technician within Maintenance Connect. The results of the Method 21 monitoring and the work order are documented within LeakDAS. If a leak is found or there are any indications of dripping liquid around seals, repairs will be carried out within 15 calendar days, with the first attempt at repair occurring no later than 5 calendar days after the leak is detected.

Refer to the Plantwide LDAR Procedures in Appendix N-1 for additional information.

There are no valves currently designated as unsafe or difficult to monitor under Subpart BB requirements.

N.3.g Pumps and Valves in Heavy Liquid Service, Pressure Relief Devices in Light Liquid or Heavy Liquid Service, and Flanges and Other Connectors (40 CFR 264.1058)

The site does not have any Subpart BB components in Heavy Liquid Service. PRVs in light liquid service are not monitored as the emissions from the PRV are vented back into the process.

Flanges and connectors in light liquid service are monitored via EPA Method 21, if a leak is found by a visual, audible, olfactory, or other detection method. If a leak is found via confirmation with Method 21 (i.e., reading above 10,000 ppm), a work order is created by the LDAR technical within Maintenance Connect software. The results of the Method 21 monitoring and the work order are documented within Leak DAS (field sheets). The first attempt at repairs is made within 5 calendar days after a leak detected.

The site does have several connectors that are exempt from the requirements of 40 CFR 264.1058 as they are covered with insulation.

N.3.h Delay of Repair (40 CFR 264.1059)

There are no delay of repair Subpart BB components identified at the facility.

N.3.i Closed-Vent Systems and Control Devices (40 CFR 264.1060)

Boiler No. 4 waste storage tanks are equipped with a closed vent system which routes vapors to a flare for emission control. This system was installed in 1997.

Refer to Appendix N-1, Plantwide Procedure 0B62333 for information on the closed vent system and the associated flare.

N.4 Alternative Standards for Valves in Gas/Vapor Service or in Light Liquid Service: Percentage of Valves Allowed to Leak (40 CFR 264.1061)

The site has not had a leaking Subpart BB valve to date, therefore calculations are not performed on the percent of leaking valves per 264.1061.

N.5 Alternative Standards for Valves in Gas/Vapor Service or in Light Liquid Service: Skip Period Leak Detection and Repair (40 CFR 264.1062)

SI Group follows this standard since there are no leaking valves. Refer to Section N.3.f regarding the procedures followed to comply with this standard.

N.6 Test Methods and Procedures (40 CFR 264.1063)

Monitoring is done using a desktop computer, hand held computer (data logger), computer software which allows bidirectional communication between the two, and a portable gas chromatograph (TVA 1000B). Plantwide Procedure OB62730 provides the information regarding the TVA calibration and quarterly certification.

The LDAR technician traverses the entire possible leak interface of component with probe and holds the probe at the highest reading for twice the time of equipment response. The TVA-1000B connects to a data logger via a WDA-1000 or WDA-2000 Blue Tooth adapter. After performing a daily calibration and assuring that the TVA has been certified for the quarter, the TVA is then connected to the data logger via a WDA-1000 Blue Tooth adapter. The LeakDAS Mobile software is launched and monitoring of the downloaded route can begin.

N.7 Recordkeeping Requirements (40 CFR 264.1064)

LeakDAS software is used to maintain the equipment, monitoring, leak, and repair data. A schedule for monitoring is also maintained within LeakDAS. The records maintained include equipment identification number, the hazardous waste management unit, approximate location, type of equipment, and method of compliance. In addition to this screening log, records are maintained on leaking components, repair attempts, repairs made, and components assigned to a shutdown log.

Per 40 CFR 264.1064(e), design documentation on the Boiler No. 4 closed vent system and control device is maintained in the EHS File room.

There are no unsafe to monitor Subpart BB components at the site, hence recordkeeping under 40 CFR 264.1064(i) is not required (refer to Appendix N-1 — Procedure OB62780). Additionally, there are no dual mechanical seals system pumps on the site; therefore, recordkeeping requirements under 40 CFR 264.1064(j) are not applicable.

Per 40 CFR 264.1064(k) (1), the design capacities of Boiler No. 4 and associated four storage tanks are maintained in the EHS file room. However since SI Group assumes all Subpart BB components are in light liquid service, the recordkeeping requirements per 40 CFR 264.1064(k)(2) are not maintained. Per 40 CFR 264.1064(k)(3), the site will continue to assume that all Subpart BB components are in service at > 10% organics (by weight) and are in light liquid service; therefore, recordkeeping is not maintained for this requirement.

Per Plantwide Procedure OB62720, equipment that is found to have leaks above the leak definition rate must have a Fugitive Emissions Leaker Tag applied. The tag will be maintained until the necessary repairs have been made and it has been monitored for two consecutive months without a leak detected.

N.8 Reporting Requirements (40 CFR 264.1065)

Semiannual reports will be submitted to the EPA/SC DHEC as appropriate for the following:

1. Any leaks that are not repaired within 15 days

2. Date(s) of Hazardous Waste Management (i.e., Boiler No. 4 and associated storage tanks) shutdowns which occurred within the semiannual reporting period, and

3. Dates when Boiler No. 4 flare was outside the design specifications

Appendix N-1
Plant Wide Procedures

SCOPE:

This document outlines how the Orangeburg facility will manage the LDAR program using a contract organization.

RESPONSIBILITY:

The Manager-Environmental Compliance is responsible for the administration of this procedure. The Environmental Department is responsible for its implementation.

DOCUMENT CONTROL:

This procedure must be reviewed and approved by the Manager-Environmental Compliance, who is the Master Copy Holder and is responsible for all revisions.

REQUIRED TRAINING:

At a minimum, all contractors who do any monitoring, tagging or database management will be required to have training on Method 21, based on the EPA's published guidance "Leak Detection and Repair: A Best Practices Guide." They should also be have a working knowledge of Inspection Logic's LeakDAS Mobile software.

In addition, any contractor who does any work in the processing areas of the facility will be required to successfully complete the Safety Department's training program.

The Senior Environmental Technician will be responsible for training contractor site managers on physical locations of LDAR equipment. The site managers will be responsible for training the monitoring technicians on physical locations of LDAR equipment.

EQUIPMENT:

Contract monitoring will be done using facility owned and supplied equipment (e.g. TVA-1000B, WDA-2000 Bluetooth adaptor and MC9090 data-logger). In the event that the facilities equipment in not functioning or additional equipment is necessary, contractors can use their own equipment as long as it is of the same model currently owned by the facility.

Daily calibration and quarterly certification will be performed according to OB62730.

MONITORING SCHEDULE:

Monitoring schedule for contract technicians will be based primarily on schedules suggested within the LeakDAS software and verified by the Senior Environmental Technician. OB62740 gives guidance to the monitoring schedule.

For example, Method 21 monitoring of pumps and agitators under PHARMA is only required once a quarter. However, the facility chooses to have all pumps and agitators that fall within the LDAR program monitored every month (including PHARMA pumps and agitators).

LEAKS:

When a leak is discovered during monitoring, a leak tag will be applied offending equipment according to OB62720. Once the run for that day is complete and data has been downloaded from the mobile unit to LeakDAS, LeakDAS software will notify of a leak. A work order will be

then be created for the leaking component by the Senior Environmental Technician using LeakDAS data. The Senior Environmental Technician will then monitor progress of repairs and schedule equipment retest.

QA OF TECHNICIAN MONITORING:

LeakDAS has a QA function built into the software that will be run by the Senior Environmental Technician on the completion of contractor daily monitoring. Any discrepancies will be communicated to the site manager for resolution.

Contractor site manager will do a quarterly review and QA of monitoring technician performance and inform the Senior Environmental Technician.

Finally, the Senior Environmental Technician will do verification monitoring once a quarter of 10% of the components with a result of 100ppm to 499ppm.

REVISION DOCUMENT

Date:	Description of Change
8/17/17	Initial entry into SharePoint

Reference EN-PP-303

T-15M-42 15,000 gallon tank

Limit is < 76.6 kPA to be Level 1

Vapor pressure at 40 Degrees Celsius

Component	Weight Percent	Molecular Weight	Weight Percent x Molecular Weight	Mole Fraction in Organic Phase	Component Vapor Pressure psia	VOL Vapor Pressure psia	VOL Vapor pressure kPa
4-methyl-1-pentene	56.1	84.16	47.21	0.38	8.51	3.23	22.28
4-methyl-2-pentene, trans	24.1	84.16	60.10	0.48	4.16	2.01	13.86
4-methyl-2-pentene, cis	8.5	84.16	7.15	0.06	4.16	0.24	1.65
toluene	3.7	92.14	3.41	0.03	1.13	0.03	0.21
hexene (other)	7.6	84.16	6.40	0.05	2.99	0.15	1.06
						0.00	0.00
						0.00	0.00
						0.00	0.00
						0.00	0.00
total	100		124.27			**5.67**	**39.07**

Data Source:

Based on analytical data from Howie Phan 1/12/16.

Unit 6 Code 91 in LIMS

Used hexene for the other hexene components noted in Howie's report.

Although analysis showed 51 % 4 methyl 1 pentene, increased it to 56.1% since component with highest vapor pressure and total constituents did not add up to 100%.

12/7/16

T-1034

10,000 gallon tank

Vapor pressure at 100 Degrees Celsius

Note: Component listing, MW, and component percent from Todd Brandes (used same composition for theoretical flash point calculations)

Component	Weight Percent	Molecular Weight	Weight Percent x Molecular Weight	Mole Fraction in Organic Phase	Component Vapor Pressure psia	VOL Vapor Pressure psia	VOL Vapor pressure kPa
no 2 fuel oil	60	200	120.00	0.29	0.04	0.010581036	0.07
heptane	1.896	100	60.10	0.15	58.00	8.537250145	58.86
AN-92	0.28	234	0.66	0.00	0.00	0	0.00
AN-62	0.44	250	1.10	0.00	0.00	0	0.00
M-2	0.52	338	1.76	0.00	0.00	0	0.00
AN-712	0.76	410	3.12	0.01	0.00	0	0.00
AN-702	9.84	424	41.72	0.10	0.00	0	0.00
AN-167	2	438	8.76	0.02	0.00	0	0.00
M-1	5.24	556	29.13	0.07	0.00	0	0.00
E-330	9.2	775	71.30	0.17	0.00	0	0.00
heavy end 1	0.92	994	9.14	0.02	0.00	0	0.00
heavy end 2	5.32	994	52.88	0.13	0.00	0	0.00
M-1A	0.52	556	2.89	0.01	0.00	0	0.00
M-1B	1	572	5.72	0.01	0.00	0	0.00
total	97.936		408.28			**8.55**	**58.94**

Data Source:

Tank Controls – Subpart CC

Tank Design Capacity	Maximum Organic Vapor Pressure of Hazardous Waste in Tank	Stabilization Occuring in Tank	Subpart CC level of control
< 20,000 gallons (75m3)	≤ 11.1 psi (76.6 kpA)	yes	Level 2
		no	Level 1
	> 11.1 psi (76.6 kPa)	yes	Level 2
		no	Level 2
≥ 20,000 gallons (75 m3) and < 40,000 gallons (151m3)	≤ 4.00 psi (27.6 kPa)	yes	Level 2
		no	Level 1
	> 4.00 psi (27.6 kPa)	yes	Level 2
		no	Level 2
≥ 40,000 gallons (151 m3)	≤0.75 psi (5.2 kPa)	yes	Level 2
		no	Level 1
	> 0.75 psi (5.2 kPa)	yes	Level 2
		no	Level 2

Level 1 - used to manage hazardous waste with low vapor pressures
Fixed roof.
Annual inspections
Records: Max. VO and annual inspections

Level 2 - 5 options
1. Fixed roof with internal floating roof
2. External floating roof
3. Fixed roof vented to a control device
4. Pressure Tank
5. Enclosure vented to an enclosed combustion device

RCRA SUBPART CC PROCEDURES – AIR EMISSION REQUIREMENTS FOR HAZARDOUS WASTE STORAGE TANKS
CONTROL NUMBER: OB62303
REVISION: 3

SCOPE: This procedure outlines how the site complies with 40 CFR 265 Subpart CC - Air Emission Standards for Tanks.

RESPONSIBILITY:
The administration of this procedure is the responsibility of the Manager, Environmental Compliance. Individual Department managers are responsible for ensuring that this procedure is effectively implemented in their areas of control.

BACKGROUND:

EPA regulation 40 CFR 265 Subpart CC was also promulgated as part of the December 6, 1996 organic air emission standards to control and reduce emissions of volatile organic compounds (VOC's) from hazardous waste storage tanks, accumulation tanks, containers and surface impoundment. The Subpart CC regulation required that VOC emissions from hazardous waste tanks that exceed specified volume/VOC vapor pressure limits be reduced by 95% - This applied to boiler waste fuel tank T-100M-5. To provide compliance with the 95% VOC emissions reduction requirement, T-100M-5's vent was routed to a flare. Waste fuel tanks T-10M-32, T-30M-61 and T-30M-66 which are located near T-100M-5 also had their vents routed to the flare.

Project No. 0-2715 was implemented to install Flare E-8332 at the No. 4 Boiler to control the VOC emissions from the waste fuel tanks, and DHEC Construction Permit No. 1860-0004-CY (reference Appendix B) was obtained for the flare installation. EPA regulation 40 CFR 265 Subpart CC required that the flare be operational by December 8, 1997. Flare E-8332 started up December 5, 1997.

DHEC Construction Permit No. 1860-0004-CY required this Operation and Maintenance (O&M) plan to be prepared for Flare E-8332. Flare E-8332 must be operated and maintained in accordance with the O&M Plan, and the plan must be available for DHEC's review. The plan must also be updated when changes occur in the flare's design, operation or maintenance.

DOCUMENT CONTROL:
This procedure must be reviewed by:
1) Environmental Compliance Department
2) Sr. Production Manager - South Plant
3) Sr. Production Manager – North Plant
4) LDAR Technician

It must be approved by the Manager, Environmental Compliance who is the Master Copy Holder and is responsible for all revisions.

DEFINITIONS:

1. **CFR:** Code of Federal Regulations

2. **Container:** Any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled (40 CFR 260.10).

3. **Light Liquid Service:** (1) vapor pressure of one or more of the organic constituents in the material is > 0.3 kPa at 20°C **and** (2) total concentration of pure organic constituents having a vapor pressure > 0.3 kPa at 20°C is equal to or greater than 20% by weight.

4. **MOVP:** Maximum Organic Vapor Pressure

5. **RCRA:** Resource Conservation and Recovery Act

6. **SC DHEC:** South Carolina Department of Health and Environmental Control

7. **VO:** Volatile Organic

REGULATORY BACKGROUND

40 CFR 265 Subpart CC and SC DHEC Rule R.61-79.265 sets forth air emission standards from tanks, surface impoundments, and containers of hazardous waste. Currently hazardous waste is only accumulated in tanks and containers.

Subpart CC regulations only apply where regulated tanks and containers manage hazardous waste containing at least 500 ppmw volatile organics (VOs) at the 'point of waste origination'. The site assumes that all hazardous waste storage tanks contain waste with at least 500ppmw VOs due to the burdensome requirements to test and calculate the VO for each waste stream.

EXEMPTIONS

Exemptions that may apply to the facility:

- Containers with a design capacity $\leq$ 0.1 m3.
- Tanks with controls operated in accordance with Clean Air Act requirements in 40 CFR Parts 60, 61, or 63. (Example controls required under MON or Pharma NESHAP).

TANKS

Tank Standards

The following table outlines the two types of emission level controls for tanks based on maximum organic vapor pressure of hazardous waste in the tank. For purposes of the Orangeburg site, waste stabilization does not occur in any tank. Two levels of acceptable emission controls for tanks:

Table 1 MOVP and Control Requirements

Tank design capacity	Maximum organic vapor pressure of hazardous waste in tank	Stabilization Occuring in Tank	Subpart CC level of control
< 20,000 gallons (75m3)	≤ 11.1 psi (76.6 kpA)	yes	Level 2
		no	Level 1
	> 11.1 psi (76.6 kPa)	yes	Level 2
		no	Level 2
≥ 20,000 gallons (75 m3) and < 40,000 gallons (151m3)	≤ 4.00 psi (27.6 kPa)	yes	Level 2
		no	Level 1
	> 4.00 psi (27.6 kPa)	yes	Level 2
		no	Level 2
≥ 40,000 gallons (151 m3)	≤ 0.75 psi (5.2 kPa)	yes	Level 2
		no	Level 1
	> 0.75 psi (5.2 kPa)	yes	Level 2
		no	Level 2

The following table lists the compliance method for each hazardous waste tank at the site.

Tank	Size of Tank	Type of Tank	Installation Date	Compliance Method
T-15M-42 (T8155)	15,000 gallons	fixed roof	1977	Level 1 - in light liquid service
T-30M-61 (T8333)	30,000 gallons	fixed roof	1990	Level 2 - Vents to Flare
T-30M-66 (T8336)	30,000 gallons	fixed roof	1993	Level 2 - Vents to Flare
T-100M-5 (T8345)	100,000 gallons	fixed roof	1994	Level 2 - Vents to Flare
T-10M-32 (T8345)	10,000 gallons	fixed roof	1993	Level 2 - Vents to Flare
**T-10M-14 (T1034)	10,000 gallons	Fixed roof	1978	Level 1 -

Level 1 Control Requirements for T-15M-42 **and T-10M-14**

Requirement Type	Requirement	Compliance
Design	(1) Determine MOVP (40 CFR 265.1085(c)(1))	Refer to Attachment B for MOVP calculation
	(2) The fixed roof and its closure devices must form a continuous barrier over the entire surface of the hazardous waste in the tank. The roof may be (a) an integral part of the structural design or (b) separate from the rest of the tank - but have no visible gaps or holes between the cover and tank when the cover is completely closed. (40 CFR 265.1085(c)(2)(i) and (ii))	Roof has been designed and installed to meet requirements.
	(3) Any openings in the fixed roof and manifold system (if associated) should be either equipped with a closure device **or** connected by a closed vent system that is vented to a control device. (40 CFR 265.1085(c)(2)(iii))	Tank roofs have been designed and installed to meet requirements.
	(4) Pressure/vacuum relief valves and conservation s vents, which vent directly to the atmosphere, are allowed as long as they operate with no detectable emissions when closed. These vents may be opened to prevent unsafe conditions but should remain in a closed position during normal operation. (40 CFR 265.1085(c)(3)(iii)).	Only monitor under LDAR program those pressure relief valves that are piped to atmosphere which have ruptured and not replaced within 5 days.
Monitoring	(1) Initial leak detection monitoring of the closed vent system components to demonstrate that the system operates with no detectable emissions as indicated by an instrument reading of less than 500 ppmw above background. (40 CFR 264.1033(l)(1)(i))	LDAR tech performed initial monitoring of closure device. Data stored in LeakDAS.
	(2) Visually inspect roof and closure devices annually. (40 CFR 264.1084(c)(4)(i) and (ii) and 265.1085 (c)(4)(i) and (ii). Initial repair attempt must be made within 5 days with completion of repairs made within 45 days. (Except for special conditions found under 40 CFR 264.1084(k)(2) or 265.1085(K)(2). (40 CFR 264.1084(k) and 265.1085(k)).	Maintenance Dept. inspects roofs annually. LDAR Tech inspects closure device annually as part of Subpart AA monitoring.

Recordkeeping	(1) Document tank identification number and inspection information.	The tanks are identified by two sets of numbers (Equipment number and PI&D number). Inspections are maintained in Maintenance Connect or the LDAR database.
	(2) Record of the MOVP determination - including date/time samples were collected, analysis conducted, and analysis results. New MOVP calculations are to be performed any time changes to the waste in the tank could potentially cause an increase in the MOVP.	See attachment A for MOVP calculations. Analytical data stored within LIMS system.
	(3) Written plan and schedule must be included in the inspection plan for the facility. (40 CFR 264.1088(b) and 265.1089(b)).	Refer to General Inspection Plan Procedure
	(4) All inspection records must be kept on site for three years.	Inspection records maintained in Maintenance Connect, LeakDas, and Env. File Room
Operating	(1) Tank contents cannot exceed the maximum organic vapor pressure (MOVP) levels specified in Table 1 above.	The MOVP has been calculated using representative waste composition for both tanks. Any changes to the process that warrant recalculation of the MOVP will be captured via the MOC system.
	(2) The waste cannot be heated such that the vapor pressures in Table 1 are exceeded.	** Waste is heated in tank T1034, however vapor pressure calculated at heated temperature does not exceed Table 1 values.**
	(3) No treatment using a waste stabilization process occurs in the tank.	Waste is not stabilized in these tanks.
	(4) Hard piping or enclosed means of conveyance is required when transferring waste from the tank to another hazardous waste tank. (This does not apply when waste are transferred from the tank to a container (trailer/drum)).	** Waste is only feed from the tank to containers (trailers or drums) for T-15M-42. T1034 waste is transferred to T-100M-5 (Boiler No. 4 waste tank) via hard piping. **

Level 2 Control Requirements for Tanks T-30M-61, T-30M-62, T-10M-32, and T-100M-5

(Fixed Roof vented to a control device - Flare):

Requirement Type	Requirement	Compliance
Design	(1) The tank must be in an enclosure that is vented to a closed vent system into an enclosed combustion control device, such as a vapor incinerator, boiler, or process heater that meets the requirements found in 40 CFR 264.1087 or 265.1088. (40 CFR 264.1084(g)(1) and 265.1085(g)(1).	Tanks T-30M-61, T-30M-62, and T-10M-32 all vent to Tank T-100M-5. T-100M-5 then vents through a knock out pot and then to Boiler No. 4 flare. The tank vent system has been designed and installed to meet requirements.

Requirement Type	Requirement	Compliance
	(2) The cover and closure device must be kept closed at all times except when performing routine inspections, maintenance or operations accessing a tank, removing accumulated sludge of other resides from a tank (40 CFR 264.1084(g)(2)(i) and 265.1085(g)(2)(i)).	The tank vent system has been designed and installed to meet requirements.
Monitoring	(1) Visually inspect roof and closure devices annually. (40 CFR 264.1084(c)(4)(i) and (ii) and 265.1085 (c)(4)(i) and (ii). Repairs must be made within 45 days of any defect discovered. (Except for special conditions found under 40 CFR 264.1084(k)(2) or 265.1085(K)(2). (40 CFR 264.1084(k) and 265.1085(k)).	Maintenance Dept. performs annual inspection of boiler; LDAR tech performs annual inspection of closure device.
	(2) Inspect and monitor the closed vent systems and control device required in 40 CFR 264.10847(c)(7) and 265.1088(c)(7). (264.1084(g)(3)(ii) and 265.1085(g)(3)(ii)) Inspections include: • Initial leak detect. • Annual visual inspection of the closed vent system joints, seams, or other connection that are permanently or semi-permanently sealed (40 CFR 264.1033(l)(1)(ii)(A)). • Monitor a component of connection using the procedures specified in 40 CFR 264.1034(b) to demonstrate that it operates with no detectable emissions following any time the component is repaired or replaced, or the connection is unsealed. •	Monitoring performed via the LDAR monitoring program. Maintenance Dept. performs annual inspection of boiler; LDAR tech performs annual inspection of closure device.
Recordkeeping	(1) Document tank identification number and inspection information.	The tanks are identified by two sets of equipment numbers. Inspections are maintained in Maintenance Connect and the LDAR database.
	(2) Written plan and schedule must be included in the inspection plan for the facility. (40 CFR 264.1088(b) and 265.1089(b)).	Refer to General Inspection Plan Procedure

Note: Refer to Procedure OB62333 for additional requirements associated with the flare.

ATTACHMENTS:

Attachment A: Vapor Pressure Calculations

T15M42.xlsx

T15M42.xlsx

t1034 subpart cc vapor pressure calc.xl

REVISION HISTORY

DATE	CHANGE
12/28/2015	New procedure
5/9/2017	Removed reference to Area 3 tank - no longer a HW tank.
09/15/17	Revised to capture the correct number sequence in SharePoint. Revised titles throughout. Replaced attachment.
03/25/18	Removed reference to SAP; updated to Maintenance Connect. Added in vapor pressure calculations for T1034 tank.

3. Cheney, J.L. and C.R. Fortune. Improvements in the Methodology for Measuring Hydrochloric Acid in Combustion Source Emissions. J. Environ. Sci. Health. *A19*(3): 337–350. 1984.

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METHOD 27—DETERMINATION OF VAPOR TIGHTNESS OF GASOLINE DELIVERY TANK USING PRESSURE-VACUUM TEST

1. *Applicability and Principle*

1.1 Applicability. This method is applicable for the determination of vapor tightness of a gasoline delivery tank which is equipped with vapor collection equipment.

1.2 Principle. Pressure and vacuum are applied alternately to the compartments of a gasoline delivery tank and the change in pressure or vacuum is recorded after a specified period of time.

2. *Definitions and Nomenclature*

2.1 Gasoline. Any petroleum distillate or petroleum distillate/alcohol blend having a Reid vapor pressure of 27.6 kilopascals or greater which is used as a fuel for internal combustion engines.

2.2 Delivery Tank. Any container, including associated pipes and fittings, that is attached to or forms a part of any truck, trailer, or railcar used for the transport of gasoline.

2.3 Compartment. A liquid-tight division of a delivery tank.

2.4 Delivery Tank Vapor Collection Equipment. Any piping, hoses, and devices on the delivery tank used to collect and route gasoline vapors either from the tank to a bulk terminal vapor control system or from a bulk plant or service station into the tank.

2.5 Time Period of the Pressure or Vacuum Test (t). The time period of the test, as specified in the appropriate regulation, during which the change in pressure or vacuum is monitored, in minutes.

2.6 Initial Pressure (P_i). The pressure applied to the delivery tank at the beginning of the static pressure test, as specified in the appropriate regulation, in mm H_2O.

2.7 Initial Vacuum (V_i). The vacuum applied to the delivery tank at the beginning of the static vacuum test, as specified in the appropriate regulation, in mm H_2O.

2.8 Allowable Pressure Change (Δp). The allowable amount of decrease in pressure during the static pressure test, within the time period t, as specified in the appropriate regulation, in mm H_2O.

2.9 Allowable Vacuum Change (Δv). The allowable amount of decrease in vacuum during the static vacuum test, within the time period t, as specified in the appropriate regulation, in mm H_2O.

3. *Apparatus*

3.1 Pressure Source. Pump or compressed gas cylinder of air or inert gas sufficient to pressurize the delivery tank to 500 mm H_2O above atmospheric pressure.

3.2 Regulator. Low pressure regulator for controlling pressurization of the delivery tank.

3.3 Vacuum Source. Vacuum pump capable of evacuating the delivery tank to 250 mm H_2O below atmospheric pressure.

3.4 Pressure-Vacuum Supply Hose.

3.5 Manometer. Liquid manometer, or equivalent instrument, capable of measuring up to 500 mm H_2O gauge pressure with ±2.5 mm H_2O precision.

3.6 Pressure-Vacuum Relief Valves. The test apparatus shall be equipped with an in-line pressure-vacuum relief valve set to activate at 675 mm H_2O above atmospheric pressure or 250 mm H_2O below atmospheric pressure, with a capacity equal to the pressurizing or evacuating pumps.

3.7 Test Cap for Vapor Recovery Hose. This cap shall have a tap for manometer connection and a fitting with shut-off valve for connection to the pressure-vacuum supply hose.

3.8 Caps for Liquid Delivery Hoses.

4. *Pretest Preparations*

4.1 Summary. Testing problems may occur due to the presence of volatile vapors and/or temperature fluctuations inside the delivery tank. Under these conditions, it is often difficult to obtain a stable initial pressure at the beginning of a test, and erroneous test results may occur. To help prevent this, it is recommended that, prior to testing, volatile vapors be removed from the tank and the temperature inside the tank be allowed to stabilize. Because it is not always possible to attain completely these pretest conditions a provision to ensure reproducible results is included. The difference in results for two consecutive runs must meet the criterion in Sections 5.2.5 and 5.3.5.

4.2 Emptying of Tank. The delivery tank shall be emptied of all liquid.

4.3 Purging of Vapor. As much as possible, the delivery tank shall be purged of all volatile vapors by any safe, acceptable method. One method is to carry a load of non-volatile

liquid fuel, such as diesel or heating oil, immediately prior to the test, thus flushing out all the volatile gasoline vapors. A second method is to remove the volatile vapors by blowing ambient air into each tank compartment for at least 20 minutes. This second method is usually not as effective and often causes stabilization problems, requiring a much longer time for stabilization during the testing.

4.4 Temperature Stabilization. As much as possible, the test shall be conducted under isothermal conditions. The temperature of the delivery tank should be allowed to equilibrate in the test environment. During the test, the tank should be protected from extreme environmental and temperature variability, such as direct sunlight.

5. *Test Procedure*

5.1 Preparations.

5.1.1 Open and close each dome cover.

5.1.2 Connect static electrical ground connections to tank. Attach the liquid delivery and vapor return hoses, remove the liquid delivery elbows, and plug the liquid delivery fittings.

NOTE: The purpose of testing the liquid delivery hoses is to detect tears or holes that would allow liquid leakage during a delivery. Liquid delivery hoses are not considered to be possible sources of vapor leakage, and thus, do not have to be attached for a vapor leakage test. Instead, a liquid delivery hose could be either visually inspected, or filled with water to detect any liquid leakage.)

5.1.3 Attach the test cap to the end of the vapor recovery hose.

5.1.4 Connect the pressure-vacuum supply hose and the pressure-vacuum relief valve to the shut-off valve. Attach a manometer to the pressure tap.

5.1.5 Connect compartments of the tank internally to each other if possible. If not possible, each compartment must be tested separately, as if it were an individual delivery tank.

5.2 Pressure Test.

5.2.1 Connect the pressure source to the pressure-vacuum supply hose.

5.2.2 Open the shut-off valve in the vapor recovery hose cap. Applying air pressure slowly, pressurize the tank to P_i, the initial pressure specified in the regulation.

5.2.3 Close the shut-off valve and allow the pressure in the tank to stabilize, adjusting the pressure if necessary to maintain pressure of P_i. When the pressure stabilizes, record the time and initial pressure.

5.2.4 At the end of t minutes, record the time and final pressure.

5.2.5 Repeat steps 5.2.2 through 5.2.4 until the change in pressure for two consecutive runs agrees within ±12.5 mm H_2O. Calculate the arithmetic average of the two results.

5.2.6 Compare the average measured change in pressure to the allowable pressure change, Δ p, as specified in the regulation. If the delivery tank does not satisfy the vapor tightness criterion specified in the regulation, repair the sources of leakage, and repeat the pressure test until the criterion is met.

5.2.7 Disconnect the pressure source from the pressure-vacuum supply hose, and slowly open the shut-off valve to bring the tank to atmospheric pressure.

5.3 Vacuum Test.

5.3.1 Connect the vacuum source to the pressure-vacuum supply hose.

5.3.2 Open the shut-off valve in the vapor recovery hose cap. Slowly evacuate the tank to V_i, the initial vacuum specified in the regulation.

5.3.3 Close the shut-off valve and allow the pressure in the tank to stabilize, adjusting the pressure if necessary to maintain a vacuum of V_i. When the pressure stabilizes, record the time and initial vacuum.

5.3.4 At the end of t minutes, record the time and final vacuum.

5.3.5 Repeat steps 5.3.2 through 5.3.4 until the change in vacuum for two consecutive runs agrees within ±12.5 mm H_2O. Calculate the arithmetic average of the two results.

5.3.6 Compare the average measured change in vacuum to the allowable vacuum change, Δ v, as specified in the regulation. If the delivery tank does not satisfy the vapor tightness criterion specified in the regulation, repair the sources of leakage, and repeat the vacuum test until the criterion is met.

5.3.7 Disconnect the vacuum source from the pressure-vacuum supply hose, and slowly open the shut-off valve to bring the tank to atmospheric pressure.

5.4 Post-Test Clean-Up. Disconnect all test equipment and return the delivery tank to its pretest condition.

6. *Alternative Procedures*

6.1 The pumping of water into the bottom of a delivery tank is an acceptable alternative to the pressure source described above. Likewise, the draining of water out of the bottom of a delivery tank may be substituted for the vacuum source. Note that some of the specific step-by-step procedures in the method must be altered slightly to accommodate these different pressure and vacuum sources.

6.2 Techniques other than specified above may be used for purging and pressurizing a delivery tank, if prior approval is obtained from the Administrator. Such approval will be based upon demonstrated equivalency with the above method.

METHOD 28—CERTIFICATION AND AUDITI
WOOD HEATERS

1. Applicability and Principle

1.1 Applicability. This method is ap
ble for the certification and auditing of
heaters. This method describes the test
ity, test fuel charge, and wood heater
ation as well as procedures for determ
burn rates and particulate emission
and for reducing data.

1.2 Principle. Particulate matter
sions are measured from a wood heater
ing a prepared test fuel crib in a test fa
maintained at a set of prescribed condi

2. Definitions

2.1 Burn Rate. The rate at which tes
is consumed in a wood heater. Measu
kilograms of wood (dry basis) per hou
hr).

2.2 Certification or Audit Test. A se
at least four test runs conducted for c
cation or audit purposes that meets th
rate specifications in Section 5.

2.3 Firebox. The chamber in the
heater in which the test fuel charge is
and combusted.

2.4 Secondary Air Supply. An air
that introduces air to the wood heate
that the burn rate is not altered by
than 25 percent when the secondary ai
ply is adjusted during the test run. The
heater manufacturer can document
through design drawings that show th
ondary air is introduced only into a r
chamber or secondary chamber outsi
firebox.

2.5 Test Facility. The area in whi
wood heater is installed, operated, and
pled for emissions.

2.6 Test Fuel Charge. The collecti
test fuel pieces placed in the wood hea
the start of the emission test run.

2.7 Test Fuel Crib. The arrangem
the test fuel charge with the proper s
requirements between adjacent fuel pie

2.8 Test Fuel Loading Density.
weight of the as-fired test fuel char
unit volume of usable firebox.

2.9 Test Fuel Piece. The 2 x 4 or 4 x
piece cut to the length required for th
fuel charge and used to construct th
fuel crib.

2.10 Test Run. An individual emissi
which encompasses the time required t
sume the mass of the test fuel charge.

2.11 Usable Firebox Volume. The v
of the firebox determined using the fol
definitions:

2.11.1 Height. The vertical distan
tending above the loading door, if fuel
reasonably occupy that space, but not
than 2 inches above the top (peak heig
the loading door, to the floor of the f
(i.e., below a permanent grate) if the

Reference EN-PP-303

T-15M-42

15,000 gallon tank

Vapor pressure at 40 Degrees Celsius

Limit is < 76.6 kPA to be Level 1

Component	Weight Percent	Molecular Weight	Weight Percent x Molecular Weight	Mole Fraction in Organic Phase	Component Vapor Pressure psia	VOL Vapor Pressure psia	VOL Vapor pressure kPa
4-methyl-1-pentene	56.1	84.16	47.21	0.38	8.51	3.23	22.28
4-methyl-2-pentene, trans	24.1	84.16	60.10	0.48	4.16	2.01	13.86
4-methyl-2-pentene, cis	8.5	84.16	7.15	0.06	4.16	0.24	1.65
toluene	3.7	92.14	3.41	0.03	1.13	0.03	0.21
hexene (other)	7.6	84.16	6.40	0.05	2.99	0.15	1.06
						0.00	0.00
						0.00	0.00
						0.00	0.00
						0.00	0.00
total	100		124.27			**5.67**	**39.07**

Data Source:

Based on analytical data from Howie Phan 1/12/16.

Unit 6 Code 91 in LIMS

Used hexene for the other hexene components noted in Howie's report.

Although analysis showed 51 % 4 methyl 1 pentene, increased it to 56.1% since component with highest vapor pressure and total constituents did not add up to 100%.

	Chemical Name	Database Component ID
1	2,6-DITERTIARYBUTYLPHENOL	1380
2	2-TERT-BUTYLPHENOL	1276
3	ISOBUTYLBENZENE	748
4	n-BUTYLBENZENE	70
5	TOLUENE	183
6	HEXANE	231
7	METHANOL	965
8	CYCLOHEXANE	246
9	DODECANE	316
10	CUMENE	1357
11	2,6-DIISOPROPYLANILINE	606
12	1,6-HEXANEDIOL	916
13	1,2-HEXANEDIOL	144
14	METHYL ACRYLATE	1331
15	EXXAL 8	1701
16	ISOPROPYL ALCOHOL	966
17	MCP DIMER	620
18	DIMETHYL CARBITOL	296
19	XYLENE-M	165
20	1H-PYRROLE	216
21	TRIETHYLAMINE	380
22	TETRAHYDROFURAN	217
23	DIETHYL KETONE	1330
24	2,6-DIISOPROPYL PHENOL	583
25	DIETHYL ETHER	859
26	AMMONIA	1144
27	ANILINE	904
28	2-ISOPROPYLANILINE	950
29	ETHANOL	947
30	METHYLENE CHLORIDE	1061
31	1,4-DIOXANE	404
32	1,4-DIETHYLBENZENE	75
33	ACETONE	967
34	1,2-PROPYLENE OXIDE	1090
35	METHYL ETHYL KETONE	1215
36	ISOHEXANE	147
37	NITROGEN	1161
38	WATER	1164
39	CARBON DIOXIDE	420
40	NITRIC OXIDE	41
41	NITROGEN DIOXIDE	42
42	4-ISOBUTYLACETOPHENONE	675
43	HME	1690
44	PME	1550
45	EXXAL 8	1701
46		
47		
48		
49		
50		

Instructions:
Click on a cell under "Chemical Name" and press "Import Component" button. Click "Import" to select component in list.

Max # components in subdatabase = 50

User Units			
T (input)	C	NBP	C
		RadGyr	ft
AcFactor	unitless	SolParam	(cal/cc)^0.5
CASNo	unitless	VolSLM	cuft/lbmol
Zc	unitless	Tmin	C
DipoleMom	Debye units	Tmax	C
LFL	volume %	TripleP	psia
MolWt	unitless	TripleT	C
RefIndex	unitless	vdWarea	sqft/lbmol
UFL	volume %	vdWvol	cuft/lbmol
		DensL	g/cc
Tautoig	C	DensS	g/cc
Pc	psia	CpL	BTU/lb-F
Tc	C	CpS	BTU/lb-F
Vc	cuft/lbmol	CpV	BTU/lb-F
dHformIG	BTU/lb	dHvap	BTU/lb
FlashT	C	SurfTens	dyne/cm
dGform	BTU/lb	ThCondL	BTU/ft-hr-F
dHcomb	BTU/lb	ThCondV	BTU/ft-hr-F
dHmelt	BTU/lb	VapP	psia
SIG	BTU/lbmol-R	ViscL	cP
MeltT	C	ViscV	cP

2,6 diisopropyl aniline

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

LLUNA 01/22/2020 CY19 Reference OB62333

Tank ID	T-30M-66		
Description	Burn Tank - Average of what burned in Cy19		
Tank contents temperature	40	°C	
Tank pressure	0	psig	
Sum of composition	99.18	wt%	
Vapor net heating value, Q_{net}	**379.3**	**BTU/scf**	

Volatile Components

PropXL - only for combustible liquids at 25 °C

	Liquid Comp. wt%	Note	Mol wt mw	Vapor Pressure P^{sat} psia	Activity Coeff. γ	Liq State Heat of Combust. at 25 °C Q_{comb}^{liq} BTU/lb	1/mw	Heat of Vaporiz. Q_{vap} BTU/lb	IG State Heat of Combust. at 25 °C Q_{comb}^{IG} BTU/lb
ISOBUTYLBENZENE	11.13		134.221	0.093606	1	17809	0	154	17963
n-BUTYLBENZENE	10.35		134.221	0.053029	1	17809	0	161	17970
4-ISOBUTYLACETOPHENONE	0.83		176.26	0.00173	1	16451	0	136	16587
METHANOL	9.24		32.0422	5.136252	1	8560	0	510	9070
TOLUENE	1.37		92.1405	1.141441	1	17404	0	179	17583
HEXANE	5.24		86.1772	5.431509	1	19257	0	157	19414
CUMENE	0.29		120.194	0.212074	1	17706	0	161	9000

Manual - for non-PropXL components and non-combustible components

Fuel Oil	11.50		200	0.2	1	18000	0.005	100	18100
Super High Flash Naphtha	1.36	SHFN is a blend, used properties for solvent naphtha however	114	0.798	1	19093	0.00877193	125	19218
heptane	1.38		100.21	0.773	1	19163	0.009979044	149	19312
4 methyl 1 pentene	2.4		84.15	8.48	1	19283	0.011883541	145	19428
4 methyl 2 pentene	1.32		84.16	7.715	1	19283	0.011882129	145	19428

Nonvolatile Components

Ethanox 330/330 heel	18.4		775.2				0.00128999		
702	1.22		424				0.002358491		
process oil	3.4		180				0.005555556		
ibuprofen (including meta, para)	18.02		206.29				0.004847545		
HME	0.87		236.314				0.004231658		
PME	0.86		220.314				0.004538976		

99.18

Notes

1 use dodecane to represent kerosene

2 component X is proprietary, but with known properties provided by the vendor

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

BTB 7/28/15

This calculation is intended to determine the net combustion heat contained in the vent stream from a tank that contains a mixture of components, one or more of which are combustible. Two main provisions of the calculation include (1) determination of the vapor composition given the liquid composition based upon the modified Raoult's Law equation, and (2) determination of the net combustion heat for each of the components.

The data entered for the calculation are in three categories. In the first section, volatile components featured in PropXL, the Corporate physical properties database for SI Group, can be selected, which allows for automatic determination of the properties used in the calculation. In the second section, volatile components not contained in PropXL may be entered manually, including their identity and properties. In the third section, non-volatile components can be entered along with their molecular weights.

Vapor Composition

$$y_i \cdot P = x_i \cdot \gamma_i \cdot P_i^{sat}$$

y_i = concentration of component i in the vapor, mol fr
P = pressure in tank
x_i = concentration of component i in the liquid, mol fr
γ_i = activity coefficient of component i in the liquid, which accounts for solution non-ideality (often a default value of unity is used)
P_i^{sat} = vapor pressure of component i at the tank temperature

Combustion

The appropriate basis for the combustion calculation is for each component in its ideal gas state, liberating vapor-phase products. That means water is produced as steam and its latent heat is not recovered, which provides the combustion calculation on a net heating basis. Typical net heat of combustion data are for the component in its normally-occurring state at standard conditions. For the volatile components in the tank, that basis is as liquid. To modify the heat of combustion to the reference state for an ideal gas, which is applicable to this calculation for the vent stream, the value is adjusted by the heat of vaporization:

$$Q_{comb}^{IG} = Q_{comb}^{liq} + Q_{vap}$$

Q_{comb}^{IG} = heat of combustion for the ideal gas state at 25 °C
Q_{comb}^{liq} = heat of combustion for the liquid state at 25 °C
Q_{vap} = heat of vaporization at 25 °C

Using the basis of 1 scf (expressed with standard conditions of 20 °C), the combustion heat for each combustible component is determined as follows:

$$n = P \cdot V/(R \cdot T)$$

n = moles in 1 scf, lbmol
V = 1 scf
R = ideal gas constant, 10.73 cuft-psia/lbmol-R
T = standard temperature, 68+459.67 R

$$Q_i = y_i \cdot n \cdot mw_i \cdot Q_{comb}^{IG}$$

Q_i = net combustion heat of component i in the vent stream
mw_i = molecular weight of component i

Finally, the total net heating value of the vent stream is determined by the sum:

$$Q_{net} = \Sigma Q_i$$

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
2	330/330 C Still Bottoms	D001	3	Fuel oil	0-50	25	N	2,643,363
				alklyated phenols	0-50	40	N	
				isobutyl benzene	25	16	N	
				normal butyl benzene	25	16		
				heptane		3	N	
3	IBB Still Bottoms	D001	**2**	isobutyl benzene	0-100	50	N	341,760
				normal butyl benzene	0-100	50	N	
5	Organic separated from Concentrated Aqueous Waste	D001, F005	Env. Ops (Pollution Control)	naphtha	0-70	70	N	0
				2,6 di tert butyl phenol	0-10	10	N	
				other alkylated phenols (non volatiles)		10	N	
				toluene (assume 10)	10	10		
7	Toluene from vessel and tank cleaning	D001, F005	2 and 3	toluene	0-70	3.7		233,600
				4 -methyl 1 pentene	0-30	51.9		
				4 - methyl 2 pentene	0-10	32.6		
				non volatiles		11.8		
16	**Used lubricating, hydraulic and cutting oil**	**D001**	**Maintenance**	various oils	90-100	100	N	0

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
23	methanol/hexane washout	D001, F003	3	methanol	0-80	45	N	14,112
				hexane	0-80	45	N	
				IBAP	0-10	5	N	
				HME	0-10	5	N	
				mis compounds			N	
85	702/703 still bottoms with super high flash naphtha	D001	1	naphtha	0-50	35	N	223,784
				702	0-50	32	N	
				703	0-50	15	N	
				cumene	0-75	7.5	N	
				formaldehyde	0.5	0.5	N	
				1,2,4 timethylbenzene	0-5	2.5	N	
				total xylenes	0-75	7.5	N	
90	DIPA Columns Bottoms	Non hazardous	2	diisopropylaniline	< 85	50	N	0
				heavy compounds	< 75	50	N	
99	Oil from Alkyla Aluminum Cylinder Cleaning	Non hazardous	2	process oil	90-100	90	N	78,283
				water	0-10	5	N	
				alkyl organics	0-5	5	N	
104	Heavy Organics from DR-3 Production (DR3 heel)	D001	3	ibuprofen	??	60	N	1,293,704
				hexane	0-20	20	N	
				para DR3	36	10	N	
				meta DR3	15	10	N	
123	Organic from DR-3 Aqueous Waste	D001	3	isobutylbenzene	0-50	20	N	224,812
				IBAP	0-50	21	N	
				PME	0-50	22	N	
				HME	0-50	22	N	
				Hexane	0-25	15	N	

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
127	E4716 Organics	D001	2	2,6 ditertiarybutyl phenol	10-50	20.00	N	0
				irganaox	0-60	20	N	
				methyl acrylate	0-20	10	N	
				process oil	10-90	10	N	
				exxall 8 alcohol	10-90	40	N	
125	DIP Misc. Organics			water	0-5	2.5	N	79,772
				phenol	10-15	12.5	Y	
				propoxylbenzene	0-5	2.5		
				2-isopropylphenol	35-40	37		
				3 ethyl 5 methylphenol	10-15	11		
				propofol	30-35	33		
				2,4,6 triisopropylphenol	0-3	1.5		
148	Recovered Process Oil-NcendX	D001, F005	2	hydrolyzed oil	90-100	100	N	0
149	AN 701 Lights			OTBP	10-20	17	N	0
				2,6 DTBP	40-55	50	N	
				2,4 DTBP	0-5	3	N	
				ttbp	10-20	17	N	
				702	0-5	4	N	
				phenol	5-10	8	Y	
				water	<0.5	1	N	

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
175	Waste Methanol	D001		water	0-10	0.99	N	0
				ammonia	100-500 ppm		N	
				hexane	0-100 ppm	0.01	N	
				methanol	90-99	99	N	
162	DIPA waste solvents	D001		anilne	15	15	Y	0
				OIPA	7	7	N	
				PIPA	1	1	N	
				DIPA	17	17	N	
				super high flash naphtha	60	57	N	
				cumene	3	3	N	
389	4716 Methanol	D001	2	methanol		98.00	N	535,198
				water		0.5	N	
				exxall 8 alcohol		1	N	
				methyl acrylate		0.5	N	
687	T-15M-60 Recycle Toluene	D001	North	toluene	75-98	94.5	Y	74,523
				hexane	0-5	2.5		
				isobutylbenzene	<1	1		
				n-butyl benzene	<1	1		
				methanol	<0.05	0.05		
				methyl acrylate	<1	0.95		
709	Fuel Oil (off spec)	D001,	North	fuel oil	90-100	95		0
				water	0-10	5		

Constituent	percent component to total burned
702	1.363844921
703	0.584504966
1,2,4 timethylbenzene	0.097417494
2,4,6 triisopropylphenol	0.020835775
2-isopropylphenol	0.51394911
3 ethyl 5 methylphenol	0.152795681
4 - methyl 2 pentene	1.326045276
4 -methyl 1 pentene	2.11109662
alklyated phenols	18.41131092
alkyl organics	0.068156202
cumene	0.292252483
formaldehyde	0.019483499
Fuel oil	11.50706932
heptane	1.380848319
hexane	0.110578067
hexane	0.587190016
hexane	4.505394564
hexane	0.0324413
HME	0.012286452
HME	0.861212023
IBAP	0.012286452
IBAP	0.822066022
ibuprofen	13.51618369
ibuprofen	2.252697282
ibuprofen	2.252697282
isobutylbenzene	2.975494484
isobutylbenzene	7.364524368
isobutylbenzene	0.782920021
isobutylbenzene	0.01297652
isooctyl alcohol	0.093192808
methanol	0.110578067
methanol	9.132895147
methanol	0.000648826
methyl acrylate	0.046596404
methyl acrylate	0.01297652
naphtha	1.363844921
non volatiles	0.479979578
normal butyl benzene	2.975494484
normal butyl benzene	7.364524368
normal butyl benzene	0.01297652
phenol	0.173631456
PME	0.861212023
process oil	1.226811629
propofol	0.458387044
propoxylbenzene	0.034726291
toluene	0.150502071
toluene	1.226281149
xylenes	0.002922525
water	0.034726291
water	0.068156202
water	0.046596404

Constituent	percent component to total burned
702 Total	1.363844921
703 Total	0.584504966
1,2,4 timethylbenzene Total	0.097417494
2,4,6 triisopropylphenol Total	0.020835775
2-isopropylphenol Total	0.51394911
3 ethyl 5 methylphenol Total	0.152795681
4 - methyl 2 pentene Total	1.326045276
4 -methyl 1 pentene Total	2.11109662
alklyated phenols Total	18.41131092
alkyl organics Total	0.068156202
cumene Total	0.292252483
formaldehyde Total	0.019483499
Fuel oil Total	11.50706932
heptane Total	1.380848319
hexane Total	5.235603947
HME Total	0.873498475
IBAP Total	0.834352474
ibuprofen Total	18.02157826
isobutylbenzene Total	11.13591539
isooctyl alcohol Total	0.093192808
methanol Total	9.24412204
methyl acrylate Total	0.059572924
naphtha Total	1.363844921
non volatiles Total	0.479979578
normal butyl benzene Total	10.35299537
phenol Total	0.173631456
PME Total	0.861212023
process oil Total	1.226811629
propofol Total	0.458387044
propoxylbenzene Total	0.034726291
toluene Total	1.37678322
xylenes Total	0.002922525
water Total	0.149478897
Grand Total	99.82821986

Constituent	percent component to total burned
alklyated phenols Total	18.41131092
ibuprofen Total	18.02157826
Fuel oil Total	11.50706932
isobutylbenzene Total	11.13591539
normal butyl benzene Total	10.35299537
methanol Total	9.24412204
hexane Total	5.235603947
4 -methyl 1 pentene Total	2.11109662
heptane Total	1.380848319
toluene Total	1.37678322
702 Total	1.363844921
naphtha Total	1.363844921
4 - methyl 2 pentene Total	1.326045276
process oil Total	1.226811629
HME Total	0.873498475
PME Total	0.861212023
IBAP Total	0.834352474
703 Total	0.584504966
2-isopropylphenol Total	0.51394911
non volatiles Total	0.479979578
propofol Total	0.458387044
cumene Total	0.292252483
phenol Total	0.173631456
3 ethyl 5 methylphenol Total	0.152795681
water Total	0.149478897
1,2,4 timethylbenzene Total	0.097417494
isooctyl alcohol Total	0.093192808
alkyl organics Total	0.068156202
methyl acrylate Total	0.059572924
propoxylbenzene Total	0.034726291
2,4,6 triisopropylphenol Total	0.020835775
formaldehyde Total	0.019483499
xylenes Total	0.002922525

Exit Velocity Calculation
Flare E-8332 for Boiler #4 Waste Tank Venting

Flare pipe exit diameter	3.5	inches
thus the area is	0.267	sq ft
Maximum estimated pump in rate	400	gpm
convert gallons to cu ft	53.48	CFM
convert minutes to seconds	0.89	cu ft per second
Therefore velocity = Flow / Area	**3.33**	feet per second

Andy M. Gunn, Jr

SCOPE: **This procedure outlines the applicable RCRA waste requirements for Boiler No. 4 flare, which controls air emissions for the four No. 4 Boiler hazardous waste storage tanks, and the associated closed vent system. The flare is dually regulated under air and waste regulations; however this procedure only lists the associated waste regulations.**

RESPONSIBILITY:

The administration of this procedure is the responsibility of the Manager, Environmental Compliance.

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) Lead Environmental Engineers or Environmental Engineer
2) Production Coordinator
3) Maintenance Manager
4) Sr. Production Manager – North

It must be approved by the Manager – Environmental Compliance who is the Master Copy Holder and is responsible for all revisions.

DEFINITIONS:

CFR Code of Federal Regulations
DHEC Department of Health and Environmental Control
RCRA Resource Conservation and Recovery Act
VOC Volatile Organic Compound

REGULATORY BACKGROUND

Boiler No. 4 is a permitted Treatment, Storage, Disposal Facility under RCRA regulations since it burns hazardous solvent wastes for energy recovery. Boiler No. 4 is permitted under the site's RCRA Part B permit as well as the Title V Air permit. The hazardous solvent waste is stored in four storage tanks (T-100M-5, T-10M-32, T-30M-61, and T-30M-66) prior to being burned in the boiler.

Boiler No. 4 Flare (E-8332) is a non-assisted flare, which was installed to control Volatile Organic Compound (VOC) emissions from the four Boiler No. 4 storage tanks. The requirement to control VOCs from these tanks comes from the Subpart CC regulations of 40 CFR Part 264, which were promulgated December 6, 1996. Note that only T-100M-5 exceeded the specified volume/VOC vapor pressure limits noted in the regulations and required the emissions be reduced by 95%. To provide compliance with the 95% VOC emission reduction requirement, T-100M-5 , and the three other tanks, had their vents routed to the flare for VOC reduction. The closed vent system includes the piping, connections and pump that transport the gases from these storage tanks to the Boiler No. 4 Flare.

Project No. 0-2715 was implemented to install Flare E-8332 and air construction permit No. 1860-0004-CY was obtained for the flare installation. The start-up date was December 5, 1997. The RCRA regulations of Subpart CC required that the flare be operational by December 8, 1997. The flare has been incorporated into the Title V Air Permit (2004) and the requirements of the construction permit (other than the O&M plan and equipment and preventative maintenance) are no longer valid. The O&M plan must be available for DHEC's review when requested and must be updated when changes occur in the flare's design, operation or maintenance. Refer to Production Process Manual.

There is a knockout pot prior to the flare for condensables/condensate collection.

Refer to Attachment A for a summary of the RCRA requirements for both the flare and the closed vent system..

GENERAL OPERATING PARAMETERS FOR FLARE

Flare Pilot Temperature:
The Title V air permit requires that the flare pilot temperature be at least 250ºF. The flare manufacturer's manual however recommends that the temperature be at least 600ºF to assure the pilot is lit. The temperature monitor currently alarms when the temperature is **below 700ºF and will remain in alarm until the temperature reaches 900ºF**. the range between these two temperatures takes into account the impact of wind conditions on the flame's contact with the sensor.

The flare has a temperature sensor to alarm if the pilot goes out. Our permit does not allow us to operate for more than one hour without the flare in operation. Should the pilot go out the operator should try to light immediately (if in AUTO the flare control unit will try to relight itself). If this fails, all operations which could cause venting must be halted (i.e., filling or transferring). Supervision should be contacted immediately thereafter.

Vent Gas Flow:
The vent gas flow must be continuous monitoring and recorded hourly. A flowmeter and a local recorder have been installed to continuously monitor and record the vent gas flow rate to the flare. The flowmeter and recorder are readily accessible to operating personnel and DHEC inspectors. The flowmeter and recorder will be calibrated and maintained in accordance with their respective manufacturer's maintenance/calibration recommendations and the site's preventive maintenance schedule. The flare operator will record the vent gas flow rate in the No. 4 Boiler's operating log once per shift during operation of the flare, not including start-up and shutdown. The VOC content of the vent gas s**hall not exceed 50 lbs/hr** per the Title V Air Permit. Vent gas flow records will be maintained on site for at least five years and will be made available to DHEC personnel upon request.

Vent Gas Heat Value:
The RCRA regulations require that the heat value of the vent gas must be at least 200 BTU/scf. Attachment B contains the net heating value calculation for CY15. The heat value of the vent gases will be recalculated should there be a significant change in the composition of the materials stored in the waste fuel tanks. The average heat value of the vent gases calculated **for **CY19 was 379** Btu/scf.** Records of the vent gas heat values will be maintained in the Environmental Department's file for at least five years and will be available for DHEC review.

Exit Velocity:
The exit velocity of the flare must be < 60 ft/sec per 264.1033(d)(4) waste regulations. Attachment C, includes the exit velocity calculations which indicate a velocity of 3.33 feet/sec.

Opacity:
The flare is limited to **no visible emissions under the RCRA regulations**. There cannot be any visible emissions for more than 5 minutes during any consecutive 2 hours.

Pilot Flame:
During operation, not including start-up and shutdown, Flare E-8332 must operate with a pilot flame **present at all times.** A thermocouple is provided for monitoring the presence of the pilot flame on a continuous basis during operation of Flare E-8332. The thermocouple's temperature output is recorded on the flare's local recorder mentioned above. A pilot flame failure alarm is also located in the No. 4 Boiler's Control Room. Pilot flame temperature and alarm records will be maintained on site for at least five years in the No. 4 Boiler operating area and will be made available to DHEC personnel upon request.

ATTACHMENTS

Attachment A: Summary of RCRA Requirements

B4 flare requirements.docx

B4 flare requirements.docx

Attachment B: Net Heat Value Calculations Average

CY19 Heat Value Average.xlsx

Heating Value Cy19

Attachment C: Exit Velocity Calculation

Exit Flare Velocity Calculation.xlsx

Exit Flare Velocity Calculation.xlsx

REVISION HISTORY

DATE	CHANGE
08/02/2016	**Creation of new document.**
08/14/17	**Revised to capture correct number sequence in SharePoint. Correct titles and re-attached all attachments.**
05/17/18	**Included Maintenance Manager and Sr. Production Manager – North as reviewers. Updated heat content calculations for CY17.**
05/18/20	**Biennial review; updated net heating value calcs.**

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Reference OB62333

Boiler No. 4 Flare Requirements

Background: Non-assisted flare

Startup date: December 5, 1997 Construction Permit: 1860-0004-CY

Flare provides VOC emissions control for T-10M-32, T-30M-61, T-30M-66, and T-100M-5

RCRA Requirements – Subpart AA and CC (Air Emission Controls for Tanks) (some of these requirements are in the TV permit)		
Citation	**Requirements**	**Compliance Method**
Visible Emissions (264.1033(d)(1) and (e)(1))	No visible emissions via Method 22 (in 40 CFR Part 60) except for no more than 5 minutes during any 2 consecutive hours.	No requirement to conduct visible emission monitoring; however if emissions are noted – contact Env. Department. Daily VE conducted during daylight hours (per Method 22). Method 22 does not require certification. Training on Method 22 will be conducted internally.
Flame Presence (264.1033(d)(2) and (f)(2)(iii))	Flare must be operated with flame present at all times as monitored by the pilot flame monitor.	Temperature probe monitor; temp alarms at < 700°F. Continuous recording on circular chart; readings also taken every 6 hours on Boiler Log sheet; logged in PI manual logger as well.
Net Heating Value (264.1033(d)(3) and (e)(2))	200 BTU/scf or greater is non assisted. Calculate net heating value using formula in section (e)(2).	The average heat value of the vent gases is calculated yearly based on average waste composition. Refer to yearly calculations.
Exit Velocity (264.1033(d)(4))	Designed and operated with an exit velocity of < 60 ft/sec.	Calculated exit velocity is 3.33 ft/sec. Refer to calculation sheet.
Flow monitoring (264.1033(f)(1))	Monitor and record flow hourly.	Flow meter installed; alarm and data prints on circular chart. In PI/ RT reports for alarms.
Closed Vent System (264.1033(k))	The closed vent system must operate with no detectable emissions (LDAR monitoring) as monitored visually on an annual basis. Leaks must be repaired within 15 days with first attempt within 5 days.	All welded except flange joints which are bolted. Sniff if repair or replace component, to ensure no leaks. Then goes back to visual.

RCRA Requirements – Subpart AA and CC (Air Emission Controls for Tanks) (some of these requirements are in the TV permit)		
Citation	**Requirements**	**Compliance Method**
Operations (264.1033(m))	Closed vent system and flare must be operated at all times when emissions are vented to system.	Monitor downtime for bypass. There is a knockout (empty pot) pot prior to the flare for condensables/condensate collection.
Bypass Valve (264.1087(b)(3)(iii))	Bypass valve must be locked or car sealed. Position of bypass valve and car seal must be visually inspected once per month to ensure the bypass is maintained in the closed position.	Recorded on AWFCO boiler recordkeeping form; recorded monthly at a minimum. AWFCO completed forms filed in Env. File Room.
Flare Downtime for routine maintenance (264.1087(c)(2)(i))	Flare can be down for no more than 240 hours/year for planned routing maintenance.	Flare downtime recorded in Boiler Operator Database spreadsheet (column DZ).
Recordkeeping (264.1035(c))	1. Record flare flow hourly 2. Continuously record presence of flare flame. 3. Record periods of time the flare is not ignited. 4. Record monthly visual check of bypass valve. 5. Record time of any visible emissions 6. Record date and start/stop time flare is down for routine maintenance. Note type/purpose of maintenance. (264.1089(e)(1)(v)(B). 7. Record planned anticipated future maintenance for next 6 months for flare/closed vent system. In which the flare will not be operational. (264.1089(e)(1)(v)(A)). 8. Documentation of heating value and exit velocity (264.1033(e)).	Circular chart for continuous readings; manual readings every 6 hours on Boiler Log sheet; PI Manual Logger. Circular chart maintained in Env. File Room. Flare downtime noted on circular chart. Monthly AWFCO form; maintained in Env. File Room Noted on Boiler Log sheet as applicable Boiler Operator Database (spreadsheet) Maintenance Planning Records Env. Procedure EN-PP-382

RCRA Requirements – Subpart AA and CC (Air Emission Controls for Tanks) (some of these requirements are in the TV permit)		
Citation	**Requirements**	**Compliance Method**
Reporting (264.1036(a) and 264.1090(c))	Semiannual report to DHEC for times: (1) flare had visible emissions for 5 minutes or longer within a two hour period or (2) any consecutive 24 hour period for which there was no pilot flame for the flare or (3) Vent gas flow > 50 lbs/hr for more than 24 consecutive hours	Reports will be submitted as appropriate to DHEC.

SCOPE:

This document outlines procedures implemented to ensure compliance with the Clean Air Act and RCRA regulations via the Leak Detection and Repair (LDAR) program. This procedure is applicable to all process equipment coming under the regulations of the Environmental Protection Agency with respect to control of fugitive emission. Process components coming under this programs include, but are not limited to: pumps, agitators, compressors, pressure relief devices, sampling connections, open ended lines, process valves, and closed-vent systems and control devices. NOTE: Connectors under Subpart GGG must be monitored via Method 21. All other regulations allow connectors to be monitored via visual, auditory or olfactory methods.

RESPONSIBILITY:

The Manager-Environmental Compliance is responsible for the administration of this procedure. The Environmental Department is responsible for its implementation.

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) **Environmental LDAR Coordinator**
2) **Lead Environmental Engineer**

It must be approved by the ** Manager – EHS, who is the Master Copy Holder and is responsible for all revisions.**

DOCUMENT REFERENCES:

A. **40 CFR Part 60**

B. **40 CFR Part 63**

C. **40 CFR Part 264 & 264, Subparts AA & BB**

D. **40 CFR Part 270**

DEFINITIONS

A. Components in LDAR Service

Components to be monitored periodically include pumps, agitators, valves, connectors, open ended lines, and closed vent systems. Pressure relief devices that are not piped to a closed vent system are identified but monitored only if they relieve and do not have a rupture disc. If they have a rupture disc it must be replaced within five days.

B. Light Liquid Service

In light liquid service means that a piece of equipment in organic hazardous air pollutant service contains a liquid that meets the following conditions:

(1) The vapor pressure of one or more of the organic compounds is greater than 0.3 kilopascals at 20 °C;

(2) The total concentration of the pure organic compounds constituents having a vapor pressure greater than 0.3 kilopascals at 20 °C is equal to or greater than 5 percent by weight of the total process stream; and

(3) The fluid is a liquid at operating conditions. (Note: Vapor pressures may be determined by the methods described in 40 CFR 60.485(e)(1).)

(4) As a conservative approach, all equipment which falls under RCRA Subpart BB regulations is considered to be in light liquid service per 40 CFR 261.1031 definition.

C. Gas/Vapor Service

In gas/vapor service means that a piece of equipment in organic hazardous air pollutant service contains a gas or vapor at operating conditions.

D. Heavy Liquid

In heavy liquid service means that a piece of equipment in organic hazardous air pollutant service is not in gas/vapor service or in light liquid service.

E. Closed Vent Systems

Closed-vent system means a system that is not open to the atmosphere and is composed of piping, ductwork, connections, and, if necessary, flow inducing devices, that transport gas or vapor from an emission point to a control device.

F. Less Than 300 Hours Service

If components are in HAP service less than 300 hours per year, they are exempt from the LDAR monitoring requirements.

G. Instrumentation System

Instrumentation system, under Pharma and MON regulations, means a group of equipment components used to condition and convey a sample of the process fluid to analyzers and instruments for the purpose of determining process operating conditions (e.g., composition, pressure, flow, etc.). Valves and connectors are the predominant type of equipment used in instrumentation systems; however, other types of equipment may also be included in these systems. Only valves nominally 0.5 inches and smaller, and connectors nominally 0.75 inches and smaller in diameter are considered instrumentation systems for the purposes of this subpart. Valves greater than nominally 0.5 inches and connectors greater than nominally 0.75 inches associated with instrumentation systems are not considered part of instrumentation systems and must be monitored individually.

PROCEDURE:

A. General Information

1. **Equipment leak standards are prescribed by the Environmental Protection Agency. The standards are designed to control fugitive emissions (leaks) from regulated equipment through the application of work practices, standards for process equipment, and operational practices. The program most commonly used to control equipment is the Leak Detection and Repair (LDAR) program. Monitoring of fugitive emissions as part of this program substantiates the effectiveness of the work/operational practices used and the equipment standards that have been set.**

2. **Component types to be monitored, monitoring frequencies, leak definitions, regulations governing repair of leaking components, and reporting requirements are given in regulations controlled by the Environmental Protection Agency under the Clean Air Act and RCRA regulations. Procedure OB62702 outlines the equipment identification and monitoring is outlined in procedure OB62704. Monitored components are tracked in the LeakDAS database (i.e. monitoring frequency, identification, limits and etcetera).**

3. **Components found to be leaking above the threshold limit set within each applicable regulation shall have a work order notification issued for repair and shall be repaired within the time frame set forth in Maintenance General Procedure **OB421-7**.**

4. **Information relating to leaking components will be kept in the LeakDAS database (e.g. leak rate, date of repair, type of repair, verification of repair).**

B. Applicable Regulations

1. **Regulations applicable to the Orangeburg SI Group plant and the processes / equipment to which the regulations apply are given below:**

Regulation	Applicability	Process Unit
40 CFR Part 60 Subpart Kb	Storage tanks >= 40m^3 capacity used for storage of volatile organic liquids (installed after 07/23/84) that require emission to be routed to a control device.	Affected Subpart Kb tanks - monitor closed vent system to control device
40 CFR Part 60 Subpart VV	Synthetic organic chemical manufacture (put in service after 01/05/81 and containing or contacting a process fluid that is at least 10% volatile organic component by weight)	Ibuprofen - acetyl chloride production
40 CFR Part 63 Subpart GGG(Pharma)	Equipment assembled to process raw materials and produce an intended product (pharmaceutical). Fluids containing at least 5% by weight HAP's	Ibuprofen & hydrogen cyanide production unit, IBB Plant 15 pharmaceutical processes.
40 CFR Part 63 Subpart FFFF(MON)	Equipment assembled to process Fluids containing at least 5% by weight HAP's organic chemicals not otherwise regulated.	702, 703, RB79, AN62, 330, 701, MMT,DIPA, Plant 7, 4716, Traffic Blending
40 CFR Parts 264 & 265 Subpart BB	Owners/operators of facilities that treat, store, or dispose of hazardous wastes containing organic concentrations of at least 10% by weight.	Hazardous Waste Boiler #4 and related volatile waste storage locations Note: Facility assumes all equipment in hazardous waste service is in Light Liquid Service.
40 CFR Part 264 Subpart AA	Permanent and semi-permanently sealed closed vent systems joints, seams and other connectors.	Boiler # 4 Storage Tanks - closed vent system to flare.
40 CFR Part 270	Emission monitoring plan.	Boiler #4 Storage Tanks - closed vent system to flare.

C. **LDAR P&ID Marking Guide and Documentation**

1. **For MACT standards, lines and equipment containing at least 5% by weight of total organic HAP's fall into the LDAR program. P&ID's for the affected equipment will be marked to indicate the affected components in the following colors. Definitions of the relevant categories are found above.**

2. **For non-MACT standards, the same markings will apply to all equipment containing 10% or greater volatile organic components (VOC's).**

Light Liquid	**Yellow**
Heavy Liquid	**Green**
Closed Vent Systems	**Light Blue**
<300 Hours Service	**Orange**
Relief valves	**Red**
Vacuum Service	**Purple**
Hazardous to Monitor	**Pink**
Instrumentation Systems	**Dark Blue**

3. **Relief valves on tanks that are utilizing the vapor equalization option (that relieve to atmosphere) must be monitored using Method 21 every quarter with no change in monitoring frequency based on leak rate. Currently this only includes T-12M-1 (hexane). These valves should be highlighted in red on the P&ID's and "Equalization".**

4. ****Documentation related to equipment in service < 300 hours/year is maintained within the LeakDAS software.****

D. Repair

1. If a leak is found on any LDAR equipment, it will be repaired as soon as possible. For purposes of regulatory compliance, this means that no later than five days from discovery of the leak, an attempt will be made to stop the leak.

2. If the leak has not been stopped after the initial attempt, the equipment must be repaired, and the leak stopped no later than fifteen days from the discovery of the leak.

3. The only exception to this repair time frame is continuously running equipment (such as a column) which falls under OB62705.

4. Leaking components will be identified and documented according to OB62702.

REVISION DOCUMENT

Date:	Description of Change
8/17/17	**Initial entry into SharePoint**
05/26/20	**Biennial review; Updated documentation for < 300 hours/year equipment**

Scope:

This document outlines the means by which equipment which comes under the Leak Detection and Repair (LDAR) program at the Orangeburg location of SI Group is identified / labeled.

Responsibility:

The Manager-Environmental Compliance is responsible for the administration of this procedure. The Environmental Department is responsible for its implementation.

Document Control:

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) **Environmental LDAR Coordinator**
2) **Lead Environmental Engineer**

It must be approved by the Manager-Environmental Compliance who is the Master Copy Holder and is responsible for all revisions.

Procedure:

A. Equipment Identification

Equipment that is to be monitored is identified through the process of reviewing the applicable standard, determining those components in the process that could have fugitive emissions in the range given in the standard, marking P&ID's for specific equipment, and identifying equipment on site map. Marked P&ID's will be kept for identification of LDAR equipment, reference and updates (through the MOC process). Digital copies will be saved on Sharepoint for use in the field. Physical tags are sometimes added to components only for ease of monitoring, not for identification purposes.

The site's Management of Change (MOC) system tracks all changes at the site which would have an LDAR impact. Pre-task assignments to the LDAR technician ensure that operational changes to equipment/processes are reviewed and documented.

Equipment that meets the criteria for being in LDAR service (i.e. PSVs, valves, pumps and agitators in HAPs service) will be assigned a unique number. This unique number will identify the equipment in the LeakDAS database which will contain information relating to that equipment with regards to LDAR (e.g. inspection history, leaks, repairs).

Should any equipment fall out of LDAR service (e.g. no longer contain HAP at 5% or greater, no longer in contact with hazardous waste, etc.), it shall be noted in the LeakDAS database by marking the equipment as inactive and giving a reason for its inactive status.

B. Lube Crew

Weekly visual inspections are required for all pumps and agitators that are in LDAR service. As it is already the function of the Lube crew to do regular inspections of all pumps and

agitators, regardless of service, the LDAR coordinator will communicate with the Maintenance Superintendent and the PMPD foreman, via email, any changes that are made to equipment in LDAR service. This will enable the Lube Crew to properly label equipment in their database as LDAR so that inspections on any short week include all LDAR equipment. Any deficiencies on LDAR equipment will be relayed to the LDAR coordinator immediately to insure that they are repaired in the required time frame. A spreadsheet will be kept in SharePoint which will contain a current list of all equipment in LDAR service.

C. Leak Tags

Equipment found to be leaking above the leak definition rate must have a Fugitive Emissions Leaker Tag applied.

The information on this tag includes the date found, leak rate, tag number, monitored by, and the reading of the equipment after repair. These tags will be maintained in the field until repairs have been made and two consecutive successful monitoring have been achieved. Records will be retained by the LDAR Technician in LeakDAS.

REVISION DOCUMENT

Date:	Description of Change
8/17/17	Initial entry into SharePoint

LDAR — TVA-1000B ANALYZER CALIBRATION & QUARTERLY CERTIFICATION
CONTROL NUMBER: OB62730
REVISION: 0

SCOPE:

This document outlines tasks performed during calibration and certification of the TVA-1000-B analyzer used for LDAR monitoring at the Orangeburg location of SI Group.

RESPONSIBILITY:

The Environmental Manager is responsible for the administration of this procedure and the Environmental Department is responsible for its implementation.

DOCUMENT CONTROL:

This procedure must be accepted by the Manager-Environmental Compliance and approved by the LDAR program manager. The Manager-Environmental Compliance is the Master Copy Holder and is responsible for all revisions.

PROCEDURE:

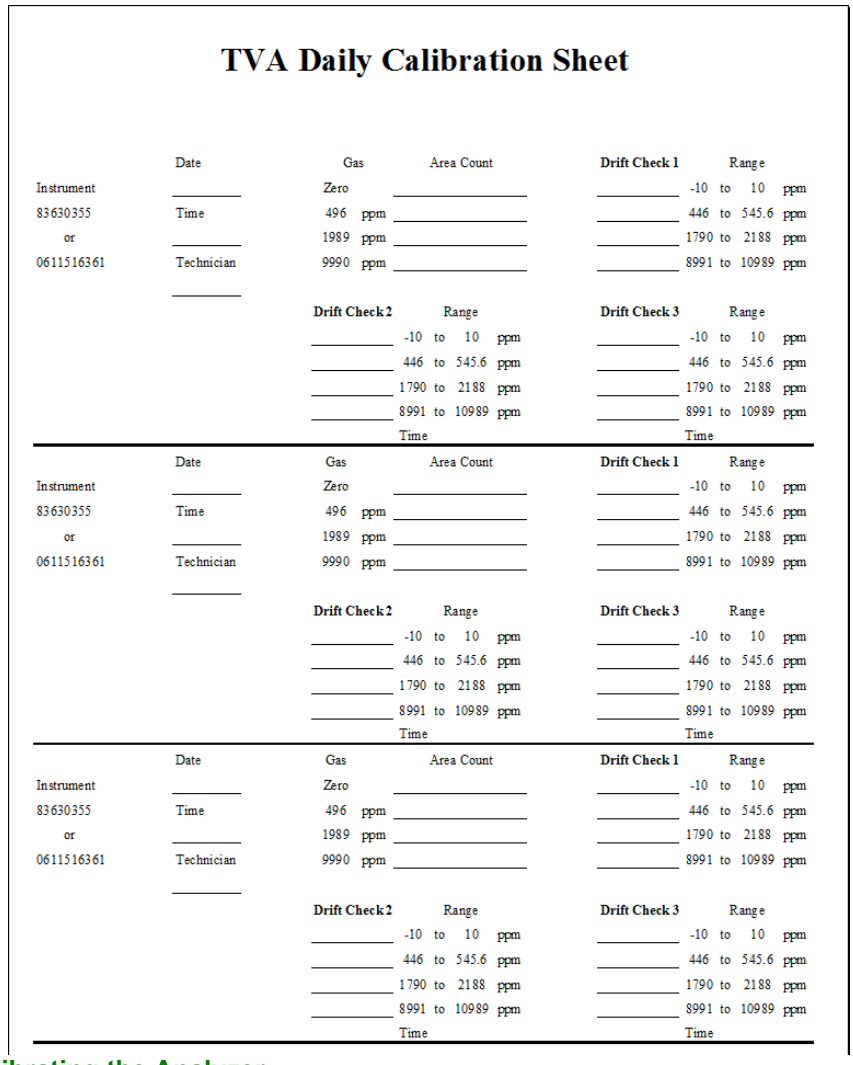
The analyzer must be calibrated each day the analyzer is used for LDAR monitoring. Certification of the analyzer must be performed on the first day used of each quarter. Criteria given on the Calibration Spreadsheet (found in SharePoint) must be met before the analyzer can be used.

A. Analyzer Preparation

1. **Remove the hydrogen cylinder from the TVA 1000-B. Acquire the pressure regulator for the TVA 1000-B.**
2. **Attach the cylinder to the regulator. Take the assembly to Analytical Services and fill the hydrogen cylinder to no more than 2000 psi (by the gauge on the end of the cylinder).**
3. **Attach the hydrogen cylinder to the analyzer.**
4. **Screw the sample probe apart. Carefully remove the metal filter from the probe and remove any trash that has collected inside.**
5. **Inspect the inside of the filter for any organic residue. If any is found, change out the filter. If a new filter is not available, take the existing filter to Analytical Services. Place the filter unit in a small beaker, cover with isopropanol (IPA), and sonicate for approximately one (1) minute. Remove the filter unit from the beaker and place in a drying oven until all residual isopropanol has evaporated. Reinstall filter.**
6. **Turn the analyzer power on.**

B. Lighting the Flame Ionization Detector (FID)

1. **Valve the hydrogen on using the red valve handle on the back of the TVA.**
2. **Press the CONTROL key on the instrument panel.**
3. **Press 1 to turn the pump on.**
4. **Allow the pump to run for a few seconds to fill the lines with hydrogen.**
5. **Press 3 to ignite to detector flame. Wait a few seconds. The pump will stop momentarily...then restart.**
6. **At the main screen, check for ignition by pressing 1 for "Run". If lit, the display will show ppm readings...if not, the display will indicate that the flame did not ignite by a 'F' on the display to the right of the ppm reading. If this happens, repeat the last two steps of the ignition procedure above until the flame lights.**
7. **Allow the detector to warm up for AT LEAST thirty minutes before attempting to calibrate the analyzer. This MUST BE DONE to prevent baseline drift during the calibration process.**



TVA Daily Calibration Sheet

	Date	Gas	Area Count	Drift Check 1	Range
Instrument	_____	Zero	_____	_____	-10 to 10 ppm
83630355	Time	496 ppm	_____	_____	446 to 545.6 ppm
or	_____	1989 ppm	_____	_____	1790 to 2188 ppm
0611516361	Technician	9990 ppm	_____	_____	8991 to 10989 ppm
	_____				

Drift Check 2	Range	Drift Check 3	Range
_____	-10 to 10 ppm	_____	-10 to 10 ppm
_____	446 to 545.6 ppm	_____	446 to 545.6 ppm
_____	1790 to 2188 ppm	_____	1790 to 2188 ppm
_____	8991 to 10989 ppm	_____	8991 to 10989 ppm
	Time		Time

	Date	Gas	Area Count	Drift Check 1	Range
Instrument	_____	Zero	_____	_____	-10 to 10 ppm
83630355	Time	496 ppm	_____	_____	446 to 545.6 ppm
or	_____	1989 ppm	_____	_____	1790 to 2188 ppm
0611516361	Technician	9990 ppm	_____	_____	8991 to 10989 ppm
	_____				

Drift Check 2	Range	Drift Check 3	Range
_____	-10 to 10 ppm	_____	-10 to 10 ppm
_____	446 to 545.6 ppm	_____	446 to 545.6 ppm
_____	1790 to 2188 ppm	_____	1790 to 2188 ppm
_____	8991 to 10989 ppm	_____	8991 to 10989 ppm
	Time		Time

	Date	Gas	Area Count	Drift Check 1	Range
Instrument	_____	Zero	_____	_____	-10 to 10 ppm
83630355	Time	496 ppm	_____	_____	446 to 545.6 ppm
or	_____	1989 ppm	_____	_____	1790 to 2188 ppm
0611516361	Technician	9990 ppm	_____	_____	8991 to 10989 ppm
	_____				

Drift Check 2	Range	Drift Check 3	Range
_____	-10 to 10 ppm	_____	-10 to 10 ppm
_____	446 to 545.6 ppm	_____	446 to 545.6 ppm
_____	1790 to 2188 ppm	_____	1790 to 2188 ppm
_____	8991 to 10989 ppm	_____	8991 to 10989 ppm
	Time		Time

C. Calibrating the Analyzer

1. **Obtain one cylinder each of Zero Air, 490 ppm Methane, 1,990 ppm Methane, and 9,990 ppm Methane from the LDAR office. Check each cylinder to make sure the date is not past the expiration date.**
2. **Each cylinder should have an on demand regulator attached.**
3. **Attach probe to be used for the day to the hose on end of regulator.**
4. **According to manufacturer's instructions, zero the instrument with the Zero Air cylinder.**
5. **Calibrate the instrument with 'Span Gas 1' being 490 ppm Methane, 'Span Gas 2' being 1,990 ppm Methane, and 'Span Gas 3' being 9,990 ppm Methane.**
6. **Record the area counts for the calibration gases and the zero air on the 'TVA Daily Calibration Sheet.'**

D. Calibration Check:

1. **Press option 1 for "Run"**
2. **Enter the vendor lot number for the Zero Air, 490 ppm, 1,990 ppm, and the 9,990 ppm Methane in the 'TVA Daily Calibration' spreadsheet.**
3. **Enter the name of the person doing the calibration and the instrument being calibrated into the spreadsheet.**
4. **Take a readings of the Zero Air, recording the value. Values are recorded to the nearest tenth ppm, any value < 0.1 ppm should be entered as a zero.**

5. **Take a readings on each of the different concentrations of Methane and record the most stable value displayed by the instrument.**
6. **The spreadsheet will alert to any abnormal readings. Click the 'Calibration & Drift' button to save all data.**
7. **If all conditions are met, the instrument is ready to be used. If NOT, contact the LDAR program coordinator immediately for further instructions.**

E. Certifying the Analyzer

Before using the TVA for the first time each quarter, the TVA must be certified.

1. **After performing the daily calibration and assuring that all values meet the criteria, proceed with certification.**
2. **Read each of the calibration gases three times and record the readings for each, allowing the analyzer to return to "zero" between each reading.**
3. **Again read each of the calibration gases three times and record the time it takes for the analyzer to reach 90% of the Methane concentration (again allowing the analyzer to return to "zero" between readings).**
4. **Record the data in the 'TVA Daily Calibration' spreadsheet.**
5. **Click the "Transfer Calibration" button in the spreadsheet to save the data.**

REVISION RECORD

Date	Description of Change
8/17/17	Initial entry into SharePoint

LDAR – FIELD MONITORING
CONTROL DOCUMENT: OB62740
REVISION: 0

SCOPE:

This document outlines the means by which field monitoring of components coming under the Leak Detection and Repair (LDAR) program is conducted at the Orangeburg location of SI Group.

RESPONSIBILITY:

The Manager-Environmental Compliance is responsible for the administration of this procedure. The Environmental Department is responsible for its implementation.

DOCUMENT CONTROL:

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) **Environmental LDAR Coordinator**
2) **Lead Environmental Engineer**

It must be approved by the Manager-Environmental Compliance who is the Master Copy Holder and is responsible for all revisions.

PROCEDURE:

A. Weekly Pump and Agitator Monitoring

Once a week, the day shift Rotator Crew visually checks each of the pumps and agitators coming under the Leak Detection and Repair program. The pumps are checked for any visual signs of leakage or odors that would indicate a leak.

If the Rotator finds a pump or agitator that appears to be leaking, he/she contacts the LDAR crew for Method 21 verification. The Rotator Tech also writes an email message to the LDAR Technician. The LDAR technician performs Method 21 testing to confirm the presence of a Leak. If a Leak is found a work order is created for the seal to be repaired. Whether or not a defined leak is detected, an email message is sent back to the Rotator Tech.

Both the results of the pump monitoring and the work order numbers associated with any leakers are given on the Field Sheets for Routine Monitoring Surveys (see Section 4.04: Reporting for form). A copy of the email message for any leaking components is routed to the LDAR Technician for filing.

Guidance for the rotator crew is given in procedure G0018

B. Periodic Route Monitoring

Monitoring is done using a desktop computer, hand held computer (data logger), computer software which allows bidirectional communication between the two, and a portable gas chromatograph (TVA 1000b).

Currently, there are five applicable regulations under which plant components fall (see OB62702). As outlined, each monitored component is identified with a component number. Information describing the type of component, its location, its component number, and the

applicable regulation under which the component falls are stored in a database controlled by the LeakDAS software. Route monitoring is done as often as necessary, determined by the regulation.

Applicable Regulation	Monitored process / system	Equipment	When Monitored
40 CFR Part 264 Subpart AA	Boiler No. 4 Storage Tanks	Closed vent system from T-100M-5 (T8332) to flare.	Initial monitoring done via Method 21, afterwards system will be visually monitored annually.
40 CFR Part 264 Subparts BB & CC	Hazardous Waste Storage Tanks, ancillary equipment, and Boiler No. 4	Pumps	Monthly
	Hazardous Waste Storage Tanks, ancillary equipment, and Boiler No. 4	Valves	First month of the second quarter. Note that the site has not encountered any leaking valves and hence has not needed to utilize the alternative standard per 264/265.1061.
40 CFR Part 60 Subpart VV	Ibuprofen - acetyl chloride production	pumps and agitators	Monthly
	Ibuprofen - acetyl chloride production	valves	First month of the second quarter
40 CFR Part 60 Subpart VVa	4716 Methanol	Resin Bed	As required but no less frequently than once a year.
40 CFR Part 60 Subpart Kb	Ibuprofen	Hexane vent to incinerator	Annual monitoring of closed vent system
40 CFR Part 63 Subpart GGG	Ibuprofen	Pumps - All except AcCl. DIP, Other Pharma processes with HAP's	Monthly
	Ibuprofen	Valves- All except AcCl. DIP, Other Pharma processes with HAP's	At least as frequently as required by the regulation based on leak rate.
	Ibuprofen	Connectors All except AcCl. DIP, Other Pharma processes with HAP's	50% every four years
40 CFR Part 63 Subpart FFFF	All MON Process	Pumps and agitators	Monthly
	All MON Process	Valves	At least as frequently as required by the regulation based on leak rate. Quarterly for relief valves on "vapor equalization option" storage tanks, i.e.: T-12M-1.

Leak definitions for equipment, specified by the appropriate regulations, are:

Applicable Regulation	Equipment Type	Leak Definition
40 CFR Part 264/265 Subparts BB & CC	Pump	10,000 ppm
	Valve	10,000 ppm
	PSV	500 ppm
40 CFR Part 60 Subpart VV	Agitator	10,000 ppm
	Pump	10,000 ppm
	Valve	10,000 ppm
	PSV	500 ppm
40 CFR Part 60 Subpart VVa	Pump	2,000 ppm
	Valve	500 ppm
	PSV	500 ppm
40 CFR Part 63 Subpart GGG	Agitator	10,000 ppm
	Pump	2,000 ppm
	Valve	500 ppm
	PSV	500 ppm
	Connector	500 ppm
40 CFR Part 63 Subpart FFFF	Agitator	10,000 ppm
	Pump	1,000 ppm
	Valve	500 ppm
	PSV	500 ppm

C. Creating the Monitoring Route and Downloading to the Data Logger

LeakDAS software will suggest components which need to be monitored based on current knowledge of the regulations. As the software suggests components based on data that has been entered, these suggestions should be verified to be accurate.

D. Downloading to the Data Logger

The data logger used for monitoring (Symbol MC9090) resides in a battery charging cradle to keep the battery charged at all times. The data logger is connected via the cradle to the computer and through that to the LeakDAS database. Once LeakDAS monitoring suggestions have been verified, routes are downloaded to the data logger via the LeakDAS software.

E. Configuring the Data Logger

The data logger is equipped with LeakDAS Mobile software and Windows Mobile 6.1. This software enables the data logger to communicate with the computer for transfer of routes and of monitoring. The LeakDAS Mobile software also allows the data logger to connect with the TVA. Configuring the data logger so that it functions properly requires a knowledge of LeakDAS software (desktop and mobile), Window Mobile, and knowledge of the LeakDAS database and address. Changes should not be made to any of the above software or pieces of equipment by anyone other than the LDAR program coordinator.

F. Monitoring

Monitoring is done according to the EPA method 21 standards (technician should traverse the entire possible leak interface of component with probe and hold probe at highest reading for twice the time of equipment response). Monitoring is done using a TVA-1000B connected to a data logger via a WDA-1000 or WDA-2000 Blue Tooth adapter. Monitoring technician should know the basics of the LeakDAS Mobile software as well as a minimum of Windows Mobile to be able to troubleshoot connectivity issues in the field(as all software can be complicated and

the EPA is very specific about Method 21, monitoring should not be attempted by anyone who has not been trained.) After performing a daily calibration and assuring that the TVA has been certified for the quarter, the TVA is then connected to the data logger via a WDA-1000 Blue Tooth adapter. The LeakDAS Mobile software is launched and monitoring of the downloaded route can begin. Make sure the analyzer is on 'Run'. Proceed into the field.

REVISION DOCUMENT

Date:	Description of Change
8/17/17	Initial entry into SharePoint

HAP	TVA Response Factor	Processes
Routine Heavy Liquid HAP's — no Method 21		
Aniline	Heavy Liquid	No longer used
Phenol	Heavy Liquid	2,6 DTBP crude
Diethylene Glycol	Heavy Liquid	RB79
Routine Light Liquid HAP's		
Hexane	0.426	Ibuprofen
Methanol	3.815	Ibuprofen & 4716
Toluene	0.339	IBB
Methylene Chloride	1.1142	330
Formaldehyde	7.2867	330 & 702
Ethylene Glycol	3.6	MMT
Glycol ethers (DMC, methoxyethanol?)	8.9	MMT
Propylene Oxide	0.92	RB79
Impurities or Occasional Compounds		
Benzene	0.346	
Acetonitrile	1.134	
Cumene	2.75	
Ethyl Benzene	0.341	
Methyl Chloride	0.997	
Methy Isobutyl ketone	0.452	
Methy tert butyl ether	0.547	
Cyanide compounds	UTM	
Triethylamine	0.385	
Xylenes	0.319	

SCOPE:

This document outlines procedures implemented when a new process is brought on site to ensure compliance with the Clean Air Act via the Leak Detection and Repair (LDAR) program. This procedure is applicable to all process equipment coming under the regulations of the Environmental Protection Agency with respect to control of fugitive emission. Process components coming under this programs include, but are not limited to: pumps, compressors, pressure relief devices, sampling connections, open ended lines, process valves, and closed-vent systems and control devices. NOTE: Connectors under GGG must be monitored via Method 21. All other regulations allow connectors to be monitored via visual, auditory or olfactory methods.

RESPONSIBILITY:

Administration: Environmental Affairs Department
Implementation: Environmental Affairs Department

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) **Environmental LDAR Coordinator**

It must be approved by the Manager-Environmental Compliance who is the Master Copy Holder and is responsible for all revisions.

DOCUMENT REFERENCES:

A. **40 CFR Part 60**

B. **40 CFR Part 63**

C. **40 CFR Part 264**

PROCEDURE:

A. General Information

1. **When a new process is brought on site, it must be evaluated for MACT standards applicability. This is done via evaluation and development of an Operating Scenario for the process. If HAP's are involved, then LDAR is likely to apply and must be addressed prior to startup. If no HAP's are involved, the Operating Scenario will state this and no further action is needed for LDAR. The LDAR coordinator will inform the lube crew, via email to maintenance superintendent and the PMPD foreman, of the new equipment being brought into service, and which falls under LDAR.**

2. **Regulations controlled by the Environmental Protection Agency under the Clean Air Act.**

B. LDAR development

1. **Operations or PT will mark up P&ID's as described in OB62701.**

2. **LDAR coordinator will determine if response factors exist for any new HAP's that are part of the process. If not, these must be developed, or alternate means of monitoring via Method 21 must be found.**

   See attached file for current list of response factors.

response factors.xls

3. **LDAR technicians will input the new components into the LeakDAS database and develop a monitoring run based on the appropriate regulation. Component types to be monitored, monitoring frequencies, and leak definitions, are defined in the applicable regulation.**

   Note: Pump and Agitator monitoring must begin in the first month that startup occurs.

4. **LDAR coordinator will communicate any changes in weekly pump and agitator inspections to the lube crew via email to maintenance superintendent and the PMPD foreman. The lube crew will modify their weekly inspection sheets to reflect the changes.**

   Note: Pump and Agitator visual inspections must begin in the first week that startup occurs.

5. **The LDAR coordinator will notify the lube crew and PMPD foreman when the equipment is ready for startup and needs to be monitored. He will also confirm that the new lube route includes the proper equipment under LDAR.**

REVISION DOCUMENT

Date:	Description of Change
8/17/17	Initial entry into SharePoint

SCOPE:

This document defines what SI Group considers Unsafe to Monitor (UTM) components and outlines procedures implemented to ensure compliance with the Clean Air Act via the Leak Detection and Repair (LDAR) program.

Responsibility:

The **Manager-Environmental Compliance is responsible for the administration of this procedure. The Environmental Department is responsible for its implementation.**

Document Control:

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) **Environmental LDAR Coordinator**
2) **Lead Environmental Engineer**

It must be approved by the **Manager-Environmental Compliance who is the Master Copy Holder and is responsible for all revisions.**

DOCUMENT REFERENCES:

A. 40 CFR Part 60

B. 40 CFR Part 63

C. 40 CFR Part 264

DEFINITION

Unsafe to Monitor

The EPA considers any agitators, pumps, valves or connectors unsafe to monitor (UTM) if, during monitoring, personnel would be exposed to an immediate danger.

PROCEDURE

1. **As it applies to SI Group Corporation's Orangeburg, South Carolina facility, this means that all process equipment containing hydrogen cyanide is unsafe to monitor. This equipment is UTM because leak levels below which the EPA defines a leak, would be immediately fatal to personnel. This is the only process covered under PHARMA that is considered UTM. Currently, there are no process covered under MON, RCRA (BB) or VV that are UTM.**

2. **All UTM components shall be subject to pressure checks at least annually. Also, any time it is necessary to break into process equipment for the purposes of repair or general maintenance, once work is completed, a pressure check shall be done before returning equipment to service. The pressure drop must be less than 1 psig over a 60 minute period to pass.**

REVISION DOCUMENT

Date:	Description of Change
8/17/17	Initial entry into SharePoint

SCOPE:

This procedures outlines the specifics put forth in EPA regulations for pressure testing systems in lieu of Method 21 monitoring.

RESPONSIBILITY:

The ** Manager - Environmental Compliance is responsible for the administration of this procedure. **The Air Specialists is responsible for the implementation of this procedure.** The **Sr. Production Manager - South** or the immediate supervisor, is responsible for approving this procedure as it will be his/her responsibility the plant follows the procedure.**

DOCUMENT CONTROL:

This procedure must be reviewed by:

1) ** Sr. Lab Technician (Environmental LDAR Coordinator)**
2) **Lead Environmental Engineer (Air Specialists)**
3) **Sr. Production Manager – South**

It must be approved by the Manager - Environmental **Compliance who is the Master Copy Holder.**

DOCUMENT REFERENCES:

A. **40 CFR Part 63**

B. **40 CFR Part 63.178**

C. **40 CFR Part 63.180(f)**

Affected Equipment

Any of the equipment within the cells that contain HCN. To include R9901, E9901, C9972, E9972, C9973, E9973, C9974, D9962, D9122, D9125 and all the associated equipment and piping for these vessels.

Procedure

Any of the affected equipment for which maintenance must break into the system to make repairs shall upon completion of maintenance activity have a pressure test done.

All affected equipment will have an annual pressure test at least once per calendar year, regardless of maintenance activity.

Pressure test shall use pressure above the highest operating pressure of the vessel and below the pressure safety device.

Pressure test duration shall be at least 15 minutes and as long as necessary to show a pressure drop rate of less than 1 psig/hour.

If a pressure test cannot meet this limit then operations and maintenance will take whatever steps are necessary to stop the leak and perform additional pressure test. Equipment will not be returned to service until a pressure test meets the limit.

Pressure will be monitored using Rosemount Pressure Transmitter model 3051T, or equivalent accuracy, as these instruments have been determined to meet EPA specifications. Any change to the transmitter or transmitter type must meet the requirements in 40CFR63.180(f)(4).

REVISION RECORD	
09/19/17	**Revised to capture correct number sequence in SharePoint. Changed titles throughout.**
03/25/2018	**Revised titles.**

Appendix N-2
List of Components Monitored

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35433	000103	T8345 BOT==OV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	AUTOMATIC	annually
51035	000107	T8332= MV out the bottom of T8332 bleed	T8332	1	OBH25F009	RCRA	VALVE	BALL	annually
35686	000110	T8332 BOT== MV on line into the side of T8335	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35644	000111	D8365 TOP== MV on the end of the loop line	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35643	000112	D8365 TOP== MV on line back into D8365 from loop	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35516	000113	T8331 SIDE==MV off Side	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35542	000118	T8331 SIDE==MV off Line from Filter	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35642	000145	D8365 BOT= MV off of loop line	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35641	000146	D8365 BOT= MV on loop on side of D8365	T8332	2	OBH25F009	RCRA	VALVE	BALL	annuallly
35640	000147	D8365 BOT= MV on line to P8332	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35626	000148	MV on line to Waste Unload/ Load	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
35664	000150	P8332== MV on line to Load/ Unload	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35500	000302	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
50485	000303	Boiler #4 SIDE==drain MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
50486	000304	Boiler #4 SIDE==drain MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
50487	000305	Boiler #4 SIDE==drain MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35497	000306	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35499	000307	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35493	000308	Boiler #4 SIDE==MV off Relief Line	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35492	000309	Boiler #4 SIDE==MV off Relief Line	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35475	000311	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35495	000314	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35515	000317	Boiler #4 SIDE==MV off Pot Line	B8394	2	OBH25F013	RCRA	VALVE	BALL	annually
35503	000321	Boiler #4 SIDE==MV off Pot Line	B8394	2	OBH25F013	RCRA	VALVE	BALL	annually
35483	000326	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35484	000327	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35480	000328	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35476	000336	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35504	000340	Boiler #4 SIDE==MV off Pot Line to PI	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
50488	000341	Boiler #4 SIDE==MV off line from FV to waste return	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
50493	000342	Boiler #4 SIDE==MV on return to waste tanks	B8394	0.5	OBH25F013	RCRA	VALVE	ROTARY	annually
35489	000343	Boiler #4 SIDE==MV on Relief Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35478	000346	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
50489	000348	Boiler #4 SIDE==MV off line from FV to waste return, bleed	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35477	000349	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35663	000467	P8332== MV off line from SZ	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35669	000469	F8332= MV on line into sample pot	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35667	000472	P8332== MV off line to Load/ Unload	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35657	000473	P8332== Sample Valve on line to Waste	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35672	000475	F8332= MV out the top ot the sample pot	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35670	000476	F8332= MV off line into sample pot(quick con)	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
51037	000509	T8332= MV of manifold above P8332	T8332	2	OBH25F009	RCRA	VALVE	MANUAL	annually
35662	000513	P8332== MV off line from SZ	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35668	000527	P8332== MV on line to Recirculation	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35680	000553	F8332= MV on line to PI	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35536	000564	T8331 SIDE==MV off Side Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35673	000565	F8332= MV out the bottom of F8332	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35674	000572	F8332= MV on line out the bottom of F8332	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35677	000594	F8332= MV on fliter pot loop line	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35678	000595	F8332= MV on line to Hazardous Waste	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35547	000596	T8331 SIDE==PSV of Filter Line	T8331	0.75	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35682	000597	F8332= PSV on tee line to T8331	T8332	2	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35684	000598	F8332= MV on line after PSV	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35675	000602	F8332= MV on fliter pot loop line	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35649	000605	P8332== MV on line into Hazardous Waste line	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35650	000606	P8332== MV off line into Hazardous Waste line	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35651	000607	P8332== MV on line into Hazardous Waste line	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35704	000610	T8332 TOP== MV off line headed from T8345	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35705	000611	T8332 TOP== PSV off line headed from T8345	T8332	3	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35706	000613	T8332 TOP== MV after PSV	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35708	000614	T8332 TOP== MV off line to Waste	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35709	000616	T8332 TOP== PSV off line to Waste	T8332	3	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35710	000619	T8332 TOP== MV after PSV	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35529	000620	T8331 SIDE==MV off Side	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35533	000622	T8331 SIDE==MV off Side Line	T8331	2	OBH25F009	RCRA	VALVE	BALL	annually
35532	000652	T8331 SIDE==MV off Side Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35531	000653	T8331 SIDE==MV off Side Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35535	000659	T8331 SIDE==MV off Side Line	T8331	0.5	OBH25F010	RCRA	VALVE	BALL	annually
35460	000679	T8333 BOT==MV off PMP DISC Line	T8333	2	OBH25F004	RCRA	VALVE	BALL	annually
35541	000710	T8331 SIDE==MV off Line from Filter	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35546	000723	T8331 SIDE==MV off Line from Filter to PSV	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35553	000724	T8331 SIDE==MV onLine after Blower	T8331	1.5	OBH25F010	RCRA	VALVE	BALL	annually
35552	000726	T8331 SIDE==MV off Line after Blower	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35554	000727	T8331 SIDE==MV onLine after Blower	T8331	1.5	OBH25F010	RCRA	VALVE	BALL	annually
35562	000728	T8331 SIDE==MV off Line after PMP	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35563	000729	T8331 SIDE==PSV off PMP DISC Line	T8331	0.75	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35564	000738	T8331 SIDE==MV off Line after PMP	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35559	000776	T8331 SIDE==MV off Line after PMP	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35560	000792	T8331 SIDE==PSV off PMP DISC Line	T8331	0.75	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35561	000798	T8331 SIDE==MV off Line after PMP	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35557	000823	T8331 SIDE==MV on Line after PMP	T8331	1.5	OBH25F010	RCRA	VALVE	BALL	annually
35558	000824	T8331 SIDE==MV on Line after PMP	T8331	1.5	OBH25F010	RCRA	VALVE	BALL	annually
35550	000825	T8331 SIDE==MV off Line from Filter after PSV	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35660	000826	P8332== MV on line to Load/Unload	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35439	000828	T8333 BOT==MV on TANK DISC Line	T8333	2	OBH25F004	RCRA	VALVE	BALL	annually
35447	000829	T8333 BOT==MV on TANK DISC Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35443	000832	T8333 BOT==MV off TANK DISC Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35449	000833	T8333 BOT==MV on PMP DISC Line to PI	T8333	0.5	OBH25F004	RCRA	VALVE	BALL	annually
35458	000835	T8333 BOT==PSV off PMP DISC Line	T8333	1	OBH25F004	RCRA	PSV	PSV w/o rd to process	
35633	000849	MV on pump loop line	Boiler Trailer Unload	3	OBH25F007	RCRA	VALVE	BALL	annually
35625	000850	MV on line to Supply	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
35627	000951	MV on line to Waste Unload/ Load	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
35632	000952	MV on pump loop line	Boiler Trailer Unload	3	OBH25F007	RCRA	VALVE	BALL	annually
35639	000953	MV on pump loop line	Boiler Trailer Unload	0.5	OBH25F007	RCRA	VALVE	BALL	annually
35628	000955	MV on line to PI off of line to Waste Unload/ Lo	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
35629	000956	MV on line to PSV off of line to Waste UnL/L	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
35630	000957	PSV on line to trench	Boiler Trailer Unload	3	OBH25F007	RCRA	PSV	PSV w/o rupture to grade	
35636	000962	MV off line to PI off of pump loop line	Boiler Trailer Unload	0.5	OBH25F007	RCRA	VALVE	BALL	annually
35637	000963	MV off line to PI off of pump loop line	Boiler Trailer Unload	0.5	OBH25F007	RCRA	VALVE	BALL	annually
51040	000964	MV off line to PI bleed	Boiler Trailer Unload	0.5	OBH25F007	RCRA	VALVE	BALL	annually
35638	000965	OV on top of trailer load	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	AUTOMATIC	annually
35715	000966	MV on top of trailer load	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
35461	000973	T8333 BOT==OV on Tank DISC Line	T8333	2	OBH25F004	RCRA	VALVE	AUTOMATIC	annually
35452	000975	T8333 BOT==PSV off PMP DISC Line	T8333	0.75	OBH25F004	RCRA	PSV	PSV w/o rd to process	
35462	000978	T8333 BOT==MV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	VALVE	BALL	annually

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35454	000979	T8333 BOT==MV off PMP DISC Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35450	000982	T8333 BOT==MV on PMP DISC Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35444	000983	T8333 BOT==MV off TANK DISC Line	T8333	1	OBH25F004	RCRA	VALVE	BALL	annually
35416	000984	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35420	000985	T8345 BOT==MV off PMP INTAKE Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35419	000986	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35417	000988	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35422	000989	T8345 BOT==MV off PMP DISC Line to PI	T8345	0.5	OBH25F015	RCRA	VALVE	BALL	annually
35423	000990	T8345 BOT==SAMPLE VLV off PMP DISC Line	T8345	0.5	OBH25F015	RCRA	VALVE	SAMPLE	annually
35425	000996	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35424	000997	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35426	000998	T8345 BOT==MV off Tank DISC Line	T8345	0.75	OBH25F015	RCRA	VALVE	BALL	annually
50214	000999	T8345 BOT==MV off Tank DISC Line	T8345	1	OBH25F015	RCRA	VALVE	BALL	annually
51039	001177	T8332= MV on manifold above P8332	T8332	2	OBH25F009	RCRA	VALVE	MANUAL	annually
35665	001557	P8332== MV off line to Load/ Unload	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35494	001558	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35498	001560	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
50490	001562	Boiler #4 SIDE==MV bleed of waste fuel inlet before pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35487	001564	Boiler #4 SIDE==PSV on Relief Line	B8394	0.75	OBH25F013	RCRA	PSV	PSV w/o rd to process	
35537	001603	T8331 SIDE==MV off Side Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35528	001620	T8331 SIDE==VLV off Tank DISC	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35463	001836	T8333 BOT==PSV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	PSV	PSV w/o rd to process	
35459	001837	T8333 BOT==MV off PMP DISC Line	T8333	1	OBH25F004	RCRA	VALVE	BALL	annually
35453	001839	T8333 BOT==MV off PMP DISC Line	T8333	1	OBH25F004	RCRA	VALVE	BALL	annually
35466	001841	T8333 BOT==MV on Tank DISC Line	T8333	2	OBH25F004	RCRA	VALVE	BALL	annually
35676	001842	F8332= PSV on fliter pot loop line	T8332	2	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35655	001844	P8332== MV off line to Grade	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35654	001845	P8332== MV on line to Grade	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35656	001846	P8332== MV off line to Grade on line to PI	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
51038	001847	T8332= MV on line to PSV	T8332	0.75	OBH25F009	RCRA	VALVE	MANUAL	annually
35539	001870	T8331 SIDE==MV off Side Line to Filter	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35418	001916	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35441	001931	T8333 BOT==MV off TANK DISC Line	T8333	2	OBH25F004	RCRA	VALVE	BALL	annually
35455	001932	T8333 BOT==Sample VLV off PMP DISC Line	T8333	3	OBH25F004	RCRA	VALVE	SAMPLE	annually
35538	002175	T8331 SIDE==MV off Side Line	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35565	002506	T8331 SIDE==MV off Line after PMP	T8331	1.5	OBH25F010	RCRA	VALVE	BALL	annually
35544	002889	T8331 SIDE==PSV of Filter Line	T8331	0.75	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35566	002966	T8331 TOP==MV on FA Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35437	002985	T8345 TOP==MV on PSV Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35434	003024	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35683	003591	F8332= MV on line to PSV	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35634	003648	MV on line after flex hose	Boiler Trailer Unload	3	OBH25F007	RCRA	VALVE	BALL	annually
50491	003650	Boiler #4 SIDE==PCV after pots on way to boiler	B8394	0.5	OBH25F013	RCRA	VALVE	AUTOMATIC	annually
35551	003802	T8331 SIDE==Blower	T8331	0	OBH25F010	RCRA	PUMP	PUMP	monthly
35648	003803	T8332----pump-8332	T8332	3	OBH25F009	RCRA	PUMP	CENTRIFUG	monthly
35446	003804	T8333 BOT==PMP	T8333	0	OBH25F004	RCRA	PUMP	CENTRIFUG	monthly
35421	003805	T8345 BOT==PMP	T8345	0	OBH25F015	RCRA	PUMP	CENTRIFUG	monthly
35522	003806	T8331 SIDE== PMP	T8331	0	OBH25F010	RCRA	PUMP	CENTRIFUG	monthly
35631	003808	pump P8335	T8335	3	OBH25F007	RCRA	PUMP	CENTRIFUG	monthly
35502	003833	Boiler #4 SIDE==MV off Pot Line	B8394	2	OBH25F013	RCRA	VALVE	BALL	annually
35523	003837	T8331 SIDE==VLV off PMP DISC	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35525	003842	T8331 SIDE==VLV off PMP DISC	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35527	003845	T8331 SIDE==VLV on Tank DISC	T8331	4	OBH25F010	RCRA	VALVE	BALL	annually
35524	003847	T8331 SIDE==VLV on PMP DISC	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35652	003854	P8332== MV off line into Hazardous Waste line	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35496	003856	Boiler #4 SIDE==MV off Pots	B8394	0.5	OBH25F013	RCRA	VALVE	BALL	annually
35519	003858	T8331 SIDE==VLV on PMP INTAKE	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35521	003860	T8331 SIDE==VLV off PMP INTAKE to PI	T8331	0.5	OBH25F010	RCRA	VALVE	BALL	annually
35635	003865	MV off line after flex hose	Boiler Trailer Unload	3	OBH25F007	RCRA	VALVE	BALL	annually
35448	003875	T8333 BOT==MV on TANK DISC Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35556	003878	T8331 SIDE==PMP	T8331	0	OBH25F010	RCRA	PUMP	CENTRIFUG	monthly
35482	003881	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35520	003883	T8331 SIDE==VLV off PMP INTAKE to PI	T8331	0.5	OBH25F010	RCRA	VALVE	BALL	annually
35486	003884	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35491	003889	Boiler #4 SIDE==MV off Relief Line	B8394	0.5	OBH25F013	RCRA	VALVE	ROTARY	annually
35658	003895	P8332== MV on line to Waste	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35479	003897	Boiler #4 SIDE==MV on Purge PMP Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35518	003899	T8331 SIDE==Sample VLV off PMP INTAKE	T8331	3	OBH25F010	RCRA	VALVE	STRAHMAN	annually
35442	003953	T8333 BOT==MV off TANK DISC Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35707	004158	T8332 TOP== MV on line to Waste	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35545	004160	T8331 SIDE==MV off Line from Filter after PSV	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35703	004162	T8332 TOP== MV on line headed from T8345	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35549	004238	T8331 SIDE==MV off Line from Filter after PSV	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35488	004242	Boiler #4 SIDE==MV on Relief Line	B8394	0.75	OBH25F013	RCRA	VALVE	BALL	annually
35543	004245	T8331 SIDE==MV off Line from Filter to PSV	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
35573	004572	T8331 TOP==LCV on FU Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35534	004616	T8331 SIDE==MV off Side Line	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35436	004618	T8345 TOP==PSV	T8345	2	OBH25F015	RCRA	PSV	PSV w/o rd to process	
35681	004701	F8332= MV on line to Hazardous Waste	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35457	004703	T8333 BOT==MV off PMP DISC Line	T8333	1	OBH25F004	RCRA	VALVE	BALL	annually
35570	004910	T8331 TOP==MV on FU Line	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35469	004990	T8333 BOT==PSV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	PSV	PSV w/o rd to process	
35471	005000	T8333 TOP==MV on NZ Line	T8333	1.5	OBH25F004	RCRA	VALVE	BALL	annually
35574	005033	T8331 TOP==MV on FU Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35427	005034	T8345 BOT==PRV off Tank DISC Line	T8345	0.75	OBH25F015	RCRA	PSV	PSV w/o rd to process	
35430	005069	T8345 BOT==MV off Tank DISC Line	T8345	1	OBH25F015	RCRA	VALVE	BALL	annually
35451	005099	T8333 BOT==MV off PMP DISC Line	T8333	0.75	OBH25F004	RCRA	VALVE	BALL	annually
35473	005100	T8333 TOP==MV on FA Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35571	005127	T8331 TOP==MV on FU Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35440	005130	T8333 BOT==MV on TANK DISC Line	T8333	4	OBH25F004	RCRA	VALVE	BALL	annually
35530	005132	T8331 SIDE==MV off Side	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35569	005208	T8331 TOP==MV on NZ Line	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35572	005210	T8331 TOP==MV on FU Line	T8331	2	OBH25F010	RCRA	VALVE	BALL	annually
35432	005278	T8345 BOT==MV off Tank DISC Line	T8345	0.75	OBH25F015	RCRA	VALVE	BALL	annually
35576	005331	T8331 TOP==PSV on FU Relief Line	T8331	0.75	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35438	005332	T8345 TOP==MV on Line to T8332	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35577	005334	T8331 TOP==MV on FU Relief Line	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35567	005343	T8331 TOP==PSV on FA Line	T8331	2	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35517	005364	T8331 SIDE==MV off Side	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35568	005653	T8331 TOP==PSV on FA Line	T8331	16	OBH25F010	RCRA	PSV	PSV w/o rd to process	
35464	005810	T8333 BOT==PSV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	PSV	PSV w/o rd to process	
35474	005879	T8333 TOP==PSV on FA Line	T8333	2	OBH25F004	RCRA	PSV	PSV w/o rd to process	
35526	005909	T8331 SIDE==VLV on PMP DISC	T8331	3	OBH25F010	RCRA	VALVE	BALL	annually
35555	006233	T8331 SIDE==MV off Line after Blower	T8331	1	OBH25F010	RCRA	VALVE	BALL	annually
35429	006502	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually

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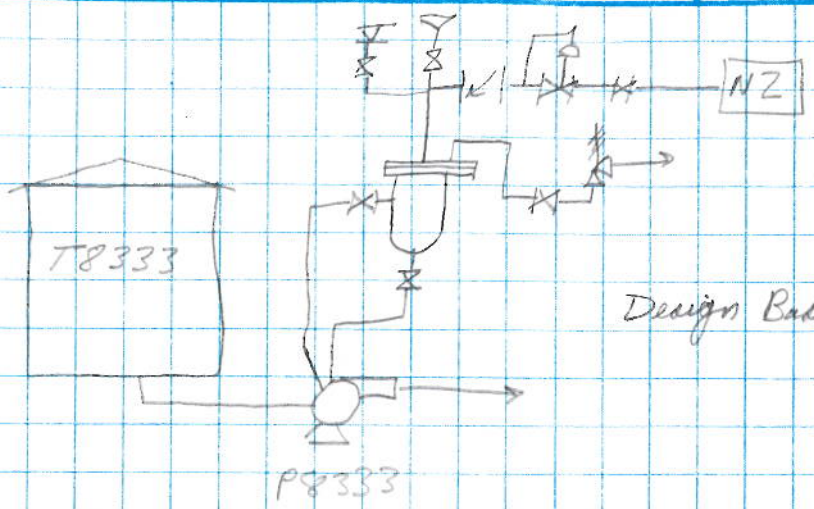
Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
35691	007382	T8332 TOP== PSV on line to D8365	T8332	8	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35689	007384	T8332 TOP== conservation vent on top of T8332	T8332	24	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35693	007385	T8332 TOP== MV on line to T8331	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35692	007386	T8332 TOP== MV on NZ line into the top of T8332	T8332	1	OBH25F009	RCRA	VALVE	BALL	annually
35688	007387	T8332 SIDE== MV into the side of T8335	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35687	007388	T8332 SIDE== MV into the side of T8335	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35685	007389	T8332 BOT== MV on line into the bottom of T8335	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35694	007390	T8332 TOP== MV on line into the top of T8332	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35695	007391	T8332 TOP== MV off line into the top of T8332	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35697	007393	T8332 TOP== OV on line into the top of T8332	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35645	007394	D8365 TOP== PSV on line out of the top of D8365	T8332	4	OBH25F009	RCRA	PSV	PSV w/o rd to process	
35431	007428	T8345 BOT==PRV off Tank DISC Line	T8345	1	OBH25F015	RCRA	PSV	PSV w/o rd to process	
35472	008031	T8333 TOP==MV on Drain Line	T8333	3	OBH25F004	RCRA	VALVE	BALL	annually
35415	008037	T8345 BOT==MV on Tank DISC Line	T8345	2	OBH25F015	RCRA	VALVE	BALL	annually
35699	008526	T8332 TOP== MV off line into the top of T8332	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35647	008527	P8332== MV on loop line	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35666	008528	P8332== MV on line to Load/ Unload	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35646	008529	P8332== MV off of line from D8365 to P8332	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35702	008530	T8332 TOP== MV on line from P9331A	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35701	008531	T8332 TOP== MV on line from P9331A	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35711	008532	T8332 TOP== MV on line to Waste	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
35713	008533	T8332 TOP== MV on line to T8331	T8332	3	OBH25F009	RCRA	VALVE	BALL	annually
50495	008550	T8332 TOP== MV on line from Boiler to tank	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
50496	008551	T8332 TOP== MV on line from P9331A to tank	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
35548	008673	T8331 SIDE==MV off Line from Filter after PSV	T8331	0.75	OBH25F010	RCRA	VALVE	BALL	annually
50494	017854	P8332== MV on line from 702	T8332	2	OBH25F009	RCRA	VALVE	BALL	annually
52145	019303	T8345 BOT==Bleed on pump inlet	T8345	1	OBH25F015	RCRA	VALVE	BALL	annually
52146	019304	MV under PI	Boiler Trailer Unload	2	OBH25F007	RCRA	VALVE	BALL	annually
51632	019659	T8332 TOP== MV on NZ line into the top of T8332	T8332	0.25	OBH25F009	RCRA	VALVE	BALL	annually
51633	019662	T8333 TOP==MV on LSV line	T8333	0.25	OBH25F004	RCRA	VALVE	BALL	annually
51634	019663	T8333 TOP==MV on LSV line	T8333	0.25	OBH25F004	RCRA	VALVE	BALL	annually
51635	019664	T8333 BOT==MV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	VALVE	BALL	annually
51636	019665	T8333 BOT==MV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	VALVE	BALL	annually
51637	019666	T8333 BOT==MV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	VALVE	BALL	annually
51638	019667	T8333 BOT==MV off Tank DISC Line	T8333	0.75	OBH25F004	RCRA	VALVE	BALL	annually

Subpart BB Equipment Listing

Component ID	Component Tag	LocationDescription	Property	Size Of	Drawing	Unit Description	Component Class	Component Type	W/M/Q/A
51639	019668	T8345 BOT==MV on N2	T8345	1	OBH25F015	RCRA	VALVE	BALL	annually
51640	019669	T8345 BOT==MV on N2 bleed	T8345	1	OBH25F015	RCRA	VALVE	BALL	annually
51864	019816	T8332 TOP== MV under CV	T8332	3	OBH25F009	RCRA	VALVE	ROTARY	annually
51868	019817	T8332 TOP== MV N of tank from CV	T8332	3	OBH25F009	RCRA	CLVS-H	VLV	annually
51883	019817N1	T8332 TOP== MV N of tank	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51882	019817N2	T8332 TOP== E of CV	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51884	019817S1	T8332 TOP== N of tank	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51885	019817S2	T8332 TOP== above drum from CV	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51866	019818	T8332 TOP== MV east of catwalk	T8332	2	OBH25F009	RCRA	VALVE	ROTARY	annually
51867	019819	T8332 TOP== MV east of catwalk bld	T8332	2	OBH25F009	RCRA	VALVE	ROTARY	annually
51865	019820	T8332 TOP== MV under CV	T8332	3	OBH25F009	RCRA	VALVE	CVS	annually
51869	019821	T8331 TOP==MV on LSH	T8331	0.5	OBH25F010	RCRA	VALVE	BALL	annually
51870	019822	T8331 TOP==MV on LSH	T8331	0.5	OBH25F010	RCRA	VALVE	BALL	annually
51871	019823	MV under PI	Boiler Trailer Unload	0.5	OBH25F007	RCRA	VALVE	BALL	annually
51899	019833	T8332 TOP== MV N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	VLV	annually
51898	019833N1	T8332 TOP== N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51897	019833N2	T8332 TOP== N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51900	019833S1	T8332 TOP== N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51894	019834	T8332 TOP== MV N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	VLV	annually
51893	019834N1	T8332 TOP== N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51892	019834N2	T8332 TOP== SE of dike wall in pipe rack	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51891	019834N3	T8332 TOP== E of dike wall in pipe rack	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51890	019834N4	T8332 TOP== E of dike wall in pipe rack	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51889	019834N5	T8332 TOP== E of dike wall in pipe rack	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51888	019834N6	T8332 TOP== nitrogen	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51887	019834N7	T8332 TOP== above drum under CV	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51886	019834N8	T8332 TOP== above drum to flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51895	019834S1	T8332 TOP== N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51896	019834S2	T8332 TOP== N of flare	T8332	3	OBH25F009	RCRA	CLVS-H	CON-cvs	annually
51946	019866	T8332 TOP== MV from CV	T8332	6	OBH25F009	RCRA	VALVE	ROTARY	annually
51947	019867	T8332 TOP== MV from CV	T8332	2	OBH25F009	RCRA	VALVE	ROTARY	annually
51948	019868	T8332 TOP== MV other tanks	T8332	2	OBH25F009	RCRA	VALVE	ROTARY	annually
51949	019869	T8332 TOP== MV other tanks	T8332	2	OBH25F009	RCRA	VALVE	ROTARY	annually
51950	019870	T8332 TOP== MV other tanks S of plat	T8332	2	OBH25F009	RCRA	VALVE	ROTARY	annually

Appendix N-3
Pressure Safety Valve Operational Set Points

SUBJECT Over Pressure Protection for Pump Oil Seal Pot	FILE PSV-T8333-5119
	DATE 7/30/03
DWG: 25F004	BY F. B. ISZARD



Design Basis: Failed Regulator

Relief Valve

3/4 x 1 - 873

$P_{SET} = 100 PSIG - (14.7 PSIA)$

OVPR = 10%

$P_{FLOW} = 100(1.1) + 14.7 = (124.7 PSIA)$

N_2 Regulator

size = 1/2"

Sizing Fluid

N_2 Gas

@ $P_{FLOW} = 124.7 PSIA$

$\mu = 0.0175 cP$

$k = 1.4$

Excel estimates $A_{MIN} = 0.066 IN^2$ and $d_{MIN} = \sqrt{\frac{4(0.066)}{\pi}} = 0.289 IN$

∴ the existing RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-873	100	7/17/91	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-1	TJ-30703	UV-NB	T8333-5119

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4" MNPT	1" FNPT	.110 SQ.IN.

Air Capacity	Water Capacity	Steam Capacity
208 C/F/A		

Base Matl	Body Matl	Spring Matl
316 S/S		C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S		304-316 S/S

Comments

Originator: L. FOGLE

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-873	Boiler	UT	25	OR-UT-A-A-T8333 -PSV5119	25F004	Oil

Level	Height	North	East	Location
GROUND	4	0	0	SEAL OIL POT FOR PC-300-60-23, EAST SIDE OF T-30M-61

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
100	2	Yes	8/26/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
RK	08/26/02		Yes	No	Yes	No	
JEH	09/28/00	84	Yes		No	No	
GMJ	07/09/98	81	Yes		No	No	
GS	07/30/96	83	Yes		No	No	
GS	06/06/95	83	Yes		No	No	
TOM	08/18/94	73	Yes		No	No	
TOM	08/18/93	73	Yes		No	No	
TM	07/07/92	79	Yes		No	No	
GS	10/02/91	80	Yes		No	No	INSTALLED ON SEAL OIL POT PC-300-60-23

Tag Information:	
Project No.:	
Tag No.:	PSV- T8333-5119
Vessel ID:	T8333
P&ID No.:	25F004
Line No.:	1/2 in.
Engineer:	F.B.Iszard
Date:	7/30/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	YES	VAPOR	641	1,070	0.066	0.110	0.00	0.01	-12.0
Hydraulic Expansion	NO								
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No	
Tag No.	PSV- T8333-5119
Vessel ID:	T8333
P&ID No.	25F004
Line No.	1/2 in.
Engineer	F.B.Iszard
Date:	7/30/03

PSV sizing for regulator or control valve failing wide open (Gas or Vapor Service).

Comments:

N2 pressure regulator for seal oil pot

Wide Open Coefficients for Fisher 95 Series Pressure Regulators

Body Size in.	Item No.	Cv	
1/8	1	0.8	
1/4	2	0.8	
3/8	3	1.9	
1/2	4	1.9	
3/4	5	4.4	
1	6	4.4	
1-1/4	7	12.5	
1-1/2	8	12.5	
2	9	12.5	
Other	10		User supplied Cv for other regulators or Control Valve.

Calculate Wide Open Flow Through Regulator or Control Valve

Regulator Size (Item # from above)	4
Valve Flow Coefficient, Cv	1.9
Critical Flow Factor, Cf	1
Flowing Temp, F	70
Reg. or CV Inlet Pressure, psig	150
System or Vessel MAWP	125
Downstream PSV Set Press., psig	100
PSV % Overpressure	10
% Accumulation	-12
Vessel Peak Press., psig	110
Mol. Wt.	28
Compressibility, Z	1
Viscosity, cp	0.0175
Cp/Cv	1.4
Density, lb/ft3 (flowing)	0.811
Density, lb/ft3 @ 60 F & 14.7 psia	0.0738
S. G. @ flowing temp & 14.7 psia	0.9473
S. G. @ 60 F & 14.7 psia	0.9656
Critical Pressure, psia	87.01
Critical Pressure Ratio,nc	0.5283
Actual Pressure Ratio, n	0.7571

SUBCRITICAL FLOW ACROSS REG/CV

	Critical Flow	Subcritical Flow
Flow, SCFH (14.7 psia, 60 F)	11536.8	8702.3
Flow, SCFM	192.3	145.0
Flow, lb/hr	852.8	640.7
Free Air Capacity @ STP, lb/hr	876.2	658.2
Free Air Capacity, SCFH	11468.6	8615.8

Size Safety Relief Valve

Peak Relieving Pressure, psia	124.70
Superimposed Back Press., psig	0.00
Differential Set Pressure, psig	100.00
Flowing Temperature, F	70.00
Density, lb/ft3 (flowing)	0.614
Flow, lb/hr	641
Critical Pressure, psia	65.877
Critical Pressure Ratio,nc	0.528
Actual Pressure Ratio, n	0.118

CRITICAL FLOW ACROSS PSV

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.953

Typical discharge coefficients
PSV Cd = 0.953 for air, steam, vapors & gasses (Farris Series 2600 Pressure Relief Valves)
PSD Cd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Cd by 0.9, ie: Cd = 0.9 X 0.953 (=0.8577) API RP520 2.6.2.1

C	356.1
r	0.118
F2	0.292

	Critical Flow	**Subritical Flow**
Minimum Vent Area Required, in2	0.066	0.116

Sizing Basis: CRITICAL FLOW ACROSS PSV

Minimum Vent Area Required: 0.066 sq. in.

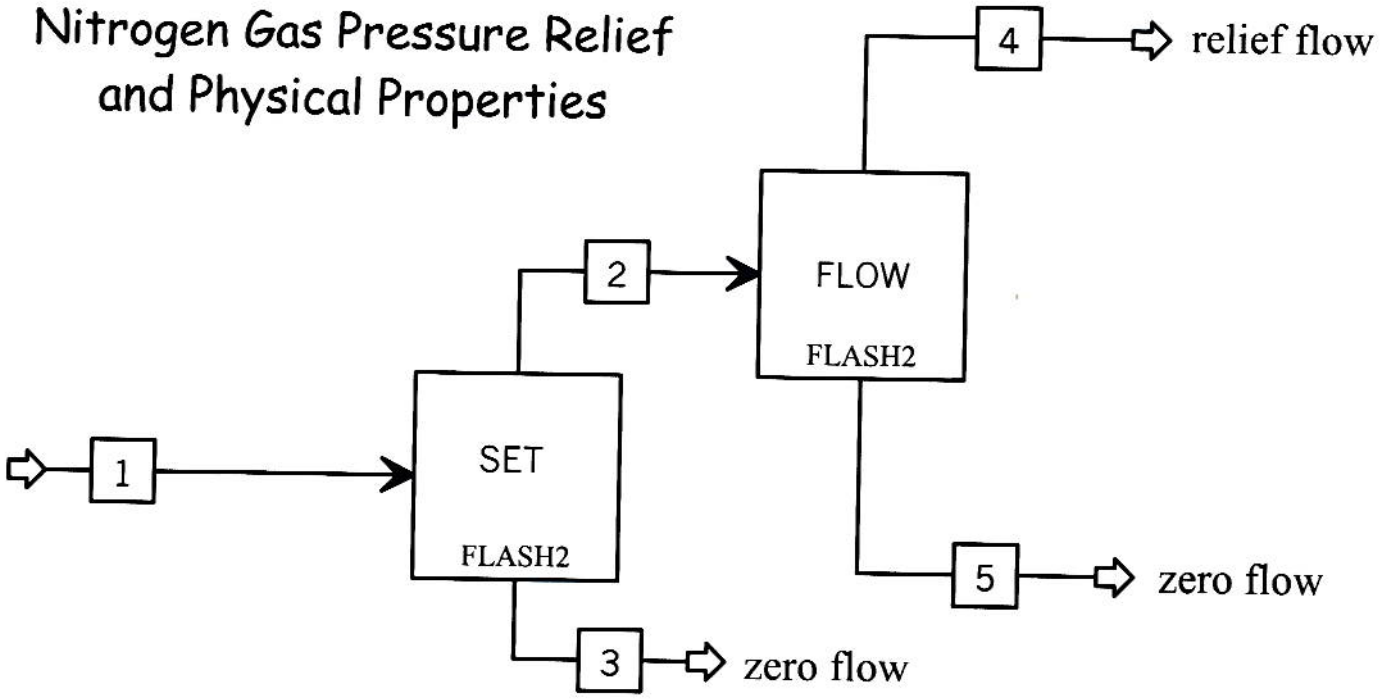
Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Vapor Relief Rate:		
	lb/hr	641
	ACFH	1,044
	SCFH (60F, 14.7 psia)	8,685
	SCFH Equivalent Air Capacity	8,612

Rated Capacity of Relief Valve, lb/hr: 1,070

Note: PSV inlet and outlet piping size is based on the rated capacity (or wide open flow rate) of selected valve.

Nitrogen Gas Pressure Relief
and Physical Properties



Filename: N2_Relief.apw

Results Summary Streams Material

	1	2	3
	SET	FLOW	
		SET	SET
	VAPOR	VAPOR	MISSING
Substream: MIXED			
Mole Flow lbmol/hr			
HCN	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
AIR	0.0	0.0	0.0
NITROGEN	577.3997	577.3997	0.0
OXYGEN	0.0	0.0	0.0
Mass Flow lb/hr			
HCN	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
AIR	0.0	0.0	0.0
NITROGEN	16174.98	16174.98	0.0
OXYGEN	0.0	0.0	0.0
Mass Frac			
HCN	0.0	0.0	
METHANOL	0.0	0.0	
AIR	0.0	0.0	
NITROGEN	1.000000	1.000000	
OXYGEN	0.0	0.0	
Total Flow lbmol/hr	577.3997	577.3997	0.0
Total Flow lb/hr	16174.98	16174.98	0.0
Total Flow cuft/hr	60000.00	28613.77	0.0
Temperature F	70.00000	69.99999	
Pressure psi	54.70000	114.7000	114.7000
Vapor Frac	1.000000	1.000000	
Liquid Frac	0.0	0.0	
Solid Frac	0.0	0.0	
Enthalpy Btu/lbmol	-48.69474	-48.69479	
Enthalpy Btu/lb	-1.738261	-1.738263	
Enthalpy Btu/hr	-28116.33	-28116.36	
Entropy Btu/lbmol-R	-2.701310	-4.171741	
Entropy Btu/lb-R	-.0964289	-.1489190	
Density lbmol/cuft	9.62333E-3	.0201790	
Density lb/cuft	.2695829	.5652864	
Average MW	28.01348	28.01348	
Liq Vol 60F cuft/hr	495.3591	495.3591	0.0
*** ALL PHASES ***			
Pressure psi	54.70000	114.7000	
Temperature F	70.00000	69.99999	
Average MW	28.01348	28.01348	
Density lb/cuft	.2695829	.5652864	

	1	2	3
	SET	FLOW	
		SET	SET
	VAPOR	VAPOR	MISSING
CPMX Btu/lb-R	.2483149	.2483149	
CPCVMX	1.399540	1.399540	
*** VAPOR PHASE ***			
Average MW	28.01348	28.01348	
Density lb/cuft	.2695829	.5652864	
CPMX Btu/lb-R	.2483149	.2483149	
CPCVMX	1.400660	1.400660	
MUMX cP	.0175398	.0175398	
ZMX	1.000000	1.000000	
*** LIQUID PHASE ***			
DHVL			
HCN			
METHANOL			
AIR			
NITROGEN			
OXYGEN			
Average MW			
Density			
CPMX			
CPCVMX			
MUMX			
SIGMAMX			
ZMX			

	4	5
	FLOW VAPOR	FLOW MISSING
Substream: MIXED		
Mole Flow lbmol/hr		
HCN	0.0	0.0
METHANOL	0.0	0.0
AIR	0.0	0.0
NITROGEN	577.3997	0.0
OXYGEN	0.0	0.0
Mass Flow lb/hr		
HCN	0.0	0.0
METHANOL	0.0	0.0
AIR	0.0	0.0
NITROGEN	16174.98	0.0
OXYGEN	0.0	0.0
Mass Frac		
HCN	0.0	
METHANOL	0.0	
AIR	0.0	
NITROGEN	1.000000	
OXYGEN	0.0	
Total Flow lbmol/hr	577.3997	0.0
Total Flow lb/hr	16174.98	0.0
Total Flow cuft/hr	26319.17	0.0
Temperature F	69.99998	
Pressure psi	124.7000	124.7000
Vapor Frac	1.000000	
Liquid Frac	0.0	
Solid Frac	0.0	
Enthalpy Btu/lbmol	-48.69485	
Enthalpy Btu/lb	-1.738265	
Enthalpy Btu/hr	-28116.39	
Entropy Btu/lbmol-R	-4.337739	
Entropy Btu/lb-R	-.1548447	
Density lbmol/cuft	.0219383	
Density lb/cuft	.6145703	
Average MW	28.01348	
Liq Vol 60F cuft/hr	495.3591	0.0
*** ALL PHASES ***		
Pressure psi	124.7000	
Temperature F	69.99998	
Average MW	28.01348	
Density lb/cuft	.6145703	

	4	5
	FLOW	FLOW
	VAPOR	MISSING
CPMX Btu/lb-R	.2483149	
CPCVMX	1.399540	
*** VAPOR PHASE ***		
Average MW	28.01348	
Density lb/cuft	.6145703	
CPMX Btu/lb-R	.2483149	
CPCVMX	1.400660	
MUMX cP	.0175398	
ZMX	1.000000	
*** LIQUID PHASE ***		
DHVL		
HCN		
METHANOL		
AIR		
NITROGEN		
OXYGEN		
Average MW		
Density		
CPMX		
CPCVMX		
MUMX		
SIGMAMX		
ZMX		

PROTECTOSEAL®
SAFETY WITHOUT COMPROMISE

Products

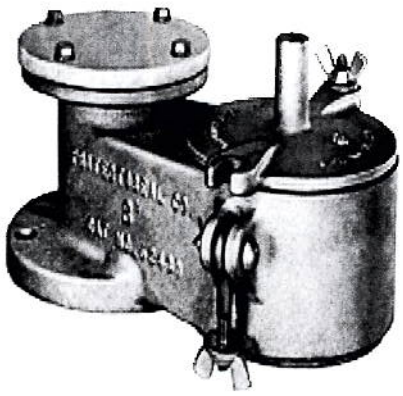
Key Contacts

Understanding Tank Safety

What's New

Regulations

END-OF-LINE VACUUM VENT
Series No. 6240



Protectoseal Series No. 6240 Vacuum Relief Vents are intended for use where only vacuum relief is required. A pallet in the vent housing retards air intake as the tank normally breathes in due to atmospheric temperature changes or emptying of the tank. The pallet opens and closes to permit only that intake relief necessary to avoid tank damage under normal operating conditions. Series No. 16240 offers a side mounted connection.

- Sizes 2" (50.8mm) through 12" (304.8mm)
- Settings achieved by weight loading
- Minimum/Maximum settings
- ProFlow® Sizing/Selection Software
- Patented, FEP Film "Air-Cushioned Seating"
- Standard unit suitable for intermittent pressures up to 2 PSIG
- Low-leak pallet design - certified test reports
- Back pressure design (DV Series) up to 50 PSIG available upon request
- Higher settings available
- Non-metallic (PVC & FRP) construction available
- Installation & maintenance instructions
- "Steam-Jacketing" available
- Drawing / dimension chart
- Time-saving "swing bolt design" permits easy handling
- Factory tested and certified

Materials of Construction*

SERIES	HOUSING	PALLETS	PALLET DIAPHRAGM

6240	Aluminum 356	Aluminum	FEP Film
C6240	Ductile Iron A536	316 S.S.	FEP Film
F6240	316 S.S.	316 S.S.	FEP Film
RE6240	Aluminim 356	316 S.S.	FEP Film
M6240	Hastelloy A494	Hastelloy C276	FEP Film

*Other exotic metals & coatings available.

Flange mating: Aluminum: Mates with 125# FF ANSI
Other metals: Mates with 150# RF ANSI

(For more detailed product information, e-mail us at: info@protectoseal.com. Be sure to include the product number and your name and address.)

| PRODUCTS | KEY CONTACTS | UNDERSTANDING TANK SAFETY |
| WHAT'S NEW | REGULATIONS |

MAIN MENU	COMPANY PROFILE	QUALITY STATEMENT
TANK PROTECTION DIVISION	SAFETY CONTAINER DIVISION
SITE MAP	E-MAIL

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E-mail: info@protectoseal.com

PROTECTOSEAL®
SAFETY WITHOUT COMPROMISE

Series No. 6240, End-of-Line Vacuum Vents

MINIMUM SETTINGS (oz/in2)

Pallet Assembly	Pressure & Vacuum
Stainless	0.75
Aluminum	0.50

MAXIMUM SETTINGS (oz/in2) *

Catalog No.	Pressure	Vacuum**
6242	N/A	11.0
6243D	N/A	11.0
6244D	N/A	7.4
6246D	N/A	18.0
6248D	N/A	18.0
6250D	N/A	19.0
6252D	N/A	23.0

* *With lead weights*

** *Higher weight loaded settings are possible. Contact Protectoseal for information.*

| PRODUCTS | KEY CONTACTS | UNDERSTANDING TANK SAFETY |
| WHAT'S NEW | REGULATIONS |

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Products

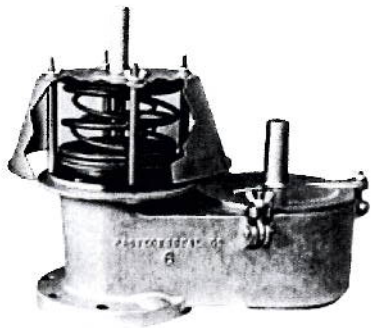
Key Contacts

Understanding Tank Safety

What's New

Regulations

SPRING-LOADED PRESSURE / VACUUM RELIEF VENTS



To meet the need for higher operating pressures, Protectoseal has developed a series of spring-loaded pressure only, pressure / vacuum and vacuum only vents for settings ranging from 3 PSIG through 12 PSIG. The spring-loaded units are available in sizes up to 24" (609.6mm) in many of the configurations and materials of construction as the weight-loaded units.

Depending on the size of an individual unit and the setting required, Protectoseal will furnish one, two or three springs of appropriate rating to achieve accuracy of initial setting, smoothness of operation and maximum flow capacity.

Spring-loaded vents are available as: 1) Pressure Relief Vents only, 2) Vacuum Relief Vents only or, 3) as Combined Pressure / Vaccum Vents that can be spring-loaded on the pressure side only, vacuum side only or on both sides. The side not spring-loaded would have conventional weight loading with a minimum setting of 2 oz./sq. in.

(For more detailed product information, e-mail us at: info@protectoseal.com. Be sure to include the product number and your name and address.)

| PRODUCTS | KEY CONTACTS | UNDERSTANDING TANK SAFETY |
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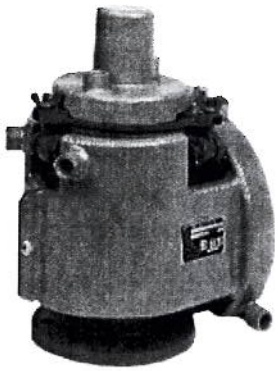
CLAMP-ON STEAM JACKETS



The clamp-on steam jackets offered by Protectoseal are designed to be installed in conjunction with pressure and/or vacuum relief vents and some flame arresters. Steam jacketing is commonly used on tanks containing liquids whose vapors tend to crystallize at ambient temperatures; (e.g. Naphthalene, Maleic Anhydride, DMT, Phthalic Anhydride) . They are often utilized in cold climates to prevent freezing and plugging.

The clamp-on jacket provides a means of transferring heat from steam to the vent or flame arrester on which it is installed. Uniform heating of the valves and housing assures the unit will remain in operating condition, free from plugging.

SPECIFICATIONS:

Carbon steel jackets are standard. Standard design is rated for 150 PSIG at 800°F. Jacket connections are 3000# FNPT. Hydrostatic testing can be done in accordance with the customer's request. Flanged connections are also available.

SPECIAL FEATURES:

- **Heating Chamber** - The entire jacket is a heating chamber rather than a small chamber embedded in an aluminum casting, where aluminum must transfer the heat.
- **Light Weight** - Because the clamp-on jacket is lighter than conventional jackets, there is less stress on the piping system. Easy removal for maintenance or repair in the field.
- **No Cross Contamination** - The clamp-on jacket eliminates the danger of cross contamination between product and heating medium.
- **Meets your Specifications** - Custom fabricated to meet your exact specification.

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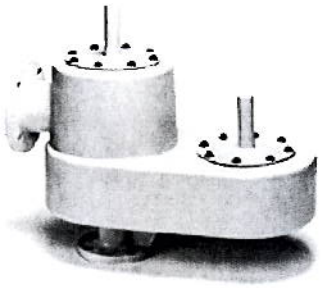
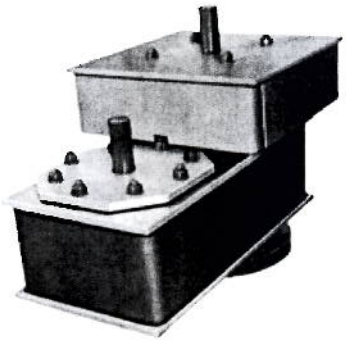
NONMETALLIC VENTS
FIBERGLASS REINFORCED PLASTIC (FRP)
POLYVINYL CHLORIDE (PVC)

For those instances when chemicals being stored are particularly aggressive or corrosive to vents of metal construction, Protectoseal offers a full line of pressure and/or vacuum relief devices manufactured from nonmetallic materials. These vents often provide superior service life and may be considered as an alternative to the use of vents protected by coatings, or vents manufactured from exotic metals.



FIBERGLASS REINFORCED PLASTIC (FRP) vents are exceptionally rugged. The unique one-piece housing and hand lay-up construction eliminates seams, insuring integrity of the vent throughout a long service life. Glass reinforcing fibers, coupled with careful choice of plastic resin, provides maximum resistance to the effects of strong corrosive media. Standard resins of construction include Derakane 470®, Derakane 411® and Furan.



POLYVINYL CHLORIDE (PVC) vents are manufactured from sheet PVC and are electronically welded to insure vapor tight seams and connections. Rugged flanges mount directly to vent system pipes. Many standard conservation and emergency vent designs are available in PVC construction.

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WEIGHT LOADED VENTS
Series Nos. 6240, 7800, 8540H, 8740, 16240, 17800 & 18540

Installation and Maintenance

INSTALLATION

If any questions arise concerning the proper installation of vents, please contact Protectoseal or one of our Authorized Representatives.

CAUTION:
When installing any Protectoseal venting device, the legal, corporate and advisory safety regulations and procedures appropriate for the specific installation site must be fully understood and followed.

Note 1: Depending on the vent style, it will include removable covers, a formed weatherhood, or a combination of covers and hood. If the vent includes a weatherhood, the stem guide may be taped to the top of the hood to prevent damage during shipment. Install the guide in the tapped hole on top of the hood.

Note 2: When pressure or vacuum weights (packed separately if heavy) are included with a unit, the weights should be inspected, properly identified and set aside for later installation. Weights will be stamped with a serial number matching the number on the vent, identification as pressure or vacuum weights, and a statement as to the contribution that each weight provides to the total pressure or vacuum setting.

PROCEDURE:

1. Loosen wing nuts and remove covers/weatherhood.
2. Withdraw pressure/vacuum pallet assemblies and remove protective cardboard and tape from each assembly.

3. Remove any protective flange covers.
4. Check carefully to insure that no packing materials remain on or inside the vent housings.
5. Mount the vent to the appropriate inlet and/or outlet flange using gaskets compatible with service conditions. Note: For some vent styles, threaded studs that mate with tapped holes in the vent housing flange are provided. For best performance, the vent should be mounted level so that the seating surfaces are no more than 1° off horizontal.
6. Reinstall pressure and/or vacuum pallet assemblies into their respective openings. Setting weights (if required) should be installed by engaging the hole in the weight on the appropriate pallet assembly stem.
7. Replace the covers and/or weatherhood. Note: Make sure that the pallet assembly stem positively engages the stem guide hole in the weatherhood or cover. Each pallet assembly must be free to move upwards, with the pallet stem traveling into the stem guide.
8. Replace wing nuts or nuts and tighten to secure covers/hoods in position.

MAINTENANCE

If any questions arise concerning the proper maintenance of vents, please contact Protectoseal or one of our Authorized Representatives.

CAUTION:

When maintaining any Protectoseal venting device, the legal, corporate and advisory safety regulations and procedures appropriate for the specific installation site must be fully understood and followed.

PROCEDURE:

1. Loosen wing nuts and remove covers/weatherhood.
2. Inspect the gasket on the covers. Replace if deteriorated or damaged.
3. Remove any loose dirt or foreign material from the housing interior and exterior. Check inside the stem guide hole of the weatherhood and/or covers and remove any dirt or accumulation of foreign material from these holes.
4. Withdraw pressure/vacuum pallet assemblies and set aside for inspection. Note: identify any weights on the pressure/vacuum

pallet assemblies for later reinstallation.

5. Inspect the screens that protect the pressure and vacuum ports. Clean or replace as necessary.
6. Inspect and clean the machined seating surfaces in the vent housings with a suitable cleaning fluid. Seats should be free of nicks, mars or accumulations of foreign material. Caution: Do not use a file or other sharp tool to clean seating surface.
7. Inspect the pallet assemblies. If pallets are deteriorated or bent, they must be replaced. Inspect the diaphragm material in the pallet assemblies. The diaphragms must be clean, flat and smooth. If the diaphragm material is deteriorated, it must be replaced. Make sure that all nuts and screws on the pallet assemblies are tightened securely.
8. Reinstall pressure and/or vacuum pallet assemblies into their respective openings. Setting weights (if required) should be reinstalled by engaging the hole in the weight on the appropriate pallet assembly stem.
9. Replace the covers and/or weatherhood and screens. Note: Make sure that the pallet assembly stem positively engages the stem guide hole in the weatherhood or cover. Each pallet assembly must be free to move upwards, with the pallet stem traveling into the stem guide.
10. Replace wing nuts or nuts and tighten to secure covers/hoods in position.

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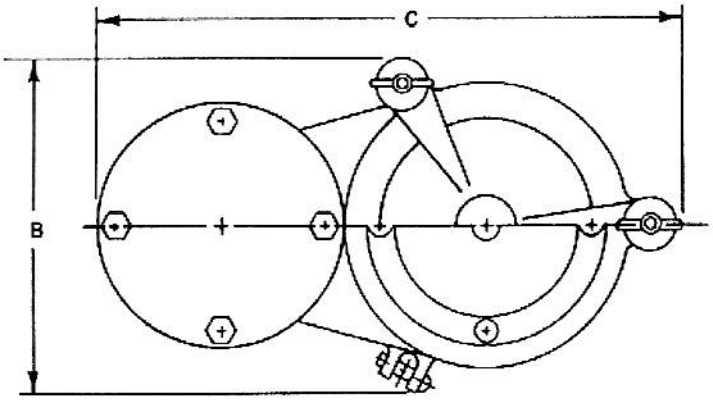
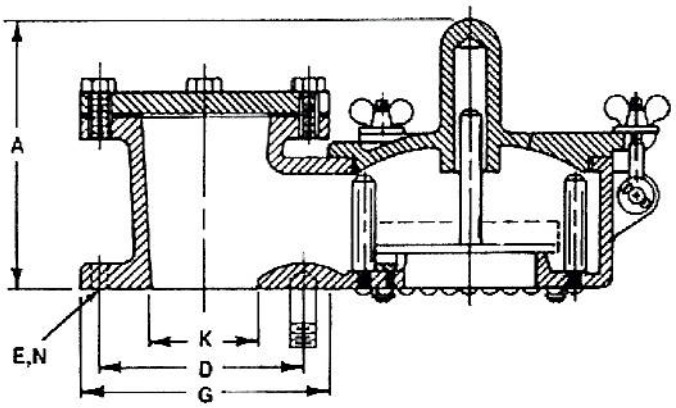
SPECIFICATIONS

Series No. 6240 Vacuum Vent





DIMENSIONS

Catalog Number*	K Pipe Size	A Height	B Width	C Length	D B.C.	G Dia.	E Dia.	N # of Holes
6242	2" *50.8 mm*	8 1/2" *215.9 mm*	7 1/2" *190.5 mm*	13 3/4" *349.3 mm*	4 3/4" *120.7 mm*	6" *152.4 mm*	3/4" *19.1 mm*	4
6243D	3" *76.2 mm*	7" *177.8 mm*	9 3/4" *247.7 mm*	15" *381.0 mm*	6" *152.4 mm*	7 1/2" *190.5 mm*	3/4" *19.1 mm*	4
6244D	4" *101.6 mm*	9" *228.6 mm*	10" *254.0 mm*	18 1/2" *469.9 mm*	7 1/2" *190.5 mm*	9" *228.6 mm*	3/4" *19.1 mm*	8
6246D	6" *152.4 mm*	12 1/4" *310.9 mm*	12 7/8" *327.0 mm*	23 1/2" *596.9 mm*	9 1/2" *241.3 mm*	11" *279.4 mm*	7/8" *22.3 mm*	8
6248D	8" *203.2 mm*	12 1/2" *317.5 mm*	15 3/4" *400.1 mm*	28 1/4" *717.6 mm*	11 3/4" *298.5 mm*	13 1/2" *342.9 mm*	7/8" *22.3 mm*	8
6250D	10" *254 mm*	13 7/8" *352.4 mm*	18 1/2" *469.9 mm*	33 1/2" *850.9 mm*	14 1/4" *362.0 mm*	16" *406.4 mm*	1" *25.4 mm*	12
6252D	12" *304.8 mm*	16 3/8" *415.9 mm*	19" *482.6 mm*	37 1/4" *945.9 mm*	17" *431.8 mm*	19" *482.6 mm*	1" *25.4 mm*	12

*Catalog numbers indicate all aluminum construction, both housing & pallets.
Add prefix "C" for ductile iron housing w/ stainless steel pallets.
Add prefix "F" for stainless steel housing w/ stainless steel pallets.
Add "RE" for aluminum housing w/ stainless steel pallets.
Add prefix "M" for hastelloy housing w/ hastelloy pallets.

Dimensions shown are for reference only. Contact factory for certified drawings.

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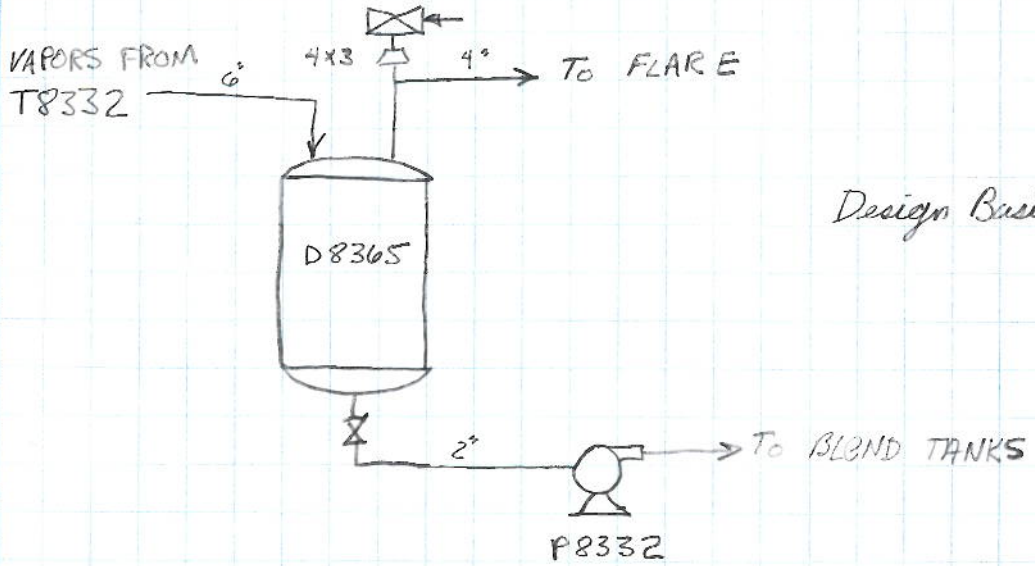
SUBJECT Over Pressure Protection for Vent Collection Drum
DWG: 25F009

FILE PSV-D8365A
DATE 7/29/03
BY F.B. ISZARD



Design Basis: Pump Out

Relief Device	Collection Tank	Sizing Fluid
VACUUM VENT	T-250-25	Waste Fuel
SIZE = 2 IN	P_{MAWP} = 104 PSIG @ 450F	
MFG = PROTECTOSEAL	P_{VAC} = 15 PSIG	
MODEL = 6242H	Pumpout Rate = 200 GPM	

$104\ PSIG \left(\frac{27.7\ "w.c.}{PSI}\right) = 2880.8\ "w.c.$; MAX. Pressure

$15\ PSIG\ (27.7/PSI) = 415.5\ "w.c.$; MAX. VACUUM

Est. approx. T-T length when D = 3FT and V = 250 gal

$$V = \frac{\pi}{4} D^2 h \rightarrow h = \frac{4V}{\pi D^2} = \frac{4(250\ GAL)}{\pi (3\ FT)^2 \left(7.48 \frac{GAL}{FT^3}\right)} = 4.73\ FT$$

Required relief Capacity = 1764 SCFH of air

This device has a max. capacity of 20,000 SCFH air at 29.5 "w.c. so it is adequate.

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	#4 Boiler	Rev. Date:	
Job Name:	Vent Collection Drum	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/28/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Vent Collection Drum
Tank Identification:	D8365 (T-250-25)
Relief Device No:	PSV-D8365A
P&ID :	25F009
File Name:	PSV-D8365A

Check Device: VACUUM VENT ☑ ~~Conservation~~ Vent ☐ Emergency Vent ☐ Flame Arrestor

Vessel:			
	Tank MAWP (in.wc)	2880.0 in. w.c.	103.971 psig
	Design Temperature(F)	450.0 F	
	Vacuum Rating(in.wc)	415.5 in w.c.	15.000 psig
	Emergency Vent Dia.	24.0	in
	Conservation Vent Dia.	2.0	in
	Total Vessel Volume	250	gallons
	Max. Working Volume	225	gallons
	D_{TANK}	3.0	ft
	L_{T-T}	4.7	ft
	Percent liquid filled	90%	(Max. Opr. = 90%)

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	-	#VALUE!
Set point for CV (vacuum), P_{Vset} (in.wc)	415.50 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	-	#VALUE!
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$	3456.0 in w.c.	(127.059 psig)
(fire case, ovpr=21%)		

Process Notes:

This relief device is a vacuum vent valve

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel
Phase (Liquid or Vapor)	Liquid
Flash point temperature (F)	460.0 F
Molecular Weight	168 lb/lbmol
Formula (i.e. CxHx)	Organic Mixture
Normal Boiling Temperature (F)	400 F
Heat of Vaporization (btu/lb)	140.0 btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

CONSERVATION VENT CALCULATIONS

In-breathing Capacity Estimation (Vacuum Relief Capacity)

Maximum Pump Out Rate = 200 gpm

$$Vi = \frac{Vpump(gpm)\ 60(min/hr)}{7.5\ (gal/hr/cf\ air)} = 1600 \text{ scfh}$$

Thermal effect, Table 2 in API 2000

V_{VAC} = 75 scfh

total 1675 scfh of air

Out-breathing Capacity Estimation (Pressure Relief Capacity)

Maximum Fill Rate = 200 gpm

$$Vo = \frac{Vfill(gal/min)\ 60(min/hr)}{Cs\ (gal/hr/cf\ air)} = 1714 \text{ scfh}$$

Thermal effect, Table 2 in API 2000

V_{PRES} = 50 scfh

total 1764 scfh

Required relief Capacity=	1764	scfh of air

Specified CV Device

From the manufacturers catalog, the following minimum size CV is identified

Manufacturer	Protectoseal
Size	2 in.
Model	6242H
Pressure Drop at required flow capacity	28.0 in w.c.

CONSERVATION VENT DESIGN RECORD

Venting Conditions:

Maximum Positive Pressure	2880.0 in w.c.
Maximum Vacuum	415.5 in w.c.
Maximum Normal Oper. Temperature	95.0 F

Vessel or System Characteristics

Vent Nozzle Diameter (D_{CV})	2.0 in.
MAWP	2880.0 in w.c.
Maximum Vacuum	415.5 in w.c.

Conservation Vent Summary

Flame Arrester Included		No	
Available CV nozzle size		2.0	in
Required relief capacity		1,764	scfh air
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Installed Device			
Manufacturer		Protectoseal	
Size		2 in.	
Model		6242H	
Maximum Flow Capacity	Pressure	-	scfh air @ -
	Vacuum	20,000	scfh air @ 29.5 in w.c.

CONSERVATION VENT SPECIFICATION SHEET

Originated By: F.B.Iszard Origin Date: 7/28/03

Revision No: Revision Date:

Project:

1	Device Identification			PSV-D8365A
2	System Name			Vent Collection Drum
3	Process / Site	Plant Utilities		#4 Boiler
4	P&ID Sheet			25F009
5	Tank Identification			D8365 (T-250-25)
6	Sizing with flame arrester			No
7	Tank design pressure (mawp), in. w.c.			2880.0
8	Tank capacity, gallons			250
9	Tank diameter / height, ft		3.0	4.7
10	Fluid contained			Waste Fuel
11	Flash point temperature, F			460
12	Maximum operating temperature, F			95
13	Normal boiling temperature, F			400
14	Maximum fill rate, gpm			200
15	Out-breathing due to filling/thermal effect, scfh		1714	50
16	Total outbreathing, scfh			1,764
17	CV pressure setting, in.w.c.			-
18	Maximum pump out rate, gpm			200
19	In-breathing - pump out/thermal effect,scfh		1,600	75
20	Total in-breathing, scfh			1,675
21	CV vacuum setting, in.w.c.			415.50
22	Manufacturer / Model	Protectoseal		6242H
23	Size (diameter), inches			2
24	Discharge to …			atmosphere
25	Back pressure, psig			0
26	Body material			316 ss
27	Seat and trim material			316 ss
28	Diaphragm material			Teflon
29	Tank nozzle size, inches			2.0
30	Required flow capacity, scfh air			1,764
31	Maximum flow capacity, scfh air	(pressure)		-
32	at (inches of water column)			-
33	Maximum flow capacity, scfh air	(vacuum)		20,000
34	at (inches of water column)			29.5
35	In-line pressure drop, in w.c.			28.0
36	Flange facing			R.F.
37	Notes:			

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Series No. 6240

Vacuum Vent

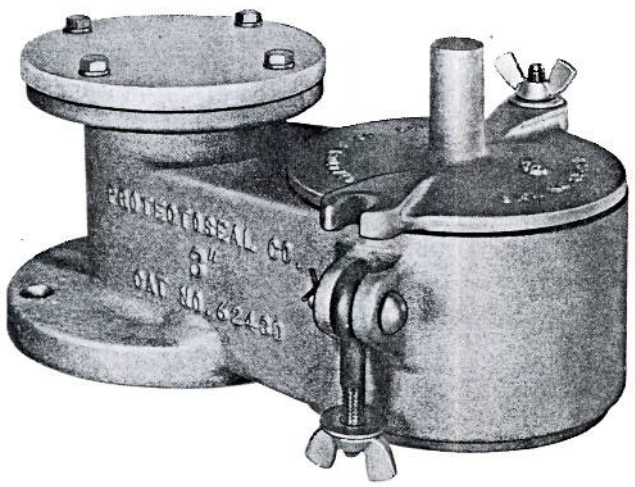
End-of-Line Vacuum Relief Vent

OBJECTIVE
Protectoseal Series No. 6240 Vacuum Relief Vents are intended for use where only vacuum relief is required. Ruggedly built for dependable service.

TECHNIQUE
A pallet in the vent housing retards air intake as the tank normally breathes in due to atmospheric temperature changes or due to emptying the tank. The pallet opens and closes to permit only that intake relief necessary to avoid tank damage under normal operating conditions.

CONSTRUCTION
Standard: Lightweight low Copper content Aluminum body, Aluminum pallets, and Teflon® Air-Cushioned Seating.
Custom: Aluminum housing with Stainless Steel pallets, Ductile Iron housing with Stainless Steel pallets, Stainless Steel housing with Stainless Steel pallets. Other materials, and rubber or metal-to-metal seating, available upon request.

SPECIAL FEATURES
Fast and Easy Cleaning and Inspection. Time-saving "swing bolt design" permits removal of the vent housing cover for cleaning or inspection in a fraction of the usual time.
Maintains Accurate Vacuum Settings. Pallets are fabricated to the precise weights necessary to maintain accurate vacuum settings. When closed, they are tightly seated to prevent leakage. Standard Aluminum pallet setting is ½ oz./sq. in. On 316 Stainless units, the standard setting is ¾ oz./sq. in. Higher settings are also available. Standard unit suitable for intermittent pressures up to 2 PSIG. Consult factory for other applications. Back pressure design (DV Series) up to 50 PSIG available upon request.



SERIES 6240 FEATURING PROTECTOSEAL'S PATENTED TEFLON AIR CUSHIONED SEATING

Automatic Condensate Drainage. The vent is protected from freezing, binding and clogging by self-draining body and drip rings which keep condensate away from seating surfaces.

Air-Cushioned Seating. Exclusive Protectoseal Air-Cushioned Seating is featured, assuring high vacuum integrity. The pallets have peripheral guiding and center stabilizing stems to insure proper alignment and tight seating over the life of the vent.

Numerous Sizes Available. All sizes, 2-inch through 12-inch, mate with standard flanged A.N.S.I. connections. Select the correct size vent to provide adequate vacuum relief under both operating and thermal conditions.

Quality Assurance. Each unit is factory tested for leakage and correct settings to meet Protectoseal's high standards prior to shipment.

MATERIALS OF CONSTRUCTION

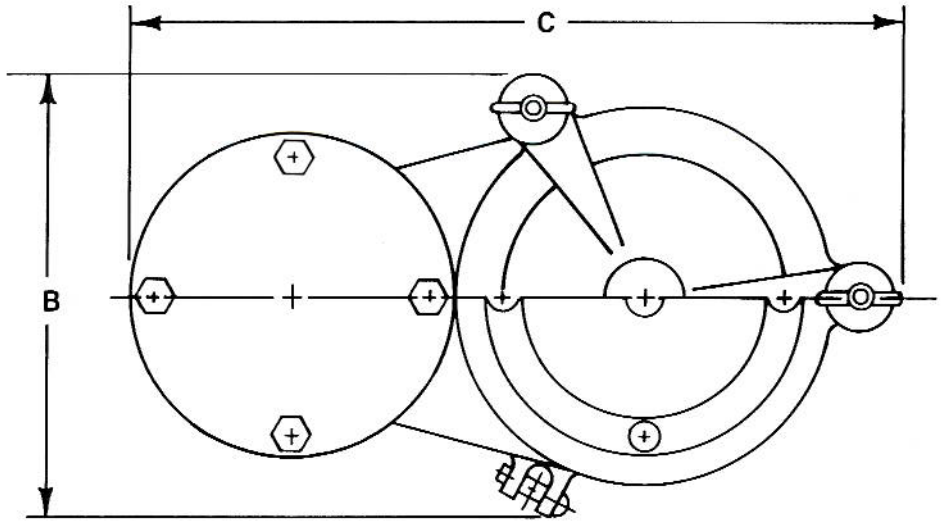
Series	Housing	Pallets*	Pallet Diaphragm
6240	Aluminum 356	Aluminum	Teflon®
C6240	Ductile Iron A536	316 Stainless Steel	Teflon®
F6240	316 Stainless Steel	316 Stainless Steel	Teflon®
RE6240	Aluminum 356	316 Stainless Steel	Teflon®
M6240	Hastelloy C A494	Hastelloy C	Teflon®

*On Ductile Iron and Aluminum vents, weights are Steel or Lead. On Stainless Steel vents, weights are Stainless Steel or Lead. On Hastelloy vents, weights are Hastelloy or Lead. Aluminum flanged to mate with 125# FF A.N.S.I. Ductile Iron, Stainless Steel and Hastelloy flanged to mate with 150# RF A.N.S.I.

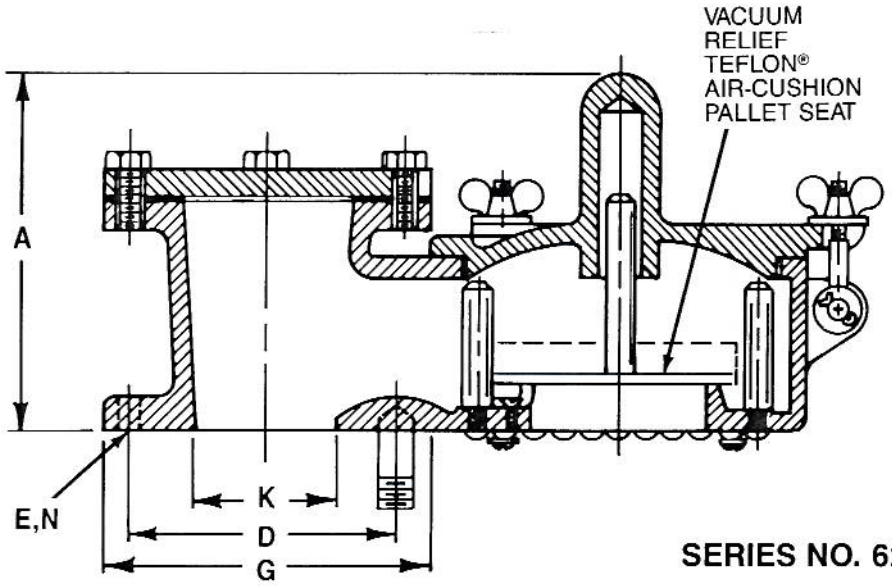
SPECIFICATIONS

Series No. 6240
Vacuum Vent

TOP VIEW



SIDE VIEW



SERIES NO. 6240

DIMENSIONS

Catalog No.	K Pipe Size	A Ht.	B Width	C Length	D B.C.	G Dia.	E Dia.	No. N Holes
			Standard Construction					
For Aluminum Housing and Pallets								
6242	2"	8½"	7½"	13¾"	4¾"	6"	¾"	4
6243D	3"	7"	9¾"	15"	6"	7½"	¾"	4
6244D	4"	9"	10"	18½"	7½"	9"	¾"	8
6246D	6"	12¼"	12⅞"	23½"	9½"	11"	⅞"	8
6248D	8"	12½"	15¾"	28¼"	11¾"	13½"	⅞"	8
6250D	10"	13⅞"	18½"	33½"	14¼"	16"	1"	12
6252D	12"	16⅜"	19"	37¼"	17"	19"	1"	12

Add prefix "C" for Ductile Iron Housing with Stainless Steel Pallets.
Add prefix "F" for Stainless Steel Housing with Stainless Steel Pallets.
Add prefix "RE" for Aluminum Housing with Stainless Steel Pallets.
Add prefix "M" for Hastelloy Housing with Hastelloy Pallets.
Check with Sales Department for availability and scheduled delivery.

THE PROTECTOSEAL COMPANY
ISO 9001 CERTIFIED
225 Foster Ave., Bensenville, IL 60106-1690
Ph: 1-630-595-0800 Fax: 1-630-595-8059

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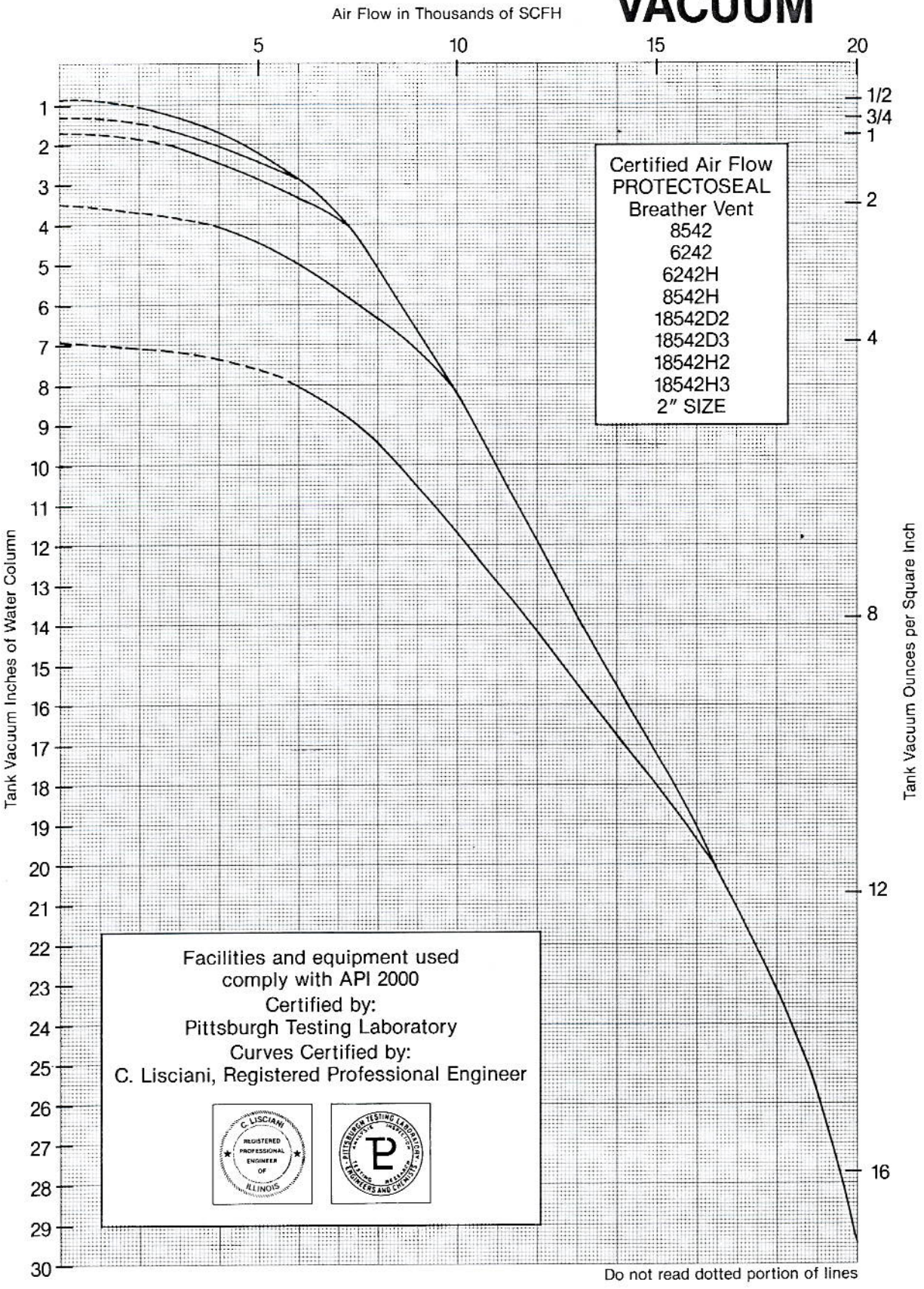
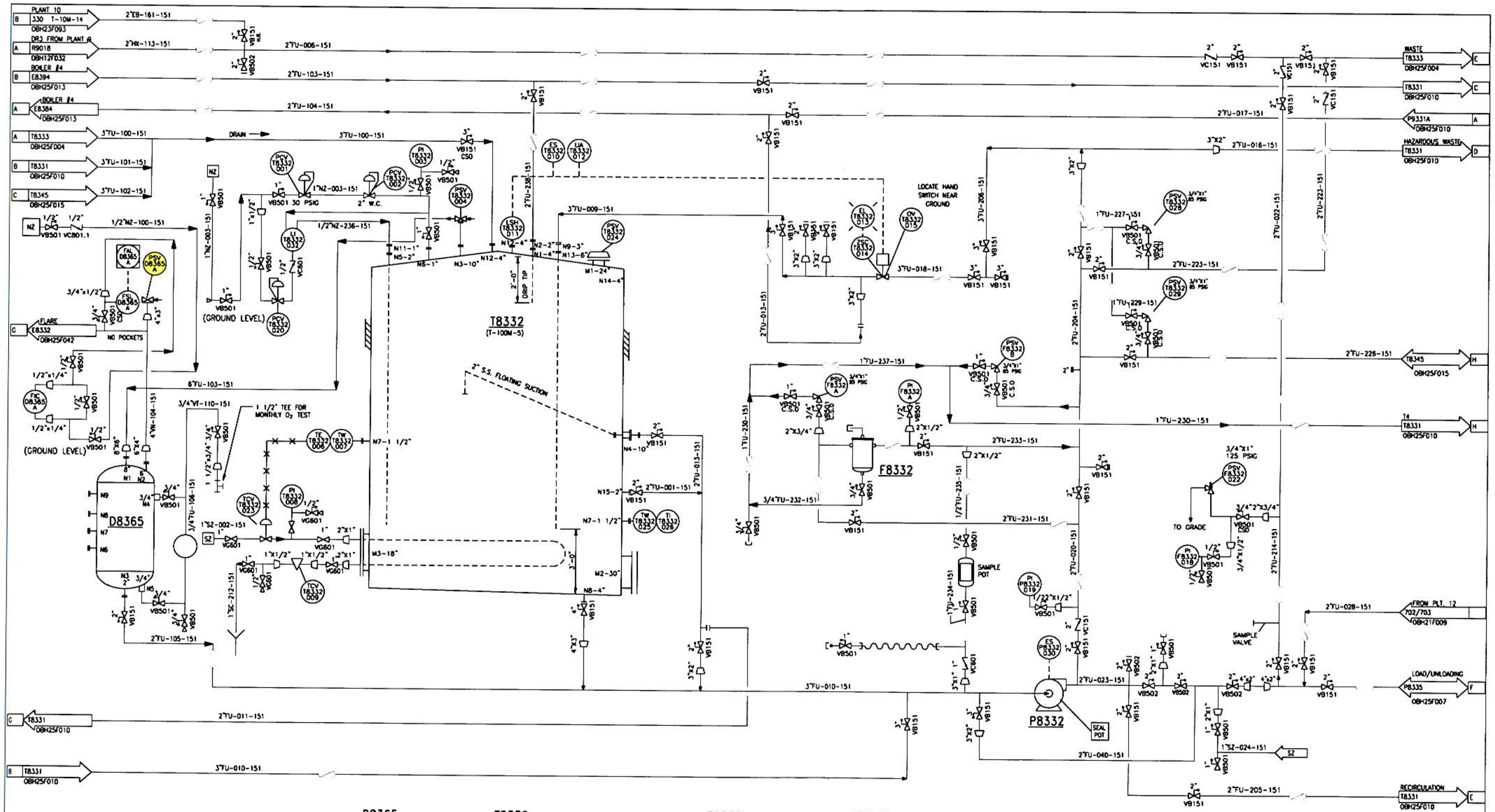
Series
No. 6240
Vacuum Vent
Certified Air Flow Curves

VACUUM



The Protectoseal Company / 225 Foster Avenue, Bensenville, IL 60106-1690 / 1-708-595-0800, Fax 708-595-8059



NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJ COOR	APP'D
0	AS-BUILT FOR UTILITIES	10/01/91	10/03/91			10/3/91	5/20/92
	PER PROCESS SAFETY REVIEW	RDS	RR			GFW	EG
16	AS-BUILT PER PROJ # 3380	12/16/02	2/18/02	12/18/02	12/18/02	12/18/02	12/18/02
	BURN DETDA WASTE IN #4 BOILER	JWR	ACB	JSS	JWR	JSS	RLT
17	AS-BUILT PER TSR# 3005	7/25/03	7/30/03		7/30/03	7/29/03	8/5/03
	PHA UTILITIES	JWR	GTK		MJK	GFW	RAT
18	GENERAL REVISION PER FIELD CHECK	10/14/03	10/15/03	10/15/03	10/15/03	10/15/03	10/15/03
		RDS	RDS	JSS	JWR	JSS	RAT
14	ADDED BALL VALVES TO CHECK NITROGEN	4/23/99	4/26/99	4/26/99	4/27/99	4/26/99	4/27/99
	DEMAND PER TSR-9068 & YS #04328Y	RR	AMC	AMC	JWR	GFW	RLT
15	INSTALL 3/4" LINE FOR MONTHLY O2 TEST	04/12/00	04/13/00	04/13/00	04/14/00	04/13/00	04/14/00
	PER TSR-9210, YS#04332Y	JSJ III	AMC	AMC	JWR	GFW	RLT

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DRAWZEBURG ENGINEERING

ALBEMARLE™ CORPORATION

WASTE FUEL STORAGE T-8332 (T-100M-5) P&ID

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F009	18

SCALE: NONE
OPERATING AREA: -
BUILDING NO: -

Design Basis

P&ID Loop No.
PSV-D8365-A

P&ID No.: OBH25F009

Relief Type: VV

Functional Location: OR-UT-A-A-D8365 -PSVA

PHA Title:

☐ In SAP?

SAP No.:

Orangeburg Equipment No.:

Manufacturer: PROTECTOSEAL

Model No.: 6242H

Serial No.:

Description: PSV-D8365-A; T-250-25 Vacuum Vent

○ Fire ◉ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid: Waste Fuel

Actual Fluid: Waste Fuel

Other Sizing: Tank Dimensions 3' x 4.73'

Required Size: 2"

Actual Size: 2"

P&ID Size:

☑ PSV OK?

Design Pressure: 104 PSIG

Existing Setpoint: N/A

P&ID Set Pressure:

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes

F.Pt. set at 460F per Albemarle MSDS records; Max empty rate set at 200 GPM
Tank vacuum: 15 PSIG Vent vacuum: 29.5" wc (estimated setting)

ALBEMARLE™ CORPORATION

ENGINEERING DEPARTMENT

PRESSURE/VACUUM VENT

SPEC NO.		700	
SHEET		OF	1
PROJECT	ENGR		
P.O. NO.			
MR NO.			
DATE		9/8/97	

R-VACVT

REV	BY	DATE
0	SFC	9-9-97

GEN	01	TAG NUMBER		PSV-D8365A	
	02	P&ID		OBH25F009	
	03	LINE NUMBER		D8365	
	04	BLANK 1			
BASE	05	TYPE: PRESS OR VACUUM		Vacuum	
	06	FLANGE SIZE & RATING		3"-150#RF	
	07	BASE MATERIAL		Ductile iron	
	08	ANSI OR API BOLTING		ANSI	
	09	MOUNTING		Vertical pipe	
	10	BLANK 2			
COVER	11	COVER MATERIAL		Ductile Iron	
	12	SEAT MATERIAL			
	13	PALLET MATERIAL		316ss	
	14	DIAPHRAGM MATERIAL (SEAT)		Teflon	
	15	BLANK 3			
	16	BLANK 4			
OPTNS	17	BLANK 5			
	18	BLANK 6			
	19	BLANK 7			
	20	BLANK 8			
SERVICE	21	PROC ENG/ PROC REV DATE		SFC	8/28/97
	22	PRES UNITS	TEMP UNITS	"H2O	DEGC
	23	FLUID	STATE	Air	Gas
	24	CORROSIVE	FOULING	N	N
	25	TEMP: MIN / NORM / MAX		amb	amb amb
	26	FLOW RATE	FR UNITS		
	27	EQUIV. AIR FLOW (scfh)		1608	
	28	SET PRESSURE (in. w.c.)		1.3"	
	29	VESSEL MAWP		10"	
	30	PRESS @ REL'V CAPACITY		1.3" @ 1600 SCFH	
	31	BLANK 9			
	32	MANUFACTURER		Protect-O-Seal	
	33	MODEL NUMBER		C6243D	

why 3" instead of 2"

NOTES:

DESIGN BASIS

CV/EV No.: PSV-D8365A

Fifth Level Func Loc: D8365-A

P&ID No.: 25F009

MANUFACTURER: Protectoseal

MODEL No.: C6243D

SERIAL No.:

☐ FIRE ☐ COOLING LOSS ☒ PUMP IN/OUT ☐ THERMAL ☐ CONTROL FAILURE

OTHER SIZING:

SIZING FLUID: hexane

ACTUAL FLUID: waste fuel

RELIEVING STATE: ◉ VAPOR ○ LIQUID ○ BOTH

REQUIRED SIZE: 2"

DESIGN SET PT: 10" wc

☒ ACCEPTABLE

ACTUAL SIZE: 3"

SET PRESSUR: 10" wc

☒ FILED

DESIGN NOTES:

PSV-D8365A **25F009** **Vacuum relief valve**
FIC-D8365A **25F009** **Purge meter**

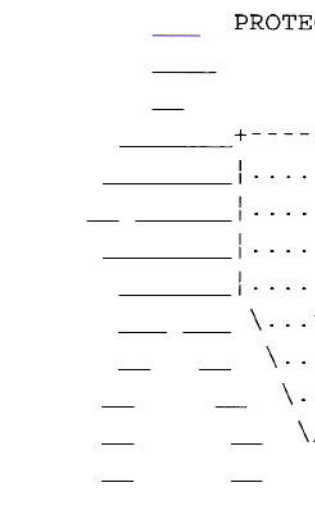
From cc:Mail message from Stacy Baltzegar on 5/19/97, "27151 Scope Review Comments":
"Per conversation with Andy, it was determined that these instrumnets were needed per the scope. The PSV will prevent the flame at the flare form being pulled back into D8365 when pump P-8332 is initiated. The installation of the nitrogen purge into the flare inlet line was a request per Operations from a meeting held in the field on Friday, May 9th."

For the vacuum relief, size based on the 200 gpm capacity of P-8332. Use minimum possible set point. Use the 10" rating of the connected tanks.

From Protectoseal:

END-OF-LINE VACUUM VENT

Recommended Vent	6242D 2 Inch
Tank Capacity	250 gal
Flash Point	-7 F



VACUUM PARAMETERS

Max Empty Rate	200.000 gpm
Tank Design Vacuum	10.000*In H20
Vacuum Set Point	0.860 In H20

VACUUM VENTING REQUIREMENTS

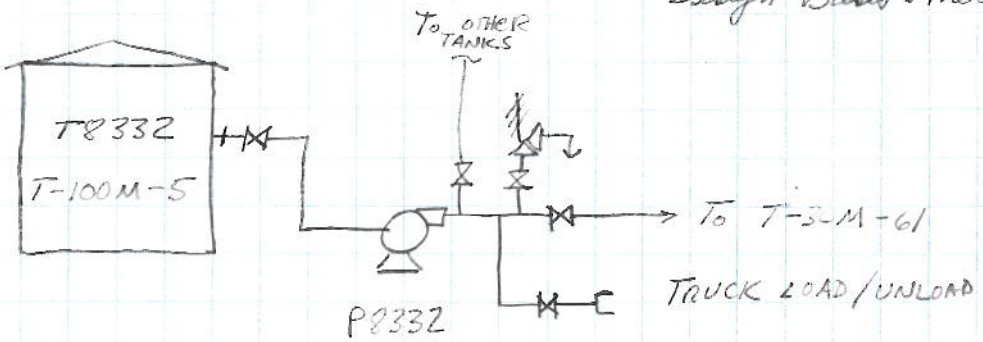
Add Flow	0.000 Mscfh
Thermal	0.008 Mscfh
Emptying	1.600 Mscfh
Total	1.608*Mscfh

VENT INFLOW CHARACTERISTICS

Vacuum At Req Flow	1.079 In H20
% Max Tank Vacuum	11 %

SUBJECT Over Pressure Protection For Hydraulic Expansion of Waste Fuel DWG: 25F009	FILE PSV-F8332-022
	DATE 7/28/03
	BY F. B. IZZARD

Design Basis: Thermal Expansion



Relief Valve

3/4 x 1 - 735

$P_{SET} = 125 PSIG - (139.7 PSIA)$

OVPR = 10%

$P_{FLOW} = 125(1.1) + 14.7 = 152.2 PSIA$

Transfer Piping

D = 2", L = 35FT

Sizing Fluid

Waste Fuel a PW

@ 70F, $\rho = 61.5$

$\hat{V} = 0.01625$

@ 100F, $\rho = 60.6$

$\hat{V} = 0.01648$

$SG = 43.3/62.4 = 0.694$

$C_p = 0.807 \ BTU/LbF$

$\mu = 0.186 cP$

Heat transfer rate from Fire Exposure

$Q = U A \Delta T$

$U = 95 \frac{BTU}{HR \ FT^2 F}$

$A = \pi D L = \pi \left(\frac{2}{12}\right)(35) = 18.3 FT^2$

$\Delta T = (1100 - 70) = 1030F$

$Q = (95)(18.3)(1030)$

$Q = 1,790,655 \ BTU/HR$

Excel estimates $A_{MIN} = 0.0078 IN^2$ and $d_{MIN} = \sqrt{\frac{4(0.0078)}{\pi}} = 0.099 IN$

∴ the existing 3/4 x 1 RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-735	125	2/2/89	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990 C-1	TH-47855 DV-56638	UV-NB	F8332-022

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4" MNPT	1" FNPT	

Air Capacity	Water Capacity	Steam Capacity

Base Matl	Body Matl	Spring Matl
316 S/S		C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S		316 S/S

Comments

Originator: JWR/PMD

Charge Code: PRJ-7246

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-735	BOILER	UT	25	OR-UT-A-A-F8332 -PSV022	25F009	Unknown

Level	Height	North	East	Location
G	6	90	1250	WASTE BOILER # 4, DR-3 TRANSFER LINE.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
125	2	Yes	8/27/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	Yes	Yes	No	
JEH	10/11/01	110	Yes	Yes	No	No	
GS	06/16/99	110	Yes		No	No	
GS	04/29/97	112	Yes		No	No	
FG	10/17/96	110	No		No	No	leaking ,trash between seats.
FG	08/31/96	110	Yes		No	No	RELIEVED, WOULD NOT RESEAT.
GMJ	03/25/96	105	Yes		No	No	
GMJ	03/29/95	105	Yes		No	No	
FG	03/28/94	105	Yes		No	No	
TM	03/22/93	72	Yes		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- F8332-022
Vessel ID:	F8332
P&ID No.:	25F009
Line No.:	2-FU-214-151
Engineer:	F.B.Iszard
Date:	7/28/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	1,048	N/A	0.008	0.110	0.05	0.01	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- F8332-022
Vessel ID:	F8332
P&ID No.	25F009
Line No.	2-FU-214-151
Engineer	F.B.Iszard
Date:	7/28/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	1,790,655	For heat exchangers, maximum exchanger duty
G = Specific Gravity referenced to water @ 60 F	0.694	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.807	
Viscosity, cp	0.186	
System or Vessel MAWP	125	
PSV Set Pressure, psig	125	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	125	
Maximum Relieving Pressure, psig	137.5	
Liquid Expansion Rate, gpm	3.018	
Liquid Expansion Rate, lb/hr	1048.3	
Orifice Reynolds Number	357172	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

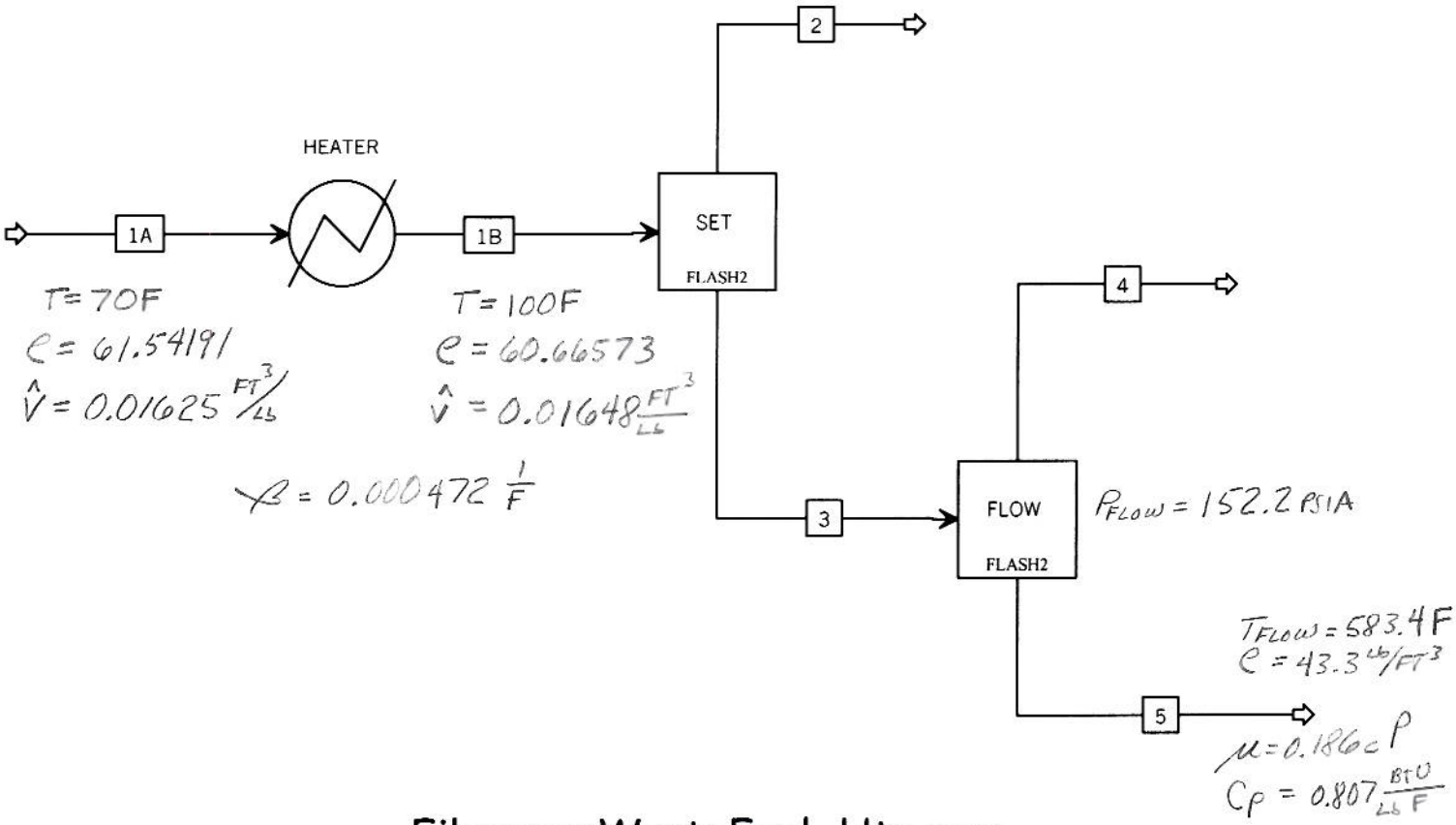
Typical discharge coefficients
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0078 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode): 1X2 D 0.11 sq. in.
Actual Installed Orifice Size (Rating Mode): sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.43894E-4
IBB	.1117559	.1117559	1.30328E-3
DETDA	.0841373	.0841373	7.25957E-5
TOLUENE	.1085299	.1085299	3.55050E-3
BP350	.0464626	.0464626	4.19026E-4
BP525	.0295767	.0295767	5.24406E-5
BP700	.0202392	.0202392	4.20730E-6
Mole Frac			
AN701	.3260920	.3260920	.0914732
IBB	.1879532	.1879532	.2191874
DETDA	.1415038	.1415038	.0122092
TOLUENE	.1825277	.1825277	.5971303
BP350	.0781418	.0781418	.0704725
BP525	.0497427	.0497427	8.81957E-3
BP700	.0340387	.0340387	7.07591E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1122054
IBB	15.00000	15.00000	.1749272
DETDA	15.00000	15.00000	.0129423
TOLUENE	10.00000	10.00000	.3271450
BP350	6.700000	6.700000	.0604242
BP525	6.600000	6.600000	.0117020
BP700	6.700000	6.700000	1.39278E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.7007391
Total Flow cuft/hr	1.624909	1.648377	.4703934
Temperature F	70.00000	100.0000	570.1953
Pressure psi	14.70000	.2100321	139.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	15331.54
Enthalpy Btu/lb	-535.4649	-524.0510	130.0918
Enthalpy Btu/hr	-53546.49	-52405.10	91.16041
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.45214
Entropy Btu/lb-R	-1.353130	-1.331779	-.6572001
Density lbmol/cuft	.3659245	.3607148	.0126403
Density lb/cuft	61.54191	60.66573	1.489687
Average MW	168.1820	168.1820	117.8517

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0124537
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	139.7000
Temperature F	70.00000	100.0000	570.1953
Average MW	168.1820	168.1820	117.8517
Density lb/cuft	61.54191	60.66573	1.489687
CPMX Btu/lb-R	.3695765	.3910039	.5324623
CPCVMX	1.000000	1.000000	1.032680
*** VAPOR PHASE ***			
Average MW			117.8517
Density lb/cuft			1.489687
CPMX Btu/lb-R			.5324623
CPCVMX			1.032748
MUMX cP			.0117818
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET		
	LIQUID	FLOW VAPOR	FLOW LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933485	5.71002E-4	.1927775
IBB	.1104526	1.31321E-3	.1091394
DETDA	.0840647	7.92042E-5	.0839855
TOLUENE	.1049794	3.44716E-3	.1015322
BP350	.0460436	4.16060E-4	.0456275
BP525	.0295243	5.51360E-5	.0294691
BP700	.0202350	4.71296E-6	.0202303
Mole Frac			
AN701	.3284619	.0970023	.3307999
IBB	.1876377	.2230887	.1872796
DETDA	.1428098	.0134552	.1441164
TOLUENE	.1783398	.5856059	.1742260
BP350	.0782192	.0706806	.0782954
BP525	.0501561	9.36655E-3	.0505681
BP700	.0343754	8.00641E-4	.0347145
Mass Flow lb/hr			
AN701	39.88779	.1177978	39.77000
IBB	14.82507	.1762602	14.64881
DETDA	14.98706	.0141205	14.97294
TOLUENE	9.672855	.3176229	9.355232
BP350	6.639576	.0599966	6.579579
BP525	6.588298	.0123035	6.575994
BP700	6.698607	1.56018E-3	6.697047
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.29926	.6996618	98.59960
Total Flow cuft/hr	2.262356	.4329270	2.275593
Temperature F	570.1953	583.4084	583.4084
Pressure psi	139.7000	152.2000	152.2000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-44330.47	15297.43	-43066.40
Enthalpy Btu/lb	-262.7920	128.7022	-254.5390
Enthalpy Btu/hr	-26095.05	90.04801	-25097.45
Entropy Btu/lbmol-R	-169.4887	-78.24100	-168.6618
Entropy Btu/lb-R	-1.004733	-.6582669	-.9968562
Density lbmol/cuft	.2601925	.0135969	.2560922
Density lb/cuft	43.89196	1.616120	43.32919
Average MW	168.6903	118.8591	169.1937

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.563046	.0123992	1.550647
*** ALL PHASES ***			
Pressure psi	139.7000	152.2000	152.2000
Temperature F	570.1953	583.4084	583.4084
Average MW	168.6903	118.8591	169.1937
Density lb/cuft	43.89196	1.616120	43.32919
CPMX Btu/lb-R	.7740012	.5382884	.8073097
CPCVMX	1.000000	1.032033	1.000000
*** VAPOR PHASE ***			
Average MW		118.8591	
Density lb/cuft		1.616120	
CPMX Btu/lb-R		.5382884	
CPCVMX		1.032099	
MUMX cP		.0118797	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	95.16257		93.33250
IBB	89.50418		86.45091
DETDA	150.4994		149.0260
TOLUENE	63.83969		53.47988
BP350	78.52912		75.04827
BP525	88.80838		87.16501
BP700	87.55371		86.51187
Average MW	168.6903		169.1937
Density lb/cuft	43.89196		43.32919
CPMX Btu/lb-R	.7740012		.8073097
CPCVMX	1.000000		1.000000
MUMX cP	.1919587		.1867346
SIGMAMX dyne/cm	7.137672		6.669892
ZMX	.0485807		.0530939

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Revised

Tag number PSV-F8332-022

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	125 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .0156 in2
RELIEF PRESSURE = 137.5 psig

Selected valve capacity = 14363 lb/h at FTP
and 2037 lb/h @ backpressure of 134.8 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62\,D^2\,L\,B\,G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f(P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6\,W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}}\right) K_w\right)}{1.12} \text{ psig}$$

whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

PLANT 10
B 330 T-10M-14
OBH23F093
2"EB-161-151
2"VB151 HLK
2"VB502

DRJ FROM PLANT A
A R9018
OBH12F032
2"HX-113-151

BOILER #4
B E8394
OBH25F013
2"FU-103-151

BOILER #4
A E8384
OBH25F013
2"FU-104-151

2"FU-006-151

A T8333
OBH25F004
3"FU-100-151

B T8331
OBH25F010
3"FU-101-151

C T8345
OBH25F015
3"FU-102-151

DRAIN
3"FU-100-151
3"VB151 CSO

NZ
1"VB501
1"NZ-003-151
1"VB501 30 PSIG
2" W.C.
1"NZ-003-151
(GROUND LEVEL)

PCV T8332 001
PCV T8332 002
PI T8332 003
1/2" VB501
PSV T8332 004
PCV T8332 020

1/2" NZ-100-151
NZ VB501 VC801.1
1/2"NZ-236-151
U T8332 032
VC801

FAL D8365 A
PSV D8365 A
FSL D8365 A
3/4"x1/2"
3/4" VB501 CSO
4"x3"
G FLARE E8332 OBH25F042
NO POCKETS

1/2"x1/4"
FIC D8365 A
1/2" VB501
1/2"x1/4"
(GROUND LEVEL)

6"FU-103-151
3/4"VT-110-151
1 1/2" TEE FOR MONTHLY O_2 TEST
4"VN-104-151
8"x6"
6"x4"
8" N1 6" N2
N9 N8 N7 N6 N3 N4 N5
D8365
3/4" VB501
3/4"FU-106-151
2" VB151
3/4" VB501
2"FU-105-151

TE T8332 006
TW T8332 007
N7-1 1/2"
TCV T8332 023
PI T8332 008
1/2" VG601
1"SZ-002-151
SZ 1" VG601
1"X1/2" 1"X1/2" 2"X1"
VG601
1"SC-212-151
TCV T8332 009

N11-1" N5-2" N6-1" N3-10" N12-4"
N12-4" N2-2" N9-3" N1-4" N13-6" M1-24" N14-4"
2'-0" DRIP TIP
T8332
(T-100M-5)
2" S.S. FLOATING SUCTION
M3-18"
3'-0"
M2-30"
N8-4"
4"VB151
4"X3"

2"VB151
N4-10"
N15-2"
2"FU-001-151
TW T8332 025
TI T8332 026
N7-1 1/2"
2"FU-013-151

ES T8332 010
UA T8332 012
2"FU-238-151
LSH T8332 011
PSV T8332 024
3"FU-009-151

2"VB151
3"X2"
3"VB151
3"FU-018-151
2"FU-013-151
3"X2"
PI T8332 013
ZSC T8332 014
OV T8332 015
LOCATE HAND SWITCH NEAR GROUND
3"FU-206-151

1"FU-237-151
PSV F8332 A 3/4"X1" 85 PSIG
1" VB501 C.S.O
3/4" VB501 C.S.O
PI F8332 A 1/2" VB501
2"X3/4"
2"X1/2" VB151
F8332
3/4"FU-232-151
3/4" VB501
1/2"FU-235-151
2"FU-233-151
2"FU-231-151
2" VB151
1"FU-230-151
1"FU-234-151
SAMPLE POT
1" VB501 VC601
PI F8332 019
1/2"X1/2" VB501
2"FU-020-151
2" VB151 VC151
ES F8332 030
P8332
SEAL POT
2"FU-040-151
3"FU-010-151
3"X2" 3" VB151
2"FU-023-151
2" VB502
2"X1" 1" VB501
1" 2"X1" VB501
1"SZ-024-151
SZ
2"FU-205-151
2" VB151

PSV F8332 B 1" VB501 C.S.O 3/4"X1" 85 PSIG
1"FU-229-151
PSV F8332 029 3/4"X1" 85 PSIG
1"FU-227-151
PSV F8332 028 3/4"X1" 85 PSIG
2"FU-223-151
2"FU-204-151
2"FU-022-151
2"FU-223-151
3"X2"
2"FU-016-151
2"FU-017-151
2" VC151 VB151

PSV F8332 022 3/4"X1" 125 PSIG
TO GRADE
PI F8332 018 1/2" VB501
3/4"X1/2"
3/4"2"X3/4" VB501 CSO
2"FU-214-151

2"FU-028-151
FROM PLT. 12
702/703
OBH21F009
SAMPLE VALVE
LOAD/UNLOADING
P8335
OBH25F007
F

2"FU-226-151
T8345
OBH25F015
H
1"FU-230-151
T4
T8331
OBH25F010
H

WASTE
T8333
OBH25F004
E
T8331
OBH25F010
C
P9331A
OBH25F010
A
HAZARDOUS WASTE
T8331
OBH25F010
D

RECIRCULATION
T8331
OBH25F010
E

G T8331 OBH25F010
2"FU-011-151
B T8331 OBH25F010
3"FU-010-151

D8365
(T-250-25)
VENT COLLECTION DRUM
250 GAL 3'-0" DIA.
MAWP 104 PSI @ 450°F
VAC. 15 PSI @ 450°F
C.S.

T8332
(T-100M-5)
HAZARDOUS WASTE
100,000 GALLONS
27'-0"I.D. X 24'-0" S.S.
PRESS. AMT.
TEMO. AMB.
CARBON STEEL

F8332
4" OD
2" SPIRAX
SPARCO FILTER
TYPE 2V RSHO

P8332
(PC-200-90-10)
200 GPM @ 90 FOT HEAD
MOTOR 7.5 H.P. @ 1750 RPM
3"X2"

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ORANGEBURG ENGINEERING

ALBEMARLE™ CORPORATION

WASTE FUEL STORAGE T-8332 (T-100M-5) P&ID

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
0	AS-BUILT FOR UTILITIES	10/01/91	10/03/91			10/3/91	5/20/92
	PER PROCESS SAFETY REVIEW	RDS	RR			GFW	EG
16	AS-BUILT PER PROJ.# 3380	12/16/02	12/18/02	12/18/02	12/18/02	12/18/02	12/18/02
	BURN DETDA WASTE IN #4 BOILER	JWR	ACB	JSS	JWR	JSS	RLT
17	AS-BUILT PER TSR# 3005	7/25/03	7/30/03		7/30/03	7/29/03	8/5/03
	PHA UTILITIES	JWR	GTK		NLK	GFW	RAT
18	GENERAL REVISION PER FIELD CHECK	10/14/03	10/15/03	10/15/03	10/15/03	10/15/03	10/15/03
		RDS	RDS	JSS	JWR	JSS	RAT
14	ADDED BALL VALVES TO CHECK NITROGEN	4/23/99	4/26/99	4/26/99	4/27/99	4/26/99	4/27/99
	DEMAND PER TSR-9068 & YS #04328Y	RR	AMG	AMG	JWR	GFW	RLT
15	INSTALL 3/4" LINE FOR MONTHLY O2 TEST	04/12/00	04/13/00	04/13/00	04/14/00	04/13/00	04/14/00
	PER TSR-9210, YS#04332Y	JSJ III	AMG	AMG	JWR	GFW	RLT

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F009	18
SCALE: NONE	OPERATING AREA: –	BUILDING NO: –

****

3/19/98

Revised

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-F8332-A

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	500 ft
6)	Cubical expansion	.01 /degF
7)	SG @ flow conditions	.9
8)	Viscosity @ FTP	10 cp
9)	Set pressure	150 psig
10)	Total back pressure	10 psig
11)	Selected valve area	.110 in2

CALCULATED AREA = .001964 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 14669 lb/h at FTP
and 261.9 lb/h @ backpressure of 165 psig

CALCULATED FLOWRATE = 261.9 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .8204 Kp = 1

Correction applied for viscosity

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1172

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

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Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-922	Boiler	UT	25	OR-UT-A-A-F8332 -PSVA	25F009	Unknown

Level	Height	North	East	Location
4FT. ABOVE SLA	0	98	1260	NORTHEAST OF T-30,000-66

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
85	2	Yes	8/6/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/06/02		Yes		No	No	
FG	08/29/00	72	Yes	Yes	No	No	
FG	08/12/98	72	Yes	No	No	Yes	
GS	08/01/96	72	Yes		No	No	
GMJ	06/06/95	72	Yes		No	No	
FG	08/18/94	72	Yes		No	No	
GS	06/08/93		No		No	No	

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-922	85	6/8/93	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-1-LS	TJ-93745	UV/WB	T8332-A

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4"MNPT	1"FNPT	

Air Capacity	Water Capacity	Steam Capacity
	26 GPM	

Base Matl	Body Matl	Spring Matl
C/S	C/S	C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S	S/S	S/S

Comments

Originator: R L THOMAS

Charge Code:

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Revised

Tag number PSV-F8332-B

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	75 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .02039 in2
RELIEF PRESSURE = 82.5 psig

Selected valve capacity = 10989 lb/h at FTP
and 2037 lb/h @ backpressure of 79.84 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

dwg 25F009
3/4 x 1-923

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

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3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

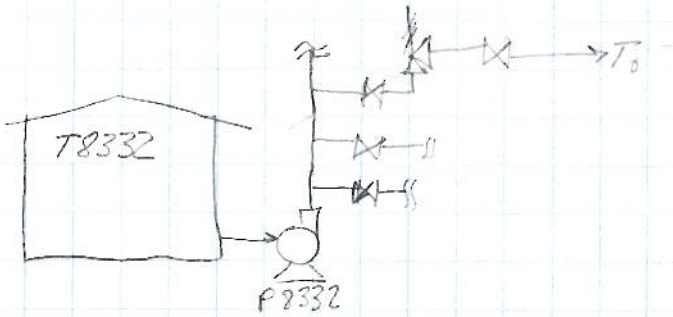
Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}}\right) K_w\right)}{1.12} \text{ psig}$$

whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

SUBJECT Over Pressure Protection for Transfer Line During Thermal Expansion Dwg: 25F009	FILE PSV-F8332B DATE 7/28/03 BY F. B. ISZARD



Design Basis: Thermal Expansion

Relief Valve
3/4 x 1-923
P_{SET} = 85 PSIG (99.7 PSIA)
OVPR = 10%
P_{FLOW} = 85(1.1) + 14.7 = 108.2 PSIA

Transfer Line
Size = 2", Length = 4 FT

Sizing Fluid
Waste fuel
β = 0.000472 1/F
SG = 0.694
C_p = 0.725 BTU/LB F
μ = 0.211 cP

Heat Transfer Rate From Fire Exposure

$$Q = UA\Delta T = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)\left[\pi \left(\frac{2}{12}\right)(4)\ FT^2\right](1000F)$$

$$Q = 198{,}966\ BTU/HR$$

Excel estimates $A_{MIN} = 0.0012\ IN^2$ $d_{MIN} = \sqrt{\frac{4\,(0.0012)}{\pi}} = 0.039\ IN$

∴ The existing 3/4 x 1 RV is adequate.

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-923	85	6/8/93	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-1-LS	TJ-99473	UV/WB	T8332-B

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4"MNPT	1"FNPT	

Air Capacity	Water Capacity	Steam Capacity
	26 GPM	

Base Matl	Body Matl	Spring Matl
C/S	C/S	C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S	S/S	S/S

Comments

Originator: R L THOMAS

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-923	Boiler	UT	25	OR-UT-A-A-F8332 -PSVB	25F009	Unknown

Level	Height	North	East	Location
6FT. ABOVE SLA	0	98	1260	N.E. OF T-100M-2 AT BOILER AREA

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
85	2	Yes	8/6/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
JEH	08/06/02	77	No	No	No	Yes	
RK	08/29/00	70	Yes	Yes	No	No	
GMJ	08/19/98	65	Yes	No	No	No	
GS	08/01/96	75	Yes		No	No	
GMJ	06/06/95	69	Yes		No	No	
FG	08/18/94	69	Yes		No	No	
GS	06/08/93		No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- F8332B
Vessel ID:	F8332
P&ID No.:	25F009
Line No.:	2-FU-204-151
Engineer:	F.B.Iszard
Date:	7/28/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	130	N/A	0.001	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- F8332B
Vessel ID:	F8332
P&ID No.	25F009
Line No.	2-FU-204-151
Engineer	F.B.Iszard
Date:	7/28/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	198,966	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.694	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.725	
Viscosity, cp	0.211	
System or Vessel MAWP	85	
PSV Set Pressure, psig	85	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	85	
Maximum Relieving Pressure, psig	93.5	
Liquid Expansion Rate, gpm	0.373	
Liquid Expansion Rate, lb/hr	129.7	
Orifice Reynolds Number	100551	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

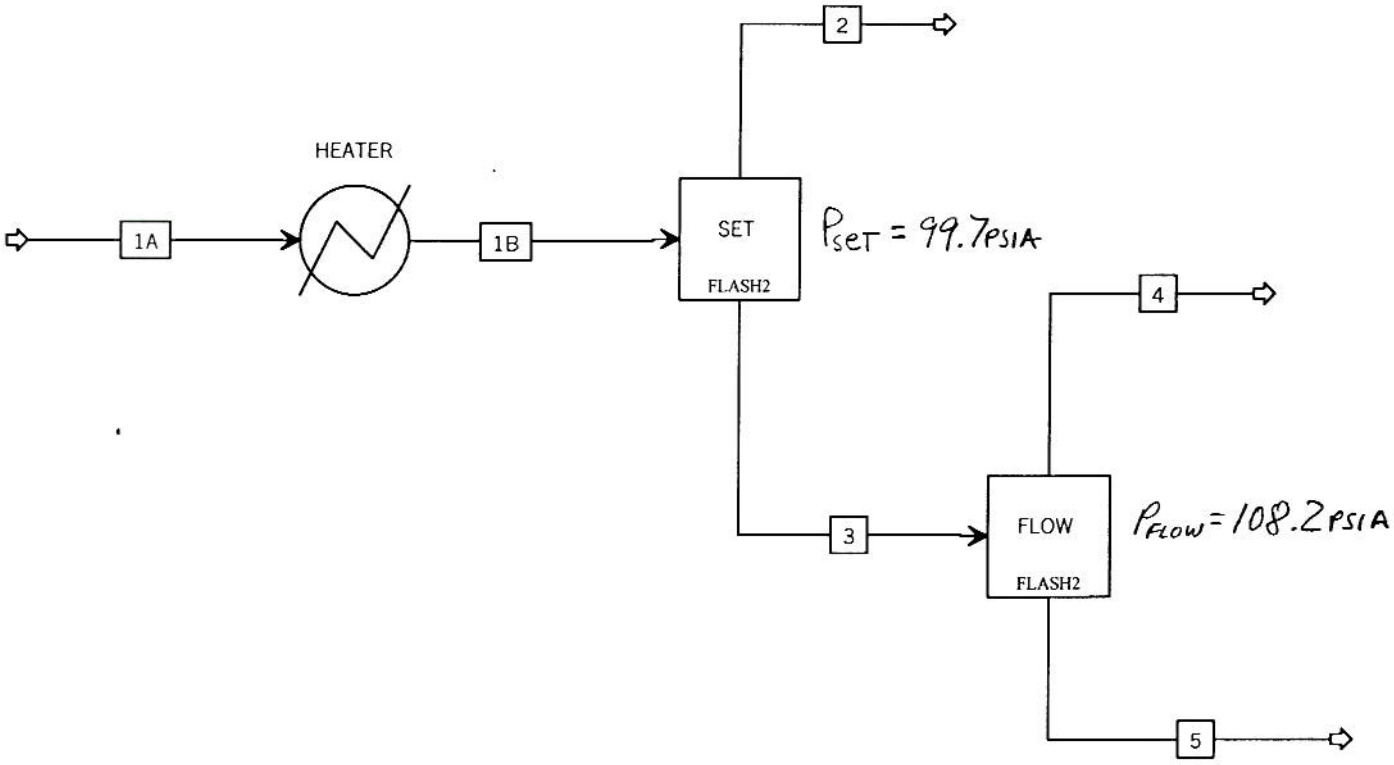
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0012 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

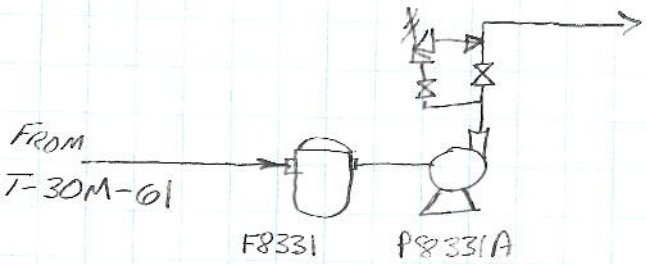
Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	4.73701E-4
IBB	.1117559	.1117559	1.27252E-3
DETDA	.0841373	.0841373	5.61079E-5
TOLUENE	.1085299	.1085299	3.66561E-3
BP350	.0464626	.0464626	4.29826E-4
BP525	.0295767	.0295767	4.52548E-5
BP700	.0202392	.0202392	2.92397E-6
Mole Frac			
AN701	.3260920	.3260920	.0796679
IBB	.1879532	.1879532	.2140150
DETDA	.1415038	.1415038	9.43633E-3
TOLUENE	.1825277	.1825277	.6164891
BP350	.0781418	.0781418	.0722889
BP525	.0497427	.0497427	7.61104E-3
BP700	.0340387	.0340387	4.91759E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.0977244
IBB	15.00000	15.00000	.1707992
DETDA	15.00000	15.00000	.0100029
TOLUENE	10.00000	10.00000	.3377510
BP350	6.700000	6.700000	.0619816
BP525	6.600000	6.600000	.0100985
BP700	6.700000	6.700000	9.67951E-4
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.6893256
Total Flow cuft/hr	1.624909	1.648377	.6317055
Temperature F	70.00000	100.0000	527.3652
Pressure psi	14.70000	.2100321	99.70000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	14327.82
Enthalpy Btu/lb	-535.4649	-524.0510	123.5880
Enthalpy Btu/hr	-53546.49	-52405.10	85.19236
Entropy Btu/lbmol-R	-227.5721	-223.9813	-76.73057
Entropy Btu/lb-R	-1.353130	-1.331779	-.6618577
Density lbmol/cuft	.3659245	.3607148	9.41252E-3
Density lb/cuft	61.54191	60.66573	1.091214
Average MW	168.1820	168.1820	115.9321

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.563166	.0122822	1.550884
*** ALL PHASES ***			
Pressure psi	99.70000	108.2000	108.2000
Temperature F	527.3652	539.2691	539.2691
Average MW	168.7097	116.9148	169.2329
Density lb/cuft	45.84895	1.180052	45.39672
CPMX Btu/lb-R	.7114150	.5203291	.7247545
CPCVMX	1.000000	1.033745	1.000000
*** VAPOR PHASE ***			
Average MW		116.9148	
Density lb/cuft		1.180052	
CPMX Btu/lb-R		.5203291	
CPCVMX		1.033815	
MUMX cP		.0114956	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	100.4782		99.08968
IBB	98.27328		95.98334
DETDA	154.6975		153.6157
TOLUENE	86.17004		80.95732
BP350	88.37478		85.82134
BP525	93.82166		92.47258
BP700	90.79921		89.91630
Average MW	168.7097		169.2329
Density lb/cuft	45.84895		45.39672
CPMX Btu/lb-R	.7114150		.7247545
CPCVMX	1.000000		1.000000
MUMX cP	.2167983		.2108143
SIGMAMX dyne/cm	8.875220		8.428515
ZMX	.0346351		.0376263

SUBJECT Over Pressure Protection for Transfer Pump P8331A
DWG: 25F010

FILE PSV-P8331A-020
DATE 7/29/03
BY F.B. ISZARD



Design Basis: Liquid Relief

Relief Valve

3/4 x 1-751
PSET = 150 PSIG (164.7 PSIA)
OVPR = 10%
PFLOW = 150(1.1) + 14.7 = 179.7 PSIA

Transfer Pump

Q = 30 GPM

Sizing Fluid

Waste Fuel
@ PFLOW = 179.7 PSIA
TFLOW = 60°F
SG = 42.3/62.4 = 0.678
C_p = 0.745 BTU/lb°F
μ = 0.176 cP

Excel estimates $A_{MIN} = 0.007 in^2$ and $d_{MIN} = \sqrt{\frac{4(0.007)}{\pi}} = 0.094 in$

∴ the existing 3/4 x 1 RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-751	150	6/2/89	1

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990-C-1	TH-62162	UV-NB	P8331A-020

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4 MNPT	1 FNPT	.110 SQ.IN.

Air Capacity	Water Capacity	Steam Capacity
162 CFM ON TAG		

Base Matl	Body Matl	Spring Matl
316 S/S		C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S		304-316 S/S

Comments

Originator: JET

Charge Code: 2310RM

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-751	Boiler	UT	15	OR-UT-A-A-P8331A -PSV020	25F010	Oil

Level	Height	North	East	Location
1	3	0	1200	SOUTH BOILER , DISCHARGE OF PUMP N. OF T-30M-66.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
150	1	Yes	8/26/02	8/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/26/02		Yes	No	Yes	No	
FG	10/11/01	118	Yes	Yes	Yes	Yes	
FG	10/18/00		No	No	No	No	STUCK CLOSED WITH DRIED CHEM. RESIDUE.,
FG	10/19/98	125	Yes		No	No	
GS	07/29/96	125	Yes		No	No	CHANGED SPRING FROM 100 TO 150 P.S.I.G. AS PER PCO-03213Y.
FG	04/04/96	85	Yes		No	No	reworked valve and change spring to 100 psi as per pco-00107y.
GMJ	03/21/96	58	Yes		No	No	
GS	03/06/95	82	Yes		No	No	CHANGED SPRING FROM 75 TO 100 PSI AS PER PCO-00107Y
FG	02/24/95	62	Yes		No	No	REMOVED FROM STOCK INSTALLED AS PER PCO-00107Y ON 02-24-95
TOM	08/05/94	60	Yes		No	No	REMOVED FROM SERVICE RETURNED TO STOCK ON 08-05-94

Tag Information:	
Project No.:	
Tag No.:	PSV- P8331A-020
Vessel ID:	T8333
P&ID No.:	25F010
Line No.:	1 1/2 in.
Engineer:	F.B.Iszard
Date:	7/29/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	NO								
Liquid Relief	YES	LIQUID	1,018	N/A	0.007	0.110	0.00	0.00	10.0
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- P8331A-020
Vessel ID:	T8333
P&ID No.	25F010
Line No.	1 1/2 in.
Engineer	F.B.Iszard
Date:	7/29/03

PSV sizing for liquid relief (ie: overfilling vessel on pump in).

Comments:

Over pressure protection for pump P8331A

Based on API RP 520 Part 1, Sec. 4.5.1

Liquid Relief Rate, gpm	3
G = Specific Gravity referrenced to water @ 60 F	0.678
Viscosity, cp	0.176
System or Vessel MAWP	150
PSV Set Pressure, psig	150
% Overpressure	10
% Accumulation	10
Superimposed Back Pressure, psig	0
Flowing Temperature, F	606
Differential Set Pressure, psig	150
Maximum Relieving Pressure, psig	165
Liquid Relief Rate, lb/hr	1018
Orifice Reynolds Number	387044

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

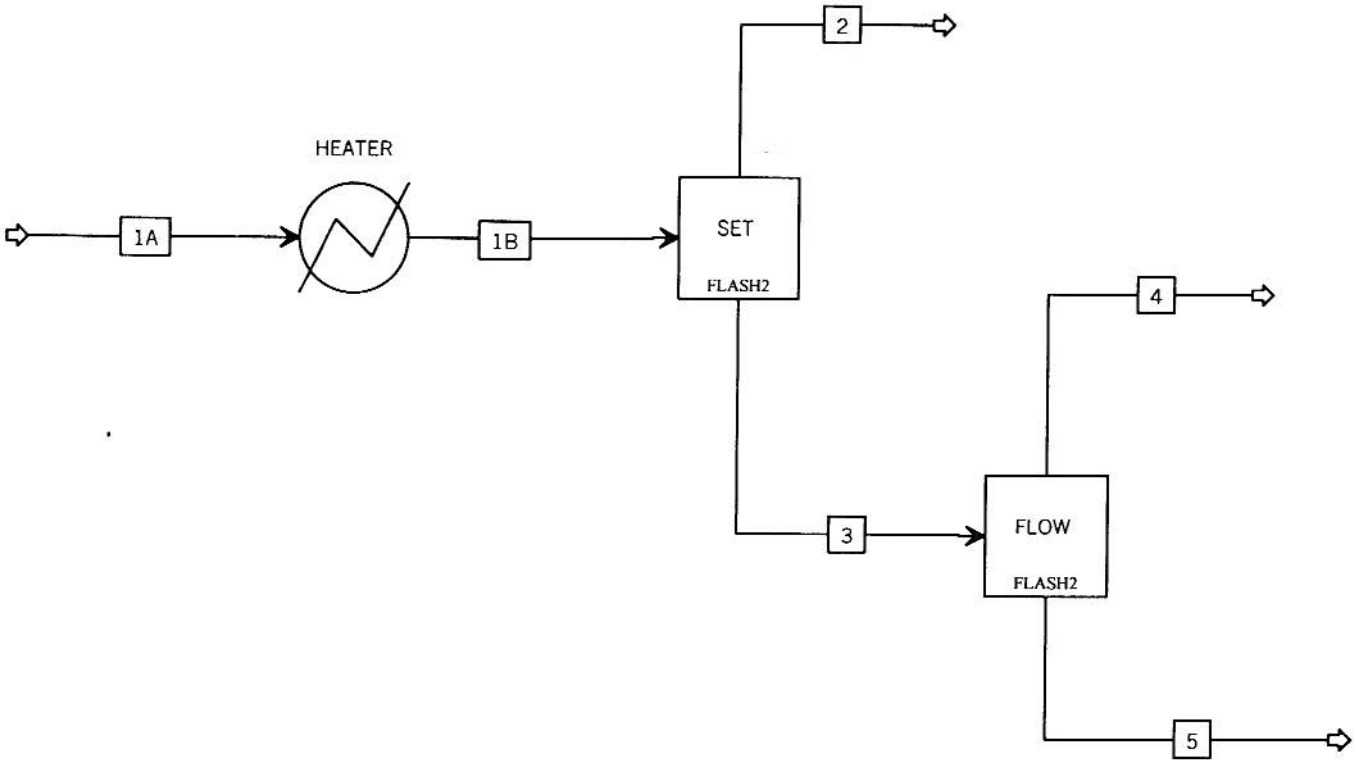
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required **0.0070** sq. in.

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



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Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.79097E-4
IBB	.1117559	.1117559	1.31627E-3
DETDA	.0841373	.0841373	8.21414E-5
TOLUENE	.1085299	.1085299	3.49681E-3
BP350	.0464626	.0464626	4.10822E-4
BP525	.0295767	.0295767	5.58372E-5
BP700	.0202392	.0202392	4.96159E-6
Mole Frac			
AN701	.3260920	.3260920	.0973936
IBB	.1879532	.1879532	.2213733
DETDA	.1415038	.1415038	.0138147
TOLUENE	.1825277	.1825277	.5881002
BP350	.0781418	.0781418	.0690929
BP525	.0497427	.0497427	9.39081E-3
BP700	.0340387	.0340387	8.34450E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1194677
IBB	15.00000	15.00000	.1766716
DETDA	15.00000	15.00000	.0146441
TOLUENE	10.00000	10.00000	.3221978
BP350	6.700000	6.700000	.0592413
BP525	6.600000	6.600000	.0124599
BP700	6.700000	6.700000	1.64249E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.7063251
Total Flow cuft/hr	1.624909	1.648377	.4075623
Temperature F	70.00000	100.0000	592.3172
Pressure psi	14.70000	.2100321	164.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	15998.67
Enthalpy Btu/lb	-535.4649	-524.0510	134.6790
Enthalpy Btu/hr	-53546.49	-52405.10	95.12717
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.68834
Entropy Btu/lb-R	-1.353130	-1.331779	-.6539911
Density lbmol/cuft	.3659245	.3607148	.0145890
Density lb/cuft	61.54191	60.66573	1.733048
Average MW	168.1820	168.1820	118.7911

Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0125091
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	164.7000
Temperature F	70.00000	100.0000	592.3172
Average MW	168.1820	168.1820	118.7911
Density lb/cuft	61.54191	60.66573	1.733048
CPMX Btu/lb-R	.3695765	.3910039	.5412393
CPCVMX	1.000000	1.000000	1.031871
*** VAPOR PHASE ***			
Average MW			118.7911
Density lb/cuft			1.733048
CPMX Btu/lb-R			.5412393
CPCVMX			1.031937
MUMX cP			.0119738
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET LIQUID	FLOW VAPOR	FLOW LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933133	6.06606E-4	.1927067
IBB	.1104396	1.32458E-3	.1091150
DETDA	.0840551	8.94221E-5	.0839657
TOLUENE	.1050331	3.39544E-3	.1016376
BP350	.0460518	4.06447E-4	.0456454
BP525	.0295209	5.84533E-5	.0294624
BP700	.0202342	5.52880E-6	.0202287
Mole Frac			
AN701	.3284021	.1030506	.3306784
IBB	.1876156	.2250207	.1872378
DETDA	.1427936	.0151910	.1440825
TOLUENE	.1784310	.5768207	.1744069
BP350	.0782332	.0690475	.0783260
BP525	.0501503	9.93009E-3	.0505566
BP700	.0343741	9.39236E-4	.0347118
Mass Flow lb/hr			
AN701	39.88053	.1251427	39.75539
IBB	14.82333	.1777867	14.64554
DETDA	14.98536	.0159421	14.96941
TOLUENE	9.677802	.3128580	9.364944
BP350	6.640759	.0586104	6.582148
BP525	6.587540	.0130437	6.574496
BP700	6.698358	1.83025E-3	6.696527
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.29367	.7052140	98.58846
Total Flow cuft/hr	2.319241	.3746732	2.337077
Temperature F	592.3172	606.1609	606.1609
Pressure psi	164.7000	179.7000	179.7000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-41316.09	16053.19	-39370.99
Enthalpy Btu/lb	-244.9364	133.9973	-232.7240
Enthalpy Btu/hr	-24320.64	94.49679	-22943.90
Entropy Btu/lbmol-R	-166.6754	-78.42072	-165.2473
Entropy Btu/lb-R	-.9881109	-.6545844	-.9767854
Density lbmol/cuft	.2538107	.0157109	.2493549
Density lb/cuft	42.81300	1.882211	42.18452
Average MW	168.6809	119.8023	169.1746

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.562990	.0124523	1.550538
*** ALL PHASES ***			
Pressure psi	164.7000	179.7000	179.7000
Temperature F	592.3172	606.1609	606.1609
Average MW	168.6809	119.8023	169.1746
Density lb/cuft	42.81300	1.882211	42.18452
CPMX Btu/lb-R	.8519737	.5471507	.7444560
CPCVMX	1.000000	1.031242	1.000000
*** VAPOR PHASE ***			
Average MW		119.8023	
Density lb/cuft		1.882211	
CPMX Btu/lb-R		.5471507	
CPCVMX		1.031306	
MUMX cP		.0120768	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	92.04296		89.94487
IBB	84.27379		80.66786
DETDA	147.9820		146.2757
TOLUENE	44.00132		0.0
BP350	72.54401		68.34641
BP525	86.02781		84.21037
BP700	85.79770		84.66828
Average MW	168.6809		169.1746
Density lb/cuft	42.81300		42.18452
CPMX Btu/lb-R	.8519737		.7444560
CPCVMX	1.000000		1.000000
MUMX cP	.1812411		.1762739
SIGMAMX dyne/cm	6.290685		5.836650
ZMX	.0574799		.0630064

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-P8331 A-A

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .01419 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 15791 lb/h at FTP
and 2037 lb/h @ backpressure of 162.3 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

PSV-P8331A-A (on P&ID P8331A)

25FO10

3/4X1-182

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}}\right) K_w\right)}{1.12} \text{ psig}$$

whichever is the smallest.

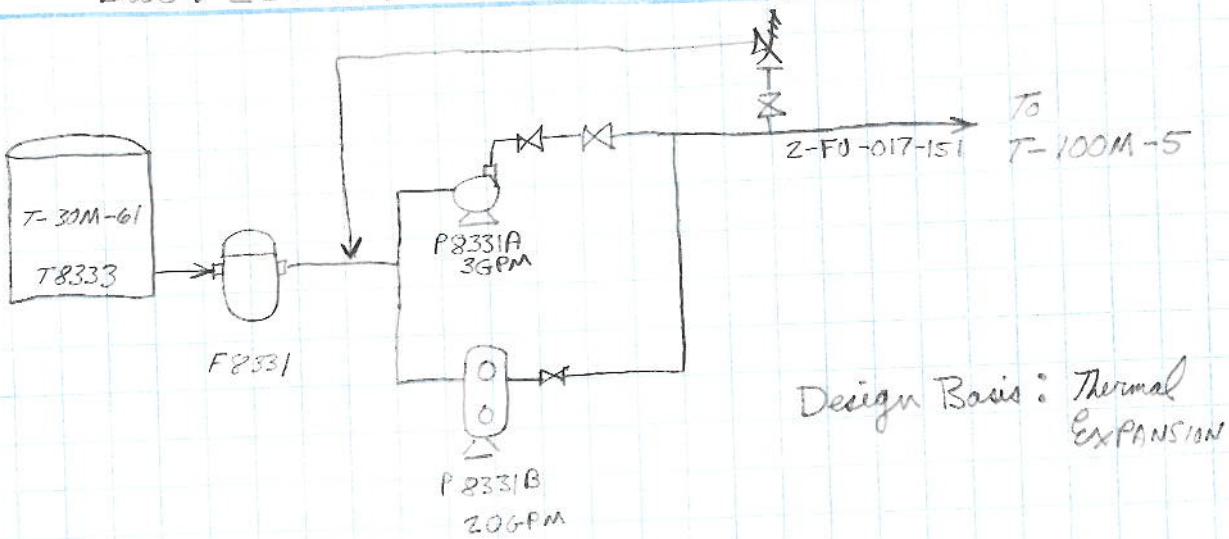
Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

ALBEMARLE CORPORATION CALCULATION SHEET ORANGEBURG PLANT PAGE

SUBJECT Over Pressure Protection for Waste Fuel Transfer Pipeline
DWG: 25F010

FILE PSV-P8331A
DATE 7/29/03
BY F.B. ISZARD



Design Basis: Thermal Expansion

Relief Valve

3/4 x 1 - 182
P_{SET} = 150 PSIG (164.7 PSIA)
OVPR = 10%
P_{FLOW} = 150(1.1) + 14.7 = 179.7 PSIA
P_{BACK} = Ø PSIG

Transfer Line

Size = 2 IN
Length = 44 FT
Heat traced to 150F

Sizing Fluid

Waste Fuel
χ = 0.000472 1/F
at P_{FLOW} = 179.7 PSIA
T_{FLOW} = 606F
SG = 42.3/62.4 = 0.678
C_p = 0.745 BTU/LB F
μ = 0.176 cP

Heat Transfer Rate

$$Q = UA\Delta T = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)\left[\pi\left(\frac{2}{12}\right)(44)\right]FT^2(150-70)F$$

$$Q = 175{,}091 \ BTU/HR$$

Excel estimates $A_{MIN} = 0.0008\,IN^2$ and $d_{MIN} = \sqrt{\frac{4(0.0008\,IN^2)}{\pi}} = 0.032\,IN$

∴ the existing 3/4 x 1 RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-182	150		2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1975C-3	TD-99681		P8331A-A

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	MNPT	FNPT	

Air Capacity	Water Capacity	Steam Capacity
280 CFM 10% OP	18 GPM 10% OP	790 LB/HR 10%OP

Base Matl	Body Matl	Spring Matl
	CARBON STEEL	CARBON STEEL

Bonnet Matl	Nozzle Matl	Trim Matl
		304SS

Comments

Originator

Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-182	Boiler	UT	25	OR-UT-A-A-P8331A -PSVA	25F010	Oil

Level	Height	North	East	Location
G	5	80	1250	T-30M-66 PUMP DISCHARGE.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
150	2	Yes	8/26/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/26/02		Yes	No	No	Yes	
JEH	10/11/01	116	Yes	Yes	Yes	Yes	
FG	10/06/00		No	Yes	No	No	STUCK CLOSED WITH CHEMICAL WASTES.
FG	07/09/98	124	Yes		No	No	
GS	07/29/96	118	Yes		No	No	VALVE INSTALLED IN PLACE OF 3/4X3/4-270-90 ON 7-29-96.
FG	07/20/93		Yes		No	No	VALVE RETURNED TO STOCK 07-20-93
GS	07/14/92	124	Yes		No	No	
GS	06/28/91	125	No		No	No	
GS	12/14/90	128	No		No	No	
TOM	12/19/89	126	No		No	No	BT @ 144 PSIG

Tag Information:	
Project No.:	
Tag No.:	PSV- P8331A
Vessel ID:	T8333
P&ID No.:	25F010
Line No.:	2-FU-017-151
Engineer:	F.B.Iszard
Date:	7/29/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	111	N/A	0.001	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- P8331A
Vessel ID:	T8333
P&ID No.	25F010
Line No.	2-FU-017-151
Engineer	F.B.Iszard
Date:	7/29/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	175,091	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.678	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.745	
Viscosity, cp	0.176	
System or Vessel MAWP	150	
PSV Set Pressure, psig	150	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	150	
Maximum Relieving Pressure, psig	165	
Liquid Expansion Rate, gpm	0.327	
Liquid Expansion Rate, lb/hr	111.0	
Orifice Reynolds Number	127828	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

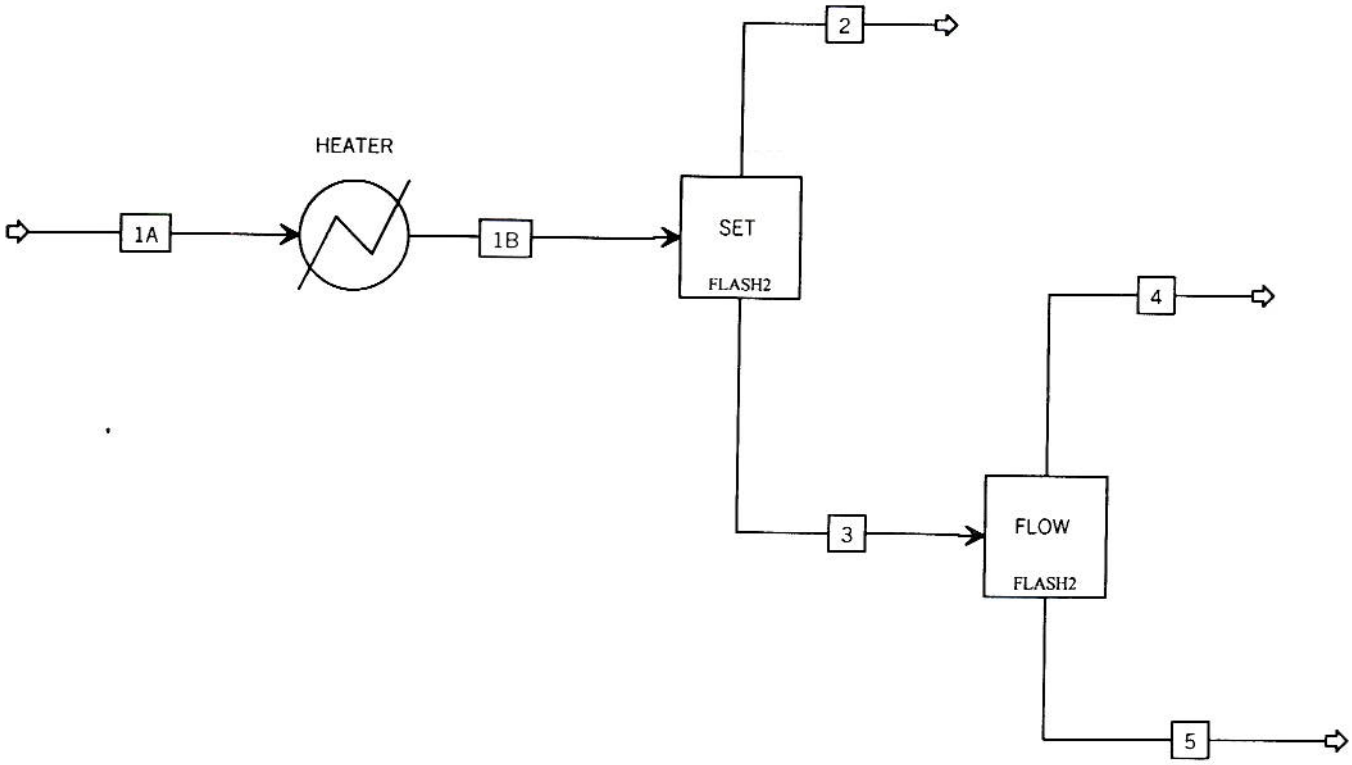
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0008 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.79097E-4
IBB	.1117559	.1117559	1.31627E-3
DETDA	.0841373	.0841373	8.21414E-5
TOLUENE	.1085299	.1085299	3.49681E-3
BP350	.0464626	.0464626	4.10822E-4
BP525	.0295767	.0295767	5.58372E-5
BP700	.0202392	.0202392	4.96159E-6
Mole Frac			
AN701	.3260920	.3260920	.0973936
IBB	.1879532	.1879532	.2213733
DETDA	.1415038	.1415038	.0138147
TOLUENE	.1825277	.1825277	.5881002
BP350	.0781418	.0781418	.0690929
BP525	.0497427	.0497427	9.39081E-3
BP700	.0340387	.0340387	8.34450E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1194677
IBB	15.00000	15.00000	.1766716
DETDA	15.00000	15.00000	.0146441
TOLUENE	10.00000	10.00000	.3221978
BP350	6.700000	6.700000	.0592413
BP525	6.600000	6.600000	.0124599
BP700	6.700000	6.700000	1.64249E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.7063251
Total Flow cuft/hr	1.624909	1.648377	.4075623
Temperature F	70.00000	100.0000	592.3172
Pressure psi	14.70000	.2100321	164.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	15998.67
Enthalpy Btu/lb	-535.4649	-524.0510	134.6790
Enthalpy Btu/hr	-53546.49	-52405.10	95.12717
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.68834
Entropy Btu/lb-R	-1.353130	-1.331779	-.6539911
Density lbmol/cuft	.3659245	.3607148	.0145890
Density lb/cuft	61.54191	60.66573	1.733048
Average MW	168.1820	168.1820	118.7911

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0125091
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	164.7000
Temperature F	70.00000	100.0000	592.3172
Average MW	168.1820	168.1820	118.7911
Density lb/cuft	61.54191	60.66573	1.733048
CPMX Btu/lb-R	.3695765	.3910039	.5412393
CPCVMX	1.000000	1.000000	1.031871
*** VAPOR PHASE ***			
Average MW			118.7911
Density lb/cuft			1.733048
CPMX Btu/lb-R			.5412393
CPCVMX			1.031937
MUMX cP			.0119738
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET LIQUID	FLOW VAPOR	FLOW LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933133	6.06606E-4	.1927067
IBB	.1104396	1.32458E-3	.1091150
DETDA	.0840551	8.94221E-5	.0839657
TOLUENE	.1050331	3.39544E-3	.1016376
BP350	.0460518	4.06447E-4	.0456454
BP525	.0295209	5.84533E-5	.0294624
BP700	.0202342	5.52880E-6	.0202287
Mole Frac			
AN701	.3284021	.1030506	.3306784
IBB	.1876156	.2250207	.1872378
DETDA	.1427936	.0151910	.1440825
TOLUENE	.1784310	.5768207	.1744069
BP350	.0782332	.0690475	.0783260
BP525	.0501503	9.93009E-3	.0505566
BP700	.0343741	9.39236E-4	.0347118
Mass Flow lb/hr			
AN701	39.88053	.1251427	39.75539
IBB	14.82333	.1777867	14.64554
DETDA	14.98536	.0159421	14.96941
TOLUENE	9.677802	.3128580	9.364944
BP350	6.640759	.0586104	6.582148
BP525	6.587540	.0130437	6.574496
BP700	6.698358	1.83025E-3	6.696527
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.29367	.7052140	98.58846
Total Flow cuft/hr	2.319241	.3746732	2.337077
Temperature F	592.3172	606.1609	606.1609
Pressure psi	164.7000	179.7000	179.7000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-41316.09	16053.19	-39370.99
Enthalpy Btu/lb	-244.9364	133.9973	-232.7240
Enthalpy Btu/hr	-24320.64	94.49679	-22943.90
Entropy Btu/lbmol-R	-166.6754	-78.42072	-165.2473
Entropy Btu/lb-R	-.9881109	-.6545844	-.9767854
Density lbmol/cuft	.2538107	.0157109	.2493549
Density lb/cuft	42.81300	1.882211	42.18452
Average MW	168.6809	119.8023	169.1746

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.562990	.0124523	1.550538
*** ALL PHASES ***			
Pressure psi	164.7000	179.7000	179.7000
Temperature F	592.3172	606.1609	606.1609
Average MW	168.6809	119.8023	169.1746
Density lb/cuft	42.81300	1.882211	42.18452
CPMX Btu/lb-R	.8519737	.5471507	.7444560
CPCVMX	1.000000	1.031242	1.000000
*** VAPOR PHASE ***			
Average MW		119.8023	
Density lb/cuft		1.882211	
CPMX Btu/lb-R		.5471507	
CPCVMX		1.031306	
MUMX cP		.0120768	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	92.04296		89.94487
IBB	84.27379		80.66786
DETDA	147.9820		146.2757
TOLUENE	44.00132		0.0
BP350	72.54401		68.34641
BP525	86.02781		84.21037
BP700	85.79770		84.66828
Average MW	168.6809		169.1746
Density lb/cuft	42.81300		42.18452
CPMX Btu/lb-R	.8519737		.7444560
CPCVMX	1.000000		1.000000
MUMX cP	.1812411		.1762739
SIGMAMX dyne/cm	6.290685		5.836650
ZMX	.0574799		.0630064

****
7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Revised 7/03 gbb

Tag number PSV-P8331A-020

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	1.55 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	125 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .008794 in2
RELIEF PRESSURE = 137.5 psig

Selected valve capacity = 14322 lb/h at FTP
and 1145 lb/h @ backpressure of 136.7 psig

CALCULATED FLOWRATE = 1145 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9828 Kp = 1

Correction applied for viscosity

****

25F010
3/4X1-751

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}}\right) K_w\right)}{1.12} \text{ psig}$$

whichever is the smallest.

Nomenclature

A	Relief area, square inches
B	Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
D	Pipe diameter, inches
G_f	Specific gravity of the liquid at flowing temperature, dimensionless
K_d	Coefficient of discharge
K_p	Overpressure correction factor, dimensionless
K_w	Back-pressure correction factor, dimensionless
K_v	Viscosity correction factor, dimensionless
L	Pipe length, feet
P_{Bmax}	Maximum allowable back-pressure, psig
P_{IN}	Set pressure, psig
P_{OUT}	Back pressure, psig
R_D	Reynolds number, dimensionless
W_m	Flow through valve, pounds per hour
μ_{cp}	Absolute viscosity, centipoises

Tag Information:	
Project No.:	PSV UPDATE
Tag No.:	PSV- P8331A-B
Vessel ID:	P8331A Seal Oil Pot
P&ID No.:	25F010
Line No.:	1/2"-XXX-XXX
Engineer:	BMS
Date:	1/7/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	YES	VAPOR	330	1,297	0.028	0.110	6.59	3.23	10.0
Hydraulic Expansion	NO								
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

VERIFY Regulator Pressure & C_v

Project No	PSV UPDATE
Tag No.	PSV- P8331A-B
Vessel ID:	P8331A Seal Oil Pot
P&ID No.	25F010
Line No.	1/2"-XXX-XXX
Engineer	BMS
Date:	1/7/03

PSV sizing for regulator or control valve failing wide open (Gas or Vapor Service).

Comments:

PSV: 3/4X1-330 on Nitrogen gas line from bottles to P8331A seal oil pot. Nitrogen cylinder is not shown on P&ID. Control valve failure: PCV??? Matheson model no: 8H1340. Inlet pressure from other regulator valve output = 590 psig. Additional piping resistanse results in a Cv value of ????????0.202

← TO BE VERIFIED

Wide Open Coefficients for Fisher 95 Series Pressure Regulators

Body Size in.	Item No.	Cv	
1/8	1	0.8	
1/4	2	0.8	
3/8	3	1.9	
1/2	4	1.9	
3/4	5	4.4	
1	6	4.4	
1-1/4	7	12.5	
1-1/2	8	12.5	
2	9	12.5	
Other	10	**0.2**	User supplied Cv for other regulators or Control Valve.

Calculate Wide Open Flow Through Regulator or Control Valve

Regulator Size (Item # from above)	**10**
Valve Flow Coefficient, Cv	0.2
Critical Flow Factor, Cf	**1**
Flowing Temp, F	**80**
Reg. or CV Inlet Pressure, psig	**590**
System or Vessel MAWP	**125**
Downstream PSV Set Press., psig	**125**
PSV % Overpressure	**10**
% Accumulation	**10**
Vessel Peak Press., psig	137.5
Mol. Wt.	**28**
Compressibility, Z	**1**
Viscosity, cp	**0.018**
Cp/Cv	**1.41**
Density, lb/ft3 (flowing)	2.922
Density, lb/ft3 @ 60 F & 14.7 psia	0.0738
S. G. @ flowing temp & 14.7 psia	0.9298
S. G. @ 60 F & 14.7 psia	0.9656
Critical Pressure, psia	318.44
Critical Pressure Ratio,nc	0.5266
Actual Pressure Ratio, n	0.2517

CRITICAL FLOW ACROSS REG/CV

	Critical Flow	Subcritical Flow
Flow, SCFH (14.7 psia, 60 F)	4461.4	4985.6
Flow, SCFM	74.4	83.1
Flow, lb/hr	329.8	367.1
Free Air Capacity @ STP, lb/hr	342.0	380.7
Free Air Capacity, SCFH	4476.7	4982.4

Size Safety Relief Valve

Peak Relieving Pressure, psia	152.20
Superimposed Back Press., psig	
Differential Set Pressure, psig	**125.00**
Flowing Temperature, F	**80.00**
Density, lb/ft3 (flowing)	0.735
Flow, lb/hr	**330**
Critical Pressure, psia	80.149
Critical Pressure Ratio,nc	0.527
Actual Pressure Ratio, n	0.097

CRITICAL FLOW ACROSS PSV

Calculation Mode:	RATE EXISTING PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.953

Typical discharge coefficients

PSV Cd = 0.953 for air, steam, vapors & gasses (Farris Series 2600 Pressure Relief Valves)
PSD Cd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Cd by 0.9, ie. Cd = 0.9 X 0.953 (=0.8577) API RP520 2.6.2.1

C	356.9
r	0.097
F2	0.261

	Critical Flow	Subritical Flow
Minimum Vent Area Required, in2	0.028	0.055

Sizing Basis **CRITICAL FLOW ACROSS PSV**

Minimum Vent Area Required	**0.028**	**sq. in.**		
Minimum Flanged PSV Selected (Design Mode):	**1X2**	**D**	**0.11**	**sq. in.**
Actual Installed Orifice Size (Rating Mode):			0.11	sq. in.

Vapor Relief Rate:	**lb/hr**	**330**
	ACFH	**448**
	SCFH (60F, 14.7 psia)	**4,471**
	SCFH Equivalent Air Capacity	**4,464**
Rated Capacity of Relief Valve, lb/hr		**1,297**

Note: PSV inlet and outlet piping size is based on the rated capacity (or wide open flow rate) of selected valve.

Pressure Drop Summary

PSV Inlet Pipe

Section	Pipe ID in	Eq. Length, ft.	K	Friction psi	Accel., psi	Total, psi
Vessel Nozzle	0.622		0.5	2.14	4.28	6.414
Pipe Section 1	0.622	2.471		5.62	0.36	5.982
Red/Exp			0.048	0.23	-3.14	-2.919
Pipe Section 2	0.824	0.500		0.26	0.01	0.264
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 3	0.824	0.000		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 4	0.824	0.000		0.00	0.00	0.000
Total				8.24	1.50	9.74

Total Non-recoverable Losses, ps	8.24
Percent of Set Pressure	6.59

WARNING: Non-recoverable pressure losses greater than 3 % of set pressure. Valve chattering may occur.

PSV Outlet Pipe

Section	Pipe ID in	Eq. Length, ft.	K	Friction psi	Accel., psi	Total, psi
Pipe Section 1	1.049	2.224		2.25	1.78	4.034
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 2	1.049	0.000		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 3	1.049	0.000		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 4	1.049	0.000		0.00	0.00	0.000
Total				2.25	1.78	4.03

Built Up Back Pressure, psi	4.03
Percent of Set Pressure	3.23
% of Gauge Back Pressure	3.22

THRUST at vent pipe exit, lbf	2

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-330	125		2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1975-C	TE-6646		P8331A-B

elief Typ	Inlet Connection	Outlet Connection	Orifice Size
C	MNPT	FNPT	

Air Capacity	Water Capacity	Steam Capacity
231 CFM 10% OP	16 GPM	647 LB/HR

Base Matl	Body Matl	Spring Matl
	CARBON STEEL	CARBON STEEL

Bonnet Matl	Nozzle Matl	Trim Matl
		304SS

Comments

Originator

Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-330	BOILER	UT	15	OR-UT-A-A-P8331A -PSVB	25F010	Oil

Level	Height	North	East	Location
1	4	0	1200	SEAL POT NORTH OF T-30M-66

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
125	2	Yes	8/27/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	No	No	Yes	
JEH	03/13/01	74	Yes		No	No	
GMJ	09/17/98	113	No		No	No	VALVE SET PRESSURE TO HIGH.
FG	09/20/96	115	Yes	No	No	No	
GMJ	06/19/96	100	Yes		No	No	
GMJ	03/21/96	115	Yes		No	No	
FG	02/24/95	114	Yes		No	No	REMOVED FROM STOCK, INSTALLED AS PER PCO-01640Y ON 02-24-95
TOM	10/18/94	109	Yes		No	No	REMOVED FROM SERVICE,PLACED IN STOCK ON 10-18-94
TOM	01/07/94	110	Yes		No	No	
FG	01/21/93	111	Yes		No	No	

BOILER #4
C E8394
VIA. 08H25F009

2"FU-103-151

D P8332
08H25F009

2"FU-016-151

PSV T8331 002 — 3/4" VB501 CSO — 1" VB501 CSO — FS T8331 009 — AND — 2" VB151 C.S.O.

PCV T8331 005 — LCV T8331 009 — YSC T8331 009 — EL T8331 009

PCV T8331 007 — PI T8331 008 — 1/2" VB501

NZ — 1" VB501 — 1"X3/4" — 1"X3/4" — 1" VB501 — 1"NZ-001-151 — 1" VC601 — 2" H2O — 1"X1/2"

LIA T8331 009 — TEST — ES T8331 009 — PSV T8331 012 — PSV T8331 003 — FA T8331 004 FLAME ARRESTOR

VB151 CSO — LSH T8331 009 — VB151 CSC

2"X1" — 4"X3" — 4" — 2" — 16" — 4"X1"

3"FU-024-151

1/2" VB501 — 1/2" VC601 — LI T8331 011

1" SCH. 80

T-8331

WASTE FUEL

PIPE TO GROUND

3"FU-206-151 — 12" — VB151 CSO — V273 — V271 — 3" VB151

TI T8331 006 — TW T8331 006 — TV T8331 001 — PI T8331 006 — TE T8331 001 — TW T8331 001

SZ — 1"SZ-5107-151 — 1" VG601 — 1/2" VG601 — 1" VG601 — 2"X1"

SC — 1"SC-5108-151 — 1" VG601 — 1" VG601 — 2"X1"

T — TCV T8331 023 — PI P8331C A — 303 — 154 — SEAL OIL POT

24" — 4" — M-1

3"FU-051-154 — 3" VB154 — 3"FU-050-154 — 3" VB154 — 3" VB154 — 4"X3" — VB151 CSO

SP 02 — STRAHMAN

P-8331C

4"X3" — VB151 — 3"FU-018-151 — 3"FU-006-151 — 2"FU-019-151 — V272 — 3" VB151 — 2"X3" — 2" VC151

WASTE FUEL
A T8333
08H25F004

2"FU-5111-151

DRAIN

3"FU-101-151

1"FU-230-151

T8332 08H25F009 B

P8332 08H25F009

2"FU-017-151

BACK FLOW REGULATOR — 3/4"X3/4" VB151 — PSV P8331 — 3/4"X3/4" 150 PSIG — PI P8331 013 — 3/4" VB501 C.S.O. — 3/4"X1/2" — 3/4"X1/2" VB501 C.S.O.

A T8332 08H25F009

2"X1 1/2" — 1 1/2"FU-016-151 — 1 1/2" VB501 — 1 1/2"X1" VB601

PSV P8331B 015 — 150 PSIG — 3/4"X1" — 3/4" 1"X3/4" VB501 — V298 C.S.O. — 3/4" VB501 C.S.O. — V286 — 1 1/2" VB154

3/4"FU-009-151 — 3/4" VB501 CSO — 1/2"FU-007-151 — 3/4"FU-008-151 — 3/4" VB501 C.S.O. — 3/4"X3/4" — PSV P8331A 020 125 PSIG — 3/4"X1/2" — PSV P8331A B — PI P8331A — 1/2" VB581 — 1/2" VB581 VC801.1 — 1/2" SS TUBING — NZ CYLINDER

PSV T8331 017 150 PSIG — 1"X1" 100 PSIG — SEAL OIL POT — STOP — ES P8331A A — 1/2" SS TUBING — 1/2" VB581

3/4" 1"X3/4" VB501 C.S.O. — PI T8331 016 — P307 — P8331A — V300 1 1/2" VB154 — V299 1 1/2" VB154 — 1 1/2"FU-015-151 — P306 — P8331B

1"X1/2" VB501 — V292 — 1 1/2"X1" VB501 — V288

F-8331

2"X1" 1" VB501 — 2" VB151 — V277 — 3"X2" — 3" VC151 — 3"FU-020-151

1"FU--151 — 2"FU-311-151 — T8345 08H25F015 A

1" VB501 — DR-3

2"X1" — 1"X1/2" 1/2" VB501 — 2"FU-025-151 — P8332 08H25F009 E

2"FU-101-151 — DETDA T/T UNLOADING 08H25F007 F

V238 — 2" VB151 — 2"FU-011-151 — V065 — T8332 08H25F009 G

3"X2" — 3"FU-010-151 — P8332 08H25F009 B

F-8331

HAYWARD

P-8331A
1 x 1 1/2 - 8
3 GPM @ 290 TDH
10 HP; 3505 RPM
316 SS

P-8331B
MOTOR 3/4 H.P.
1 1/2" X 1 1/2" FNPT

P-8331C
(45474)
T8331 CIRCULATION PUMP
200 GPM @ 80' TDH
2X3-10
7.5 HP @ 1800 RPM
D.I.

T-8331
(T-30M-66)
30'000 GALS. SKIRT MT'D
12'-0" O.D. X 36'-0" S.S.
PRES. 13" H2O
TEMP. AMB.

THIS DESIGN AND PRINT ARE THE PROPERTY OF ALBEMARLE CORPORATION. IT MUST BE RETURNED WITH QUOTATION OR UPON DELIVERY OF MATERIAL AND EQUIPMENT, AND MUST NOT BE USED IN MANUFACTURING FOR OTHERS EXCEPT BY PERMISSION OF OWNERS. ORANGEBURG ENGINEERING

ALBEMARLE™ CORPORATION

WASTE FUEL STORAGE
T8331 (T-30M-66)
P&ID

NO.	REVISION	DRAWN	CHECKED	DES ENG	DES COOR	PROJCOOR	APP'D
5	AS-BUILT PER PROJECT #06821	RDS 4/8/94	RLT 4/8/94	DRH 4/18/94	JWR 4/18/94	RLT 4/18/94	RRS 4/18/94
16	REVISED PER PCO 04324Y,TSR-8160	KET 10/22/98	AMG 10/28/98	AMG 10/28/98	JWR 11/6/98	GFW 10/28/98	RLT 10/29/98
17	INSTALLED 1/2" BALL VALVE TO CHECK NITROGEN	RR 4/23/99	AMG 4/26/99	AMG 4/26/99	JWR 4/27/99	GFW 4/26/99	RLT 4/27/99
18	DEMAND PER TSR-9068 & YS #04328Y	JWR 5/29/02	CF 6/3/02	CF 6/3/02	JWR 5/29/02	GFW 5/31/02	RLT 6/3/02
19	REVISED PER TSR# 2161	JWR 12/17/02	ACB 12/18/02	JSS 12/18/02	JWR 12/18/02	JSS 12/18/02	RLT 12/18/02
15	UPDATE EMERGENCY LP GAS BACK-UP	JWR 1/15/98	JMS 4/15/98		JWR 4/13/98	GFW 9/14/98	RLT 9/16/98
	AS-BUILT PER PROJ.# 3380						
	BURN DETDA WASTE IN NO. 4 BOILER						
	REVISED PER PROCESS SAFETY REVIEW						
	TSR #8012						

PROJECT NUMBER	DRAWING NUMBER	REV.
03911	0BH25F010	19
SCALE: NONE	OPERATING AREA: -	BUILDING NO: -

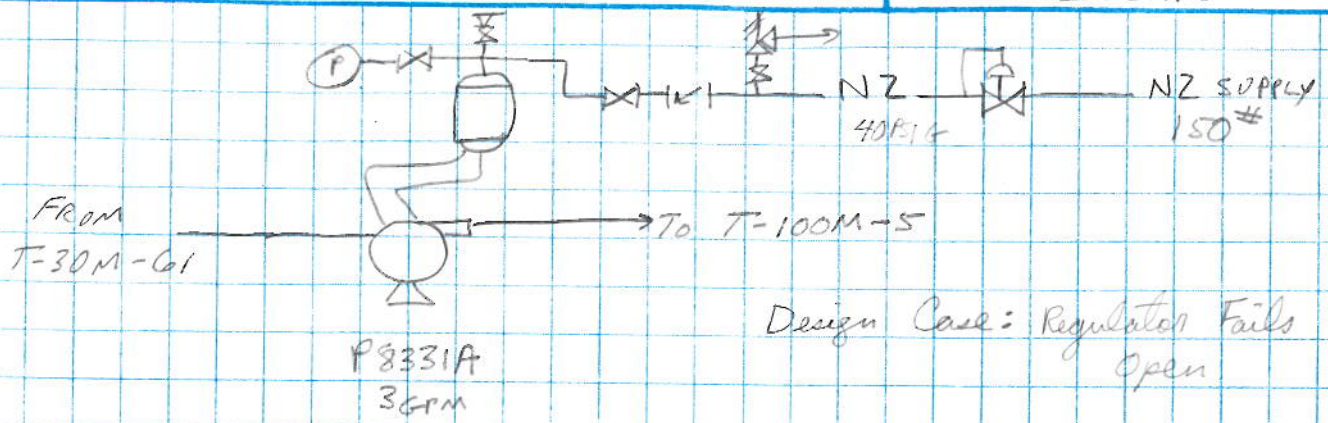
SUBJECT Over Pressure Protection for Seal Oil Pot

FILE PSV-P8331A-B

DATE 7/29/03

DWG: 25F010

BY F. B. ISZARD



Design Case: Regulator Fails Open

Relief Valve

3/4 x 1 - 330

P_{SET} = 125 PSIG (139.7 PSIA)

OVPR = 10%

P_{FLOW} = 125 (1.1) + 14.7 = 152.2 PSIA

P_{BACK} = 0 PSIG

Seal Pot

P_{MAWP} = 125 PSIG

1/2" feed line

Sizing Fluid

N_2 GAS

@ P_{FLOW} = 152.2 PSIA

T_{FLOW} = 70F

Z = 1.0

μ = 0.018 cP

k = 1.4

Excel estimates A_{MIN} = 0.186 IN^2 and $d_{MIN} = \sqrt{\frac{4(0.186)}{\pi}}$ = 0.487 IN

∴ the existing 3/4 x 1 RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-330	125		2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1975-C	TE-6646		P8331A-B

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	MNPT	FNPT	

Air Capacity	Water Capacity	Steam Capacity
231 CFM 10% OP	16 GPM	647 LB/HR

Base Matl	Body Matl	Spring Matl
	CARBON STEEL	CARBON STEEL

Bonnet Matl	Nozzle Matl	Trim Matl
		304SS

Comments

Originator

Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-330	BOILER	UT	15	OR-UT-A-A-P8331A -PSVB	25F010	Oil

Level	Height	North	East	Location
1	4	0	1200	SEAL POT NORTH OF T-30M-66

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
125	2	Yes	8/27/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	No	No	Yes	
JEH	03/13/01	74	Yes		No	No	
GMJ	09/17/98	113	No		No	No	VALVE SET PRESSURE TO HIGH.
FG	09/20/96	115	Yes	No	No	No	
GMJ	06/19/96	100	Yes		No	No	
GMJ	03/21/96	115	Yes		No	No	
FG	02/24/95	114	Yes		No	No	REMOVED FROM STOCK, INSTALLED AS PER PCO-01640Y ON 02-24-95
TOM	10/18/94	109	Yes		No	No	REMOVED FROM SERVICE,PLACED IN STOCK ON 10-18-94
TOM	01/07/94	110	Yes		No	No	
FG	01/21/93	111	Yes		No	No	

Project No	
Tag No.	PSV- P8331A-B
Vessel ID:	P8331
P&ID No.	25F010
Line No.	1/2 in.
Engineer	F.B.Iszard
Date:	7/29/03

PSV sizing for regulator or control valve failing wide open (Gas or Vapor Service).

Comments:

N2 pressure regulator for seal oil pot for P8331A

Wide Open Coefficients for Fisher 95 Series Pressure Regulators

Body Size in.	Item No.	Cv	
1/8	1	0.8	
1/4	2	0.8	
3/8	3	1.9	
1/2	4	1.9	
3/4	5	4.4	
1	6	4.4	
1-1/4	7	12.5	
1-1/2	8	12.5	
2	9	12.5	
Other	10		User supplied Cv for other regulators or Control Valve.

Calculate Wide Open Flow Through Regulator or Control Valve

Regulator Size (Item # from above)	4
Valve Flow Coefficient, Cv	1.9
Critical Flow Factor, Cf	1
Flowing Temp, F	70
Reg. or CV Inlet Pressure, psig	150
System or Vessel MAWP	125
Downstream PSV Set Press., psig	40
PSV % Overpressure	10
% Accumulation	-64.8
Vessel Peak Press., psig	44
Mol. Wt.	28
Compressibility, Z	1
Viscosity, cp	0.018
Cp/Cv	1.4
Density, lb/ft3 (flowing)	0.811
Density, lb/ft3 @ 60 F & 14.7 psia	0.0738
S. G. @ flowing temp & 14.7 psia	0.9473
S. G. @ 60 F & 14.7 psia	0.9656
Critical Pressure, psia	87.01
Critical Pressure Ratio,nc	0.5283
Actual Pressure Ratio, n	0.3564

CRITICAL FLOW ACROSS REG/CV

	Critical Flow	Subcritical Flow
Flow, SCFH (14.7 psia, 60 F)	11536.8	12446.5
Flow, SCFM	192.3	207.4
Flow, lb/hr	852.8	916.3
Free Air Capacity @ STP, lb/hr	876.2	941.5
Free Air Capacity, SCFH	11468.6	12322.8

Size Safety Relief Valve

Peak Relieving Pressure, psia	58.70
Superimposed Back Press., psig	0.00
Differential Set Pressure, psig	40.00
Flowing Temperature, F	70.00
Density, lb/ft3 (flowing)	0.289
Flow, lb/hr	853
Critical Pressure, psia	31.010
Critical Pressure Ratio,nc	0.528
Actual Pressure Ratio, n	0.250

CRITICAL FLOW ACROSS PSV

Calculation Mode:	**DESIGN NEW PSV/PSD**
System Type	**PSV**
Discharge Coefficient, Cd	**0.953**

Typical discharge coefficients
PSV Cd = 0.953 for air, steam, vapors & gasses (Farris Series 2600 Pressure Relief Valves)
PSD Cd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Cd by 0.9, ie: Cd = 0.9 X 0.953 (=0.8577) API RP520 2.6.2.1

C	356.1
r	0.250
F2	0.459

	Critical Flow	Subritical Flow
Minimum Vent Area Required, in2	0.186	0.227

Sizing Basis: CRITICAL FLOW ACROSS PSV

Minimum Vent Area Required: 0.186 sq. in.

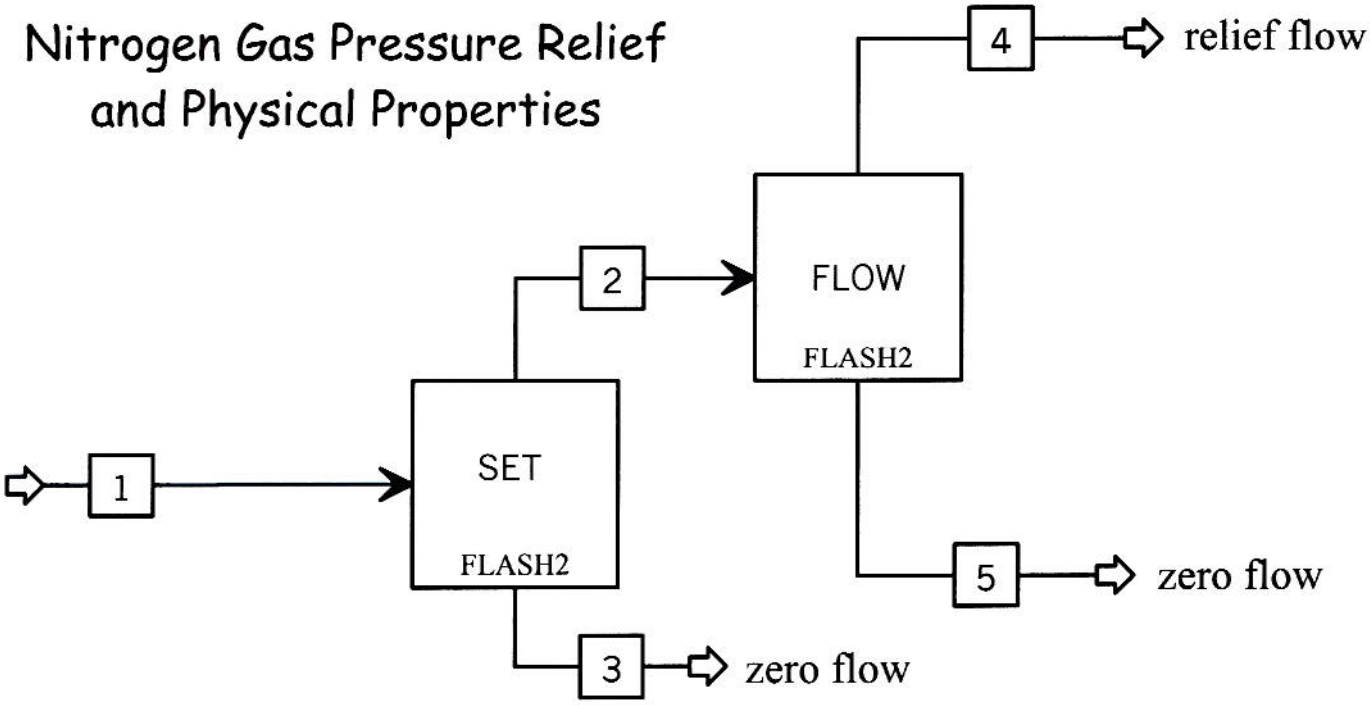
Minimum Flanged PSV Selected (Design Mode):	1X2	E	0.196	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Vapor Relief Rate:	lb/hr	853
	ACFH	2,951
	SCFH (60F, 14.7 psia)	11,561
	SCFH Equivalent Air Capacity	11,463

Rated Capacity of Relief Valve, lb/hr: 897

Note: PSV inlet and outlet piping size is based on the rated capacity (or wide open flow rate) of selected valve.

Nitrogen Gas Pressure Relief
and Physical Properties



Filename: N2_Relief.apw

Results Summary Streams Material

	1	2	3
	SET	FLOW	
		SET	SET
	VAPOR	VAPOR	MISSING
Substream: MIXED			
Mole Flow lbmol/hr			
HCN	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
AIR	0.0	0.0	0.0
NITROGEN	577.3997	577.3997	0.0
OXYGEN	0.0	0.0	0.0
Mass Flow lb/hr			
HCN	0.0	0.0	0.0
METHANOL	0.0	0.0	0.0
AIR	0.0	0.0	0.0
NITROGEN	16174.98	16174.98	0.0
OXYGEN	0.0	0.0	0.0
Mass Frac			
HCN	0.0	0.0	
METHANOL	0.0	0.0	
AIR	0.0	0.0	
NITROGEN	1.000000	1.000000	
OXYGEN	0.0	0.0	
Total Flow lbmol/hr	577.3997	577.3997	0.0
Total Flow lb/hr	16174.98	16174.98	0.0
Total Flow cuft/hr	60000.00	23493.20	0.0
Temperature F	70.00000	69.99999	
Pressure psi	54.70000	139.7000	139.7000
Vapor Frac	1.000000	1.000000	
Liquid Frac	0.0	0.0	
Solid Frac	0.0	0.0	
Enthalpy Btu/lbmol	-48.69474	-48.69479	
Enthalpy Btu/lb	-1.738261	-1.738263	
Enthalpy Btu/hr	-28116.33	-28116.36	
Entropy Btu/lbmol-R	-2.701310	-4.563304	
Entropy Btu/lb-R	-.0964289	-.1628967	
Density lbmol/cuft	9.62333E-3	.0245773	
Density lb/cuft	.2695829	.6884961	
Average MW	28.01348	28.01348	
Liq Vol 60F cuft/hr	495.3591	495.3591	0.0
*** ALL PHASES ***			
Pressure psi	54.70000	139.7000	
Temperature F	70.00000	69.99999	
Average MW	28.01348	28.01348	
Density lb/cuft	.2695829	.6884961	

	1	2	3
	SET	FLOW	
		SET	SET
	VAPOR	VAPOR	MISSING
CPMX Btu/lb-R	.2483149	.2483149	
CPCVMX	1.399540	1.399540	
*** VAPOR PHASE ***			
Average MW	28.01348	28.01348	
Density lb/cuft	.2695829	.6884961	
CPMX Btu/lb-R	.2483149	.2483149	
CPCVMX	1.400660	1.400660	
MUMX cP	.0175398	.0175398	
ZMX	1.000000	1.000000	
*** LIQUID PHASE ***			
DHVL			
HCN			
METHANOL			
AIR			
NITROGEN			
OXYGEN			
Average MW			
Density			
CPMX			
CPCVMX			
MUMX			
SIGMAMX			
ZMX			

	4	5
	FLOW	FLOW
	VAPOR	MISSING
Substream: MIXED		
Mole Flow lbmol/hr		
HCN	0.0	0.0
METHANOL	0.0	0.0
AIR	0.0	0.0
NITROGEN	577.3997	0.0
OXYGEN	0.0	0.0
Mass Flow lb/hr		
HCN	0.0	0.0
METHANOL	0.0	0.0
AIR	0.0	0.0
NITROGEN	16174.98	0.0
OXYGEN	0.0	0.0
Mass Frac		
HCN	0.0	
METHANOL	0.0	
AIR	0.0	
NITROGEN	1.000000	
OXYGEN	0.0	
Total Flow lbmol/hr	577.3997	0.0
Total Flow lb/hr	16174.98	0.0
Total Flow cuft/hr	21563.73	0.0
Temperature F	69.99998	
Pressure psi	152.2000	152.2000
Vapor Frac	1.000000	
Liquid Frac	0.0	
Solid Frac	0.0	
Enthalpy Btu/lbmol	-48.69484	
Enthalpy Btu/lb	-1.738265	
Enthalpy Btu/hr	-28116.39	
Entropy Btu/lbmol-R	-4.733487	
Entropy Btu/lb-R	-.1689718	
Density lbmol/cuft	.0267764	
Density lb/cuft	.7501010	
Average MW	28.01348	
Liq Vol 60F cuft/hr	495.3591	0.0
*** ALL PHASES ***		
Pressure psi	152.2000	
Temperature F	69.99998	
Average MW	28.01348	
Density lb/cuft	.7501010	

	4	5
	FLOW	FLOW
	VAPOR	MISSING
CPMX Btu/lb-R	.2483149	
CPCVMX	1.399540	
*** VAPOR PHASE ***		
Average MW	28.01348	
Density lb/cuft	.7501010	
CPMX Btu/lb-R	.2483149	
CPCVMX	1.400660	
MUMX cP	.0175398	
ZMX	1.000000	
*** LIQUID PHASE ***		
DHVL		
HCN		
METHANOL		
AIR		
NITROGEN		
OXYGEN		
Average MW		
Density		
CPMX		
CPCVMX		
MUMX		
SIGMAMX		
ZMX		

****

7/16/97

Revised 7/03 MB

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8331-002

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .01419 in2

RELIEF PRESSURE = 165 psig

Selected valve capacity = 15791 lb/h at FTP
and 2037 lb/h @ backpressure of 162.3 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

1/2X1-68

25F010

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006\, K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}} \right) K_w \right)}{1.12} \text{ psig}$$

whichever is the smallest.

Nomenclature

A	Relief area, square inches
B	Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
D	Pipe diameter, inches
G_f	Specific gravity of the liquid at flowing temperature, dimensionless
K_d	Coefficient of discharge
K_p	Overpressure correction factor, dimensionless
K_w	Back-pressure correction factor, dimensionless
K_v	Viscosity correction factor, dimensionless
L	Pipe length, feet
P_{Bmax}	Maximum allowable back-pressure, psig
P_{IN}	Set pressure, psig
P_{OUT}	Back pressure, psig
R_D	Reynolds number, dimensionless
W_m	Flow through valve, pounds per hour
μ_{cp}	Absolute viscosity, centipoises

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
1/2X1-68	100		2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1975C-3	TD-46056		T8331-002

elief Typ	Inlet Connection	Outlet Connection	Orifice Size
C	MNPT	FNPT	

Air Capacity	Water Capacity	Steam Capacity
		374 LB/HR

Base Matl	Body Matl	Spring Matl
	CARBON STEEL	CARBON STEEL

Bonnet Matl	Nozzle Matl	Trim Matl
		304SS

Comments

T8331-002

Originator

Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
1/2X1-68	BOILER	UT	25	OR-UT-A-A-T8331 -PSV002	25F009/10	Unknown

Level	Height	North	East	Location
G	16	120	1250	N. OF T-30M-66, RACKS. T8331- PSV002/25F010

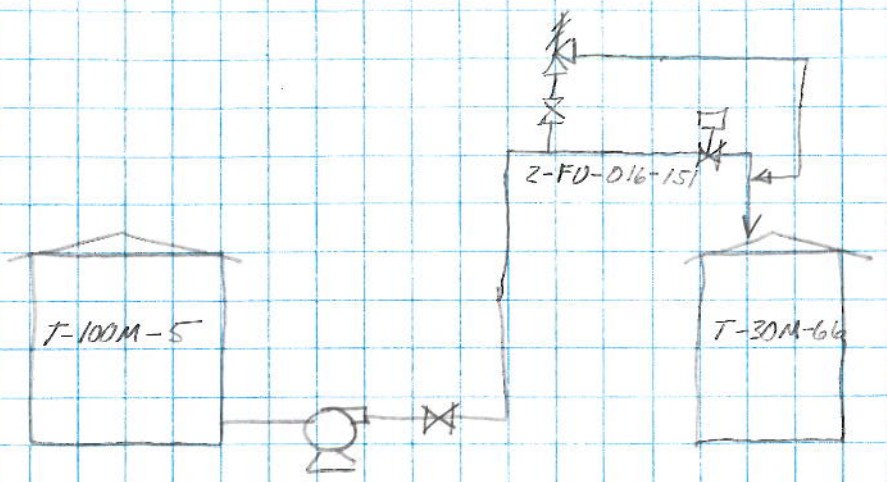
RV History

Set Pressure	Cycle	Active	Last Inspected	Due
100	2	Yes	3/15/01	3/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
JEH	03/15/01	82	Yes		Yes	No	
JEH	03/24/00	74	Yes		No	No	
FG	04/01/98	82	Yes		No	No	
FG	03/25/96	80	Yes		No	No	
GMJ	03/29/95	78	Yes		No	No	
FG	03/28/94	81	Yes		No	No	
FG	03/22/93	84	Yes		No	No	
FG	03/04/92	84	No		No	No	
GS	03/26/91	82	No		No	No	
TOM	06/26/90	81	No		No	No	

SUBJECT Over Pressure Protection for Wastefuel Transfer Line
DWG: 25F010

FILE PSV-T8331-002
DATE 7/29/03
BY F.B. ISZARD



Design = Thermal Case Expansion

Relief Valve

1/2 x 1 - 68
P_{SET} = 100 PSIG (114.7 PSIA)
OVPR = 10%
P_{FLOW} = 100(1.1) + 14.7 = 124.7 PSIA
P_{BACK} = 0 PSIG

Transfer Line

d = 2" L = 50 FT
Heat traced to 150°F
$A = \pi(\frac{2}{12})(50) = 26.2\ FT^2$

Sizing Fluid

Waste Fuel
β = 0.00472 1/°F
@ P_{FLOW} = 124.7 PSIA
T_{FLOW} = 557°F
SG = 44.6/62.4 = 0.715
$C_p = 0.75 \frac{BTU}{LB°F}$
μ = 0.2 cP

Heat Transfer

$$Q = UA\Delta T = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)(26.2\,FT^2)(150-70)F$$

$$Q = 199{,}120\ BTU/HR$$

Excel estimates $A_{MIN} = 0.0001\ in^2$ ∴ existing 1/2 x 1 RV is adequate.

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
1/2X1-68	100		2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1975C-3	TD-46056		T8331-017

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	MNPT	FNPT	

Air Capacity	Water Capacity	Steam Capacity
		374 LB/HR

Base Matl	Body Matl	Spring Matl
	CARBON STEEL	CARBON STEEL

Bonnet Matl	Nozzle Matl	Trim Matl
		304SS

Comments	Originator
	Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
1/2X1-68	BOILER	UT	25	OR-UT-A-A-T8331 -PSV002	25F009	Unknown

Level	Height	North	East	Location
G	16	120	1250	N. OF T-30M-66, RACKS.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
100	2	Yes	3/15/01	3/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
JEH	03/15/01	82	Yes		Yes	No	
JEH	03/24/00	74	Yes		No	No	
FG	04/01/98	82	Yes		No	No	
FG	03/25/96	80	Yes		No	No	
GMJ	03/29/95	78	Yes		No	No	
FG	03/28/94	81	Yes		No	No	
FG	03/22/93	84	Yes		No	No	
FG	03/04/92	84	No		No	No	
GS	03/26/91	82	No		No	No	
TOM	06/26/90	81	No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- T8331-002
Vessel ID:	T8331
P&ID No.:	25F010
Line No.:	1 1/2-FU-016-151
Engineer:	F.B.Iszard
Date:	7/29/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	1	N/A	0.000	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8331-002
Vessel ID:	T8331
P&ID No.	25F010
Line No.	1 1/2-FU-016-151
Engineer	F.B.Iszard
Date:	7/29/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	199,120	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.715	
C = Specific Heat of Trapped Fluid, Btu/lb-F	75	
Viscosity, cp	0.2	
System or Vessel MAWP	100	
PSV Set Pressure, psig	100	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	100	
Maximum Relieving Pressure, psig	110	
Liquid Expansion Rate, gpm	0.004	
Liquid Expansion Rate, lb/hr	1.3	
Orifice Reynolds Number	10948	Nre < 20,000, Viscosity Correction Required

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

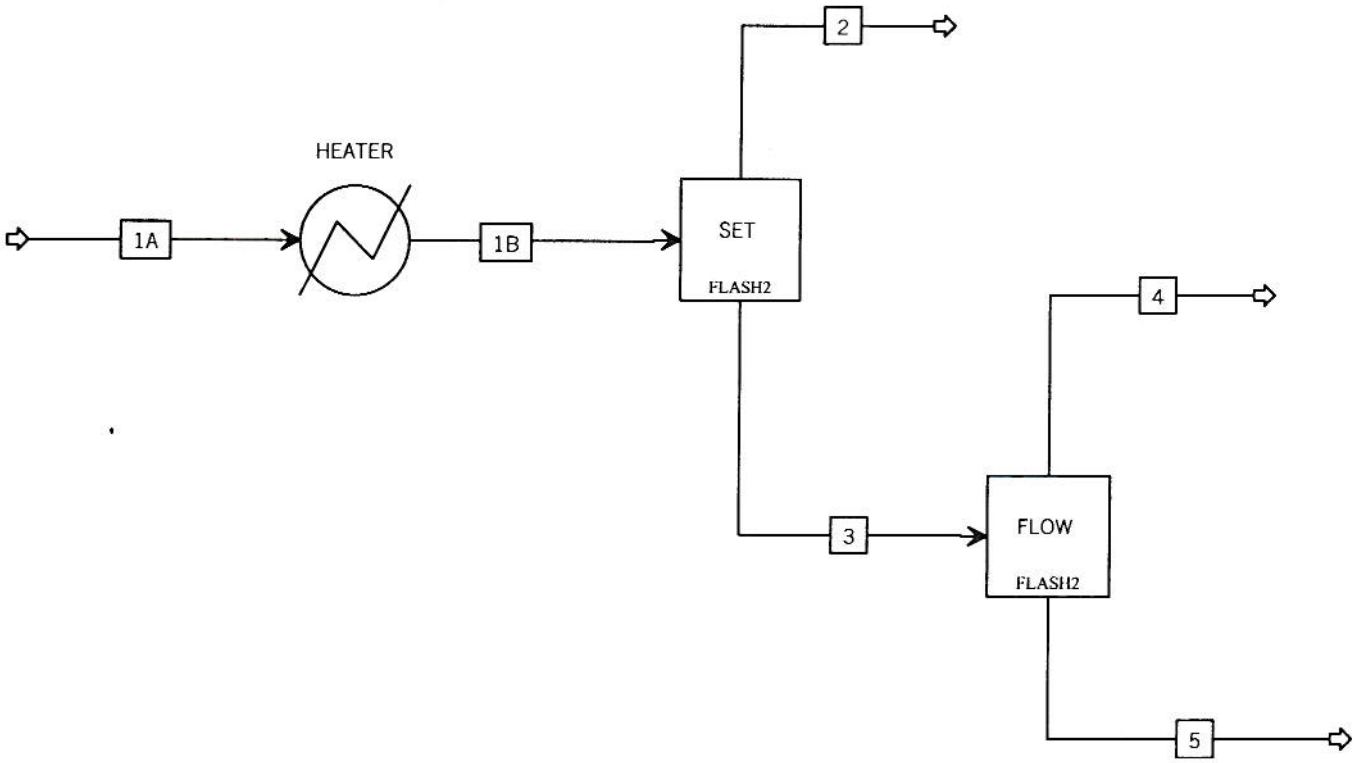
Typical discharge coefficients
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0000 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.02486E-4
IBB	.1117559	.1117559	1.28594E-3
DETDA	.0841373	.0841373	6.24845E-5
TOLUENE	.1085299	.1085299	3.61706E-3
BP350	.0464626	.0464626	4.26303E-4
BP525	.0295767	.0295767	4.82509E-5
BP700	.0202392	.0202392	3.41472E-6
Mole Frac			
AN701	.3260920	.3260920	.0845091
IBB	.1879532	.1879532	.2162719
DETDA	.1415038	.1415038	.0105087
TOLUENE	.1825277	.1825277	.6083244
BP350	.0781418	.0781418	.0716965
BP525	.0497427	.0497427	8.11493E-3
BP700	.0340387	.0340387	5.74295E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1036629
IBB	15.00000	15.00000	.1726004
DETDA	15.00000	15.00000	.0111397
TOLUENE	10.00000	10.00000	.3332779
BP350	6.700000	6.700000	.0614736
BP525	6.600000	6.600000	.0107671
BP700	6.700000	6.700000	1.13041E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.6940521
Total Flow cuft/hr	1.624909	1.648377	.5587720
Temperature F	70.00000	100.0000	544.7627
Pressure psi	14.70000	.2100321	114.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	14689.73
Enthalpy Btu/lb	-535.4649	-524.0510	125.8469
Enthalpy Btu/hr	-53546.49	-52405.10	87.34427
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.06587
Entropy Btu/lb-R	-1.353130	-1.331779	-.6602229
Density lbmol/cuft	.3659245	.3607148	.0106410
Density lb/cuft	61.54191	60.66573	1.242103
Average MW	168.1820	168.1820	116.7270

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0123843
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	114.7000
Temperature F	70.00000	100.0000	544.7627
Average MW	168.1820	168.1820	116.7270
Density lb/cuft	61.54191	60.66573	1.242103
CPMX Btu/lb-R	.3695765	.3910039	.5220583
CPCVMX	1.000000	1.000000	1.033686
*** VAPOR PHASE ***			
Average MW			116.7270
Density lb/cuft			1.242103
CPMX Btu/lb-R			.5220583
CPCVMX			1.033755
MUMX cP			.0115601
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET	FLOW	FLOW
	LIQUID	VAPOR	LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933899	5.28880E-4	.1928610
IBB	.1104699	1.29776E-3	.1091722
DETDA	.0840748	6.82191E-5	.0840066
TOLUENE	.1049128	3.51177E-3	.1014011
BP350	.0460363	4.25040E-4	.0456113
BP525	.0295284	5.09630E-5	.0294775
BP700	.0202358	3.84510E-6	.0202319
Mole Frac			
AN701	.3285323	.0898464	.3309432
IBB	.1876671	.2204647	.1873358
DETDA	.1428270	.0115891	.1441526
TOLUENE	.1782267	.5965827	.1740009
BP350	.0782069	.0722061	.0782675
BP525	.0501632	8.65764E-3	.0505824
BP700	.0343767	6.53208E-4	.0347174
Mass Flow lb/hr			
AN701	39.89634	.1091079	39.78723
IBB	14.82740	.1741871	14.65321
DETDA	14.98886	.0121621	14.97670
TOLUENE	9.666722	.3235766	9.343146
BP350	6.638526	.0612915	6.577235
BP525	6.589233	.0113723	6.577861
BP700	6.698870	1.27288E-3	6.697597
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.30595	.6929703	98.61298
Total Flow cuft/hr	2.203234	.5151312	2.212158
Temperature F	544.7627	557.2152	557.2152
Pressure psi	114.7000	124.7000	124.7000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-47566.56	14560.31	-46521.78
Enthalpy Btu/lb	-281.9566	123.6835	-274.9243
Enthalpy Btu/hr	-27999.97	85.70901	-27111.11
Entropy Btu/lbmol-R	-172.5870	-77.91034	-171.9320
Entropy Btu/lb-R	-1.023031	-.6618145	-1.016046
Density lbmol/cuft	.2671746	.0114271	.2634358
Density lb/cuft	45.07281	1.345231	44.57772
Average MW	168.7017	117.7223	169.2167

	3	4	5
	FLOW SET LIQUID	FLOW VAPOR	FLOW LIQUID
Liq Vol 60F cuft/hr	1.563115	.0123320	1.550783
*** ALL PHASES ***			
Pressure psi	114.7000	124.7000	124.7000
Temperature F	544.7627	557.2152	557.2152
Average MW	168.7017	117.7223	169.2167
Density lb/cuft	45.07281	1.345231	44.57772
CPMX Btu/lb-R	.7325684	.5277533	.7495619
CPCVMX	1.000000	1.033019	1.000000
*** VAPOR PHASE ***			
Average MW		117.7223	
Density lb/cuft		1.345231	
CPMX Btu/lb-R		.5277533	
CPCVMX		1.033087	
MUMX cP		.0116522	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	98.42660		96.86937
IBB	94.89154		92.32653
DETDA	153.0949		151.8627
TOLUENE	78.35353		71.85166
BP350	84.60000		81.71948
BP525	91.83901		90.37586
BP700	89.50402		88.55785
Average MW	168.7017		169.2167
Density lb/cuft	45.07281		44.57772
CPMX Btu/lb-R	.7325684		.7495619
CPCVMX	1.000000		1.000000
MUMX cP	.2059773		.2003061
SIGMAMX dyne/cm	8.156628		7.698213
ZMX	.0398282		.0433773

Design Basis

P&ID Loop No.
PSV-T8331-003

P&ID No.: OBH25F010

Relief Type: CV

Functional Location: OR-UT-A-A-T8331 -PSV003

PHA Title:

☐ In SAP?

SAP No.:

Orangeburg Equipment No.:

Manufacturer: PROTECTOSEAL

Model No.: 8542H

Serial No.:

Description: PSV-T8331-003; T-30M-66 Conservation Vt

○ Fire ◉ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid: Waste Fuel

Actual Fluid: Waste Fuel

Other Sizing: Tank Dim. 12'x36'

Required Size: 2"

Actual Size: 2"

P&ID Size:

☑ PSV OK?

Design Pressure: 10" wc

Existing Setpoint: 8" wc

P&ID Set Pressure:

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes

Flash Pt. set at 460F per Albemarle MSDS records; max fill and empty rates set at 200 GPM
Tank not rated for vacuum Vacuum setting: 3" wc
Calculations performed using in-house software from Fred Iszard by Fred Iszard; file created 7/31/03

DESIGN BASIS

CV/EV No.
PSV-T8331-003

P&ID No: 25F010

Description: T-30M-66 Conservation Vent

MANUFACTURER: Protectoseal

MODEL No.: 8542H

SERIAL No.:

☐ Fire ☐ Cooling Loss ☑ Pump In/Out ☐ Thermal ☐ Control Failure

Other Sizing: Tank Dim. 12'x36'

RELIEVING STATE: ◉ VAPOR ○ LIQUID ○ BOTH

Sizing Fluid: Waste Fuel

Actual Fluid: Waste Fuel

Required Size: 2"

Design Pressure: 10" wc

Capacity: 30000 gal

☑ Acceptable

☑ Filed

Actual Size: 2"

Set Pressure: 8" wc

Design Notes

Flash Pt. set at 460F per Albemarle MSDS records; max fill and emtpy rates set at 200 GPM

Tank not rated for vacuum Vacuum setting: 3" wc

Calculations performed using in-house software by Fred Iszard; file created 7/31/03

requested vacuum setting be lowered to 0.865" wc

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	Waste Boiler #4	Rev. Date:	
Job Name:	Waste Fuel Storage	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/29/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Waste Fuel Storage
Tank Identification:	T8331 (T-30M-66)
Relief Device No:	PSV-T8331-003
P&ID :	25F010
File Name:	PSV-T8331-003

Check Device: ☑ Conservation Vent ☐ Emergency Vent ☐ Flame Arrestor

Vessel:

Tank MAWP (in.wc)	10.0 in. w.c.	0.361 psig	
Design Temperature(F)	70.0 F		
Vacuum Rating(in.wc)	0.0 in w.c.	0.000 psig	
Emergency Vent Dia.	16.0	in	
Conservation Vent Dia.	2.0	in	
Total Vessel Volume	30,000	gallons	
Max. Working Volume	27,000	gallons	
D_{TANK}	12.0	ft	
L_{T-T}	36.0	ft	
Percent liquid filled	90%	(Max. Opr. = 90%)	

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	8.0 in w.c.	(0.289 psig)
Set point for CV (vacuum), P_{Vset} (in.wc)	3.00 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	10.0 in w.c.	(0.361 psig)
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$ (fire case, ovpr=21%)	12.0 in w.c.	(0.441 psig)

Process Notes:

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel	
Phase (Liquid or Vapor)	Liquid	
Flash point temperature (F)	460.0 F	
Molecular Weight	168	lb/lbmol
Formula (i.e. CxHx)	Organic Mixture	
Normal Boiling Temperature (F)	400 F	
Heat of Vaporization (btu/lb)	140.0	btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

CONSERVATION VENT CALCULATIONS

In-breathing Capacity Estimation

(Vacuum Relief Capacity)

Maximum Pump Out Rate = 200 gpm

$$Vi = \frac{Vpump(gpm)\ 60(min/hr)}{7.5\ (gal/hr/cf\ air)} = 1600 \text{ scfh}$$

Thermal effect, Table 2 in API 2000

V_{VAC} = 730 scfh

total 2330 scfh of air

Out-breathing Capacity Estimation

(Pressure Relief Capacity)

Maximum Fill Rate = 200 gpm

$$Vo = \frac{Vfill(gal/min)\ 60(min/hr)}{Cs\ (gal/hr/cf\ air)} = 1714 \text{ scfh}$$

Thermal effect, Table 2 in API 2000

V_{PRES} = 425 scfh

total 2139 scfh

Required relief Capacity=	2330	scfh of air

Specified CV Device

From the manufacturers catalog, the following minimum size CV is identified

Manufacturer	Protectoseal
Size	2 in.
Model	8542H
Pressure Drop at required flow capacity	28.0 in w.c.

CONSERVATION VENT DESIGN RECORD

Venting Conditions:

Maximum Positive Pressure	10.0 in w.c.
Maximum Vacuum	0.0 in w.c.
Maximum Normal Oper. Temperature	95.0 F

Vessel or System Characteristics

Vent Nozzle Diameter (D_{CV})	2.0 in.
MAWP	10.0 in w.c.
Maximum Vacuum	0.0 in w.c.

Conservation Vent Summary

Flame Arrester Included		No	
Available CV nozzle size		2.0	in
Required relief capacity		2,330	scfh air
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Installed Device			
Manufacturer		Protectoseal	
Size		2 in.	
Model		8542H	
Maximum Flow Capacity	Pressure	14,000	scfh air @ 10.0 in w.c.
	Vacuum	5,400	scfh air @ 3.0 in w.c.

CONSERVATION VENT SPECIFICATION SHEET

Originated By: F.B.Iszard Origin Date: 7/29/03

Revision No: Revision Date:

Project:

1	Device Identification				PSV-T8331-003
2	System Name				Waste Fuel Storage
3	Process / Site	Plant Utilities			Waste Boiler #4
4	P&ID Sheet				25F010
5	Tank Identification				T8331 (T-30M-66)
6	Sizing with flame arrester				No
7	Tank design pressure (mawp), in. w.c.				10.0
8	Tank capacity, gallons				30,000
9	Tank diameter / height, ft		12.0		36.0
10	Fluid contained				Waste Fuel
11	Flash point temperature, F				460
12	Maximum operating temperature, F				95
13	Normal boiling temperature, F				400
14	Maximum fill rate, gpm				200
15	Out-breathing due to filling/thermal effect, scfh		1714		425
16	Total outbreathing, scfh				2,139
17	CV pressure setting, in.w.c.				8.0
18	Maximum pump out rate, gpm				200
19	In-breathing - pump out/thermal effect,scfh		1,600		730
20	Total in-breathing, scfh				2,330
21	CV vacuum setting, in.w.c.				3.00
22	Manufacturer / Model		Protectoseal		8542H
23	Size (diameter), inches				2
24	Discharge to …				atmosphere
25	Back pressure, psig				0
26	Body material				316 ss
27	Seat and trim material				316 ss
28	Diaphragm material				Teflon
29	Tank nozzle size, inches				2.0
30	Required flow capacity, scfh air				2,330
31	Maximum flow capacity, scfh air	(pressure)			14,000
32	at (inches of water column)				10.0
33	Maximum flow capacity, scfh air	(vacuum)			5,400
34	at (inches of water column)				3.0
35	In-line pressure drop, in w.c.				28.0
36	Flange facing				R.F.
37	Notes:				

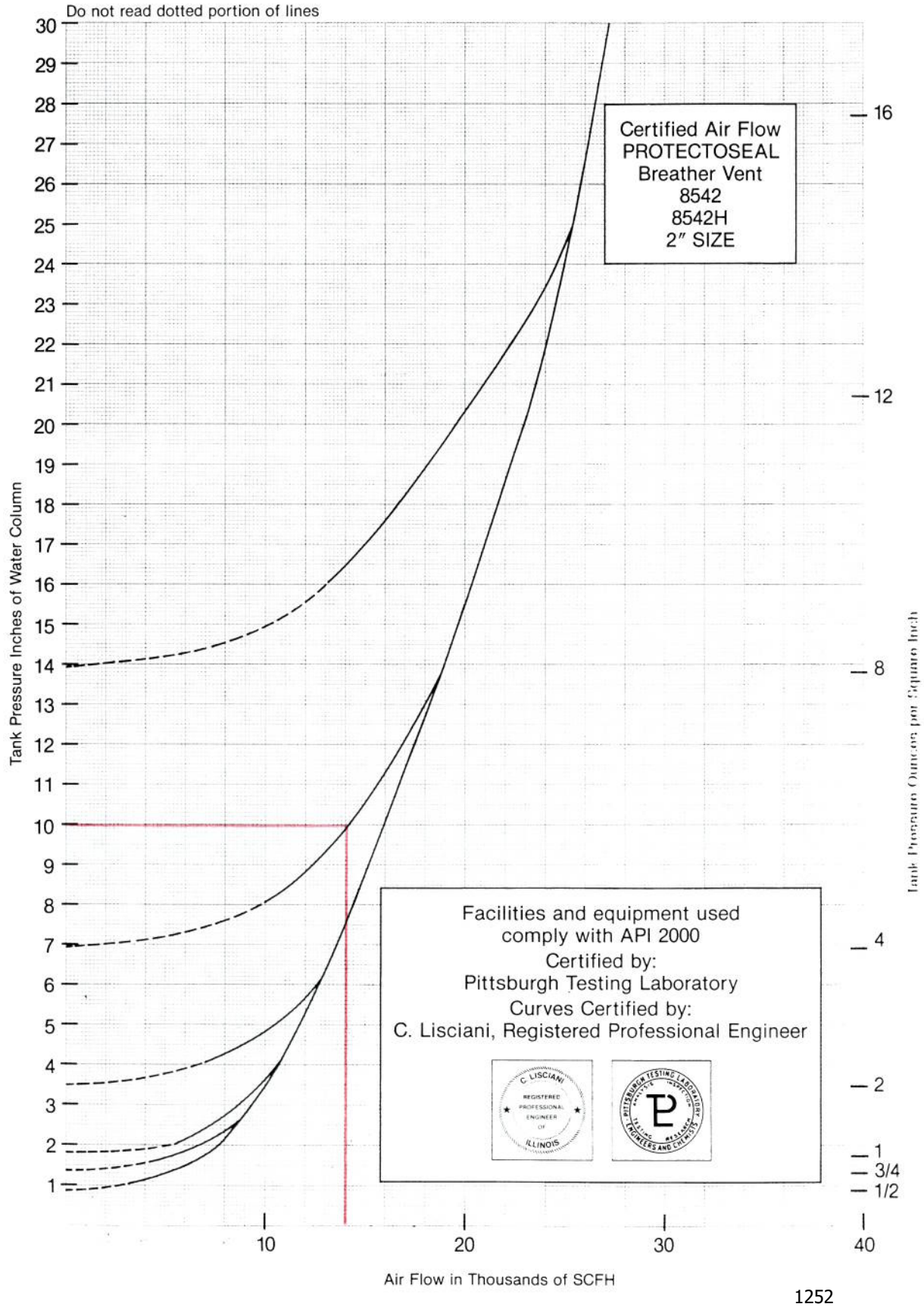
PROTECTOSEAL®
ISO 9001 CERTIFIED
SAFETY WITHOUT COMPROMISE

Series No. 8540

Conservation Breather Vent

Certified Air Flow Curves

PRESSURE



The Protectoseal Company / 225 Foster Avenue, Bensenville, IL 60106-1690 / 1-630-595-0800, Fax 630-595-8059

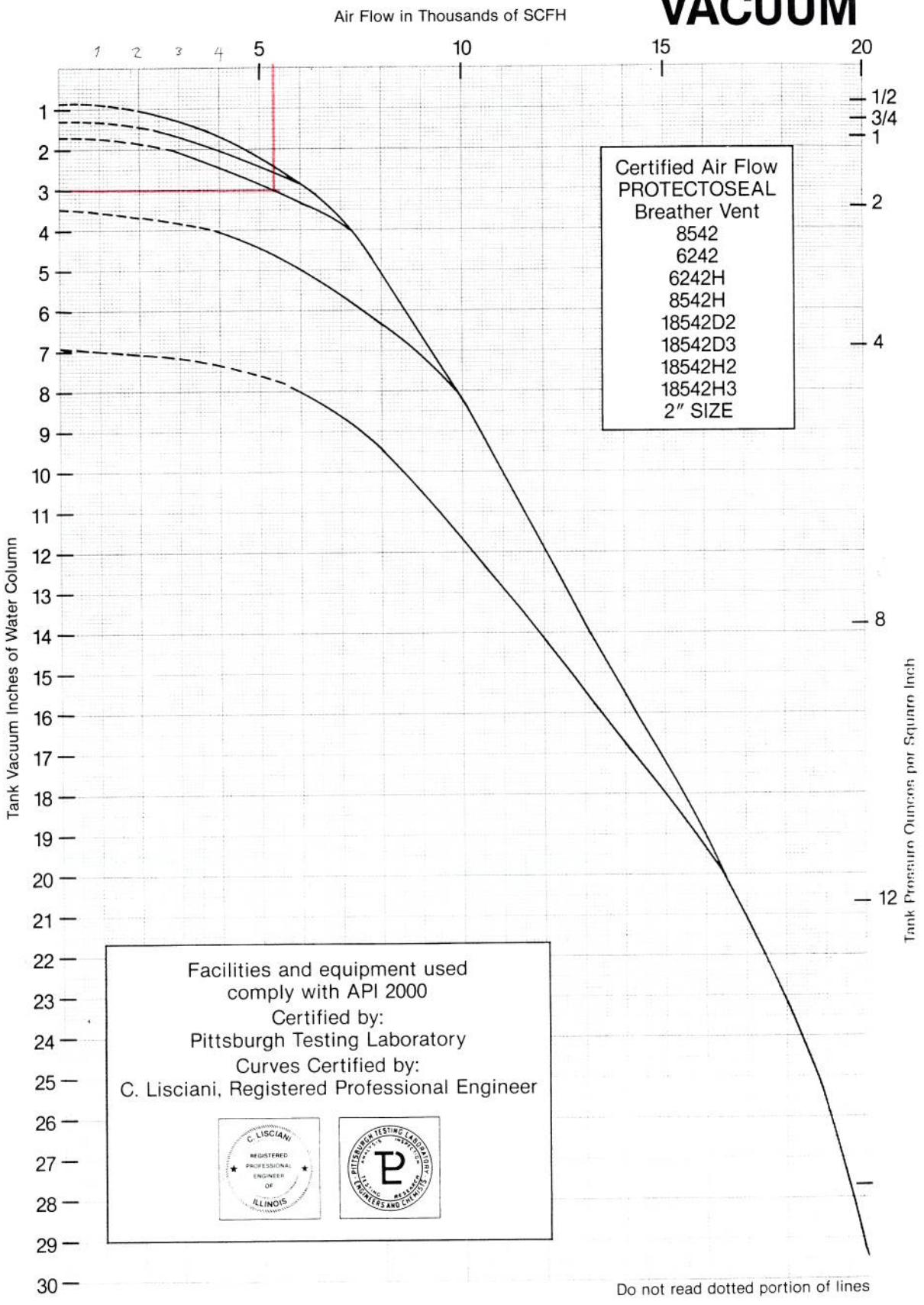
PROTECTOSEAL®
ISO 9001 CERTIFIED
SAFETY WITHOUT COMPROMISE

Series No. 8540

Conservation Breather Vent

Certified Air Flow Curves

VACUUM



The Protectoseal Company / 225 Foster Avenue, Bensenville, IL 60106-1690 / 1-630-595-0800, Fax 630-595-8059

Design Basis

P&ID Loop No.
PSV-T8331-012

P&ID No.
OBH25F010

Relief Type
EV

Functional Location
OR-UT-A-A-T8331 -PSV012

PHA Title

☐ In SAP?

SAP No.

Orangeburg Equipment No.

Manufacturer
PROTECTOSEAL

Model No.
7816

Serial No.

Description
PSV-T8331-012; T-30M-66 Emergency Vent

◉ Fire ○ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid
Waste Fuel

Actual Fluid
Waste Fuel

Other Sizing
Tank Dim. 12'x36'

Required Size
16"

Actual Size
16"

P&ID Size

☑ PSV OK?

Design Pressure
10" wc

Existing Setpoint
10" wc

P&ID Set Pressure

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes
Flash Pt. set at 460F per Albemarle MSDS records
Calculations performed using in-house software from Fred Iszard by Fred Iszard; file created 7/31/03

DESIGN BASIS

CV/EV No.	P&ID No	Description
PSV-T8331-012	25F010	T-30M-66 Emergency Vent

MANUFACTURER	MODEL No.	SERIAL No.
Protectoseal	7816	

☑ Fire ☐ Cooling Loss ☐ Pump In/Out ☐ Thermal ☐ Control Failure

Other Sizing

Tank Dim. 12'x36'

RELIEVING STATE

◉ VAPOR
○ LIQUID
○ BOTH

Sizing Fluid	Actual Fluid
Waste Fuel	Waste Fuel

Required Size	Design Pressure	Capacity
16"	10" wc	30000 gal

Actual Size	Set Pressure
16"	10" wc

☑ Acceptable

☑ Filed

Design Notes

Flash Pt. set at 460F per Albemarle MSDS records

Calculations performed using in-house software by Fred Iszard; file created 7/31/03

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	Waste Boiler #4	Rev. Date:	
Job Name:	Waste Fuel Storage	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/29/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Waste Fuel Storage
Tank Identification:	T8331 (T-30M-66)
Relief Device No:	PSV-T8331-012
P&ID :	25F010
File Name:	PSV-T8331-012

Check Device: ☐ Conservation Vent ☑ Emergency Vent ☐ Flame Arrestor

Vessel:

Tank MAWP (in.wc)	10.0 in. w.c.	0.361 psig	
Design Temperature(F)	70.0 F		
Vacuum Rating(in.wc)	0.0 in w.c.	0.000 psig	
Emergency Vent Dia.	16.0	in	
Conservation Vent Dia.	2.0	in	
Total Vessel Volume	30,000	gallons	
Max. Working Volume	27,000	gallons	
D_{TANK}	12.0	ft	
L_{T-T}	36.0	ft	
Percent liquid filled	90%	(Max. Opr. = 90%)	

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	8.0 in w.c.	(0.289 psig)
Set point for CV (vacuum), P_{Vset} (in.wc)	3.00 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	10.0 in w.c.	(0.361 psig)
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$ (fire case, ovpr=21%)	12.0 in w.c.	(0.441 psig)

Process Notes:

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel	
Phase (Liquid or Vapor)	Liquid	
Flash point temperature (F)	460.0 F	
Molecular Weight	168	lb/lbmol
Formula (i.e. CxHx)	Organic Mixture	
Normal Boiling Temperature (F)	400 F	
Heat of Vaporization (btu/lb)	140.0	btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

EMERGENCY VENT DESIGN RECORD

Fluid Characteristics:

Name	Waste Fuel
Phase	Liquid
Flash point temperature	460 F

Hazards:

Environmental
Flammable

Venting Conditions:

Flowing Pressure	=	15.1	psia
Flowing Temperature	=	400	F

Physical Properties of Fluid at Venting Conditions

Stored Liquid

Name	Waste Fuel	
Molecular Weight	168	lb/lbmol
Formula	Organic Mixture	
Flash Point Temperature	460	F
Normal Boiling Temperature	400	F

Calculation Summary

Required relief capacity	566,177	scfh air @ <= 12.0 in w.c.

From a manufacturers catalog, this relief capacity at the flowing pressure can be provided by a 16 in. emergency vent.

Emergency Vent Summary

Available emergency vent diameter		16	in
Minimum vent size		16	in.
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Manufacturer		Protectoseal	
Selected or Existing Model		7816	
Maximum Flow Capacity		570,000	scfh air
	at	12.0	in w.c.
Pressure drop at required capacity		< 30	in w.c.

EMERGENCY VENT SPECIFICATION SHEET

Originated By: F.B.Iszard
Revision No:
Project:

Origin Date: 7/29/03
Revision Date:

1	Device Identification			PSV-T8331-012
2	System Name			Waste Fuel Storage
3	Process / Site	Plant Utilities		Waste Boiler #4
4	P&ID Sheet			25F010
5	Tank identification			T8331 (T-30M-66)
6	Tank capacity, gallons			30,000
7	Tank design pressure (mawp), in. w.c.			10.0
8	Tank diameter / Height, ft		12.0	36.0
9	Fluid contained			Waste Fuel
10	Molecular weight			168
11	Flash point temperature, F			460
12	Maximum operating temperature, F			95
13	Set point for pressure relief, in. w.c.			10.0
14	Maximum flowing pressure during relief, in.w.c.			12.0
15	Required flow capacity (fire conditions), scfh air			566,177
16	Nozzle or Connection Size, in			16.0
17	Discharge to …			atmosphere
18	Back pressure, psig			0.0
19	Manufacturer / Model	Protectoseal		7816
20	Size (diameter), inches			16.0
21	Body material			316 ss
22	Seat and trim material			316 ss
23	Diaphragm material			Teflon
24	Maximum flow capacity, scfh air			570,000
25	at inches water column			12.0
26	In-line pressure drop, in w.c.			< 30

Notes :

Emergency Vent Calculations

Calculate Tank External Wetted Area

	Select One
A= p D H for vertical cylindrical tanks flat on ground	○
A= p D H + p/4 D^2 for raised vertical cylindrical tanks.	◉
A=(p D L + 2 p / 4 D^2) 0.75 for horz. cylindrical tanks	○

A = 1470 ft2

Heat Exposure to Tank

A(ft2)	MAWP(psig)	Q (btu/hr)
<200	all	20000 A
>200 & <1000	all	199300 $A^{0.566}$
>1000 & <2800	all	963400 $A^{0.338}$
>2800	>1	21000 $A^{0.82}$
>2800	<= 1	14090000

Q = 11,334,083 btu/hr

Required Vent Capacity

For tanks without a weak roof to shell attachment, and non-refrigerated storage

vent capacity requirement is determined by eqn. (1) API 2000, section 2.4.3.2

$$V = \frac{3.091 Q F}{L} (T/Mw)^{0.5}$$

F = 1.00 (no fireproof insulation)

T= Tboil = 860 R

Mw = 168.0

L=D Hvap= 140 btu/lb

Q = 11,334,083 btu/lb

V = 566,177 scfh air

Est. min. vent area = 214.8 in^2

Est. vent diameter = 16.5 in

Environmental Factors for Storage Tanks

"F" Factor	Tank Fireproof Insulation Data
1.0	Bare metal tank (default value)
0.30	Insul. Conductance = 4 btu/hr ft2 F (most common)
0.15	Insul. Conductance = 2 btu/hr ft2 F

Note: Fireproof insulation must be stainless steel and not aluminum, and resist dislodgment by fire fighting equipment, and not decompose at temperatures up to 1000 F.

T A N K

TANK NO: T-30,000-66

MODERN WELDING STORAGE TANK, REPLACES T-30,000-37, #4 BOILER

HAZARDOUS WASTE

CAPACITY 30,000 GALS; WEIGHT, EMPTY 28,000 LBS.

DIMENSIONS:

12'-0"" I.D.; 36'-1½" LENGTH, STR. SHELL; _____ OVERALL LENGTH

DESIGN NOTES:

PRES., PSI: TANK 10" H_2O; JACKET _____; COIL _____

VACUUM: TANK _____; JACKET _____; COIL _____

TEMP.,°F: TANK 250; JACKET _____; COIL _____

HYDROSTATIC TEST, PSI: TANK FILL H_2O; JACKET _____; COIL _____

THICKNESS: SHELL 5/16"; HEAD: 5/16" JACKET _____ COIL _____

HEAD DESIGN BOTTOM ASME F & D; STRESS RELIEVED NO

CODE API-650 APP.J; CODE STAMP REQD. NO; X-RAY SPOT

MATERIAL SPECIFICATIONS:

SHELL SA-516-70 CARBON STEEL HEADS SA-516-70 CARBON STEEL

JACKET _____ COIL _____

NOZZLES _____ FLANGES _____

DRAWINGS: 14-5577-1,2,3&4, ETHYL DRAW #:OBH25D001

MANUFACTURER: MODERN WELDING CO.

AUGUSTA, GA

VENDOR: SAME

SERIAL#: 5577 YEAR: 1993

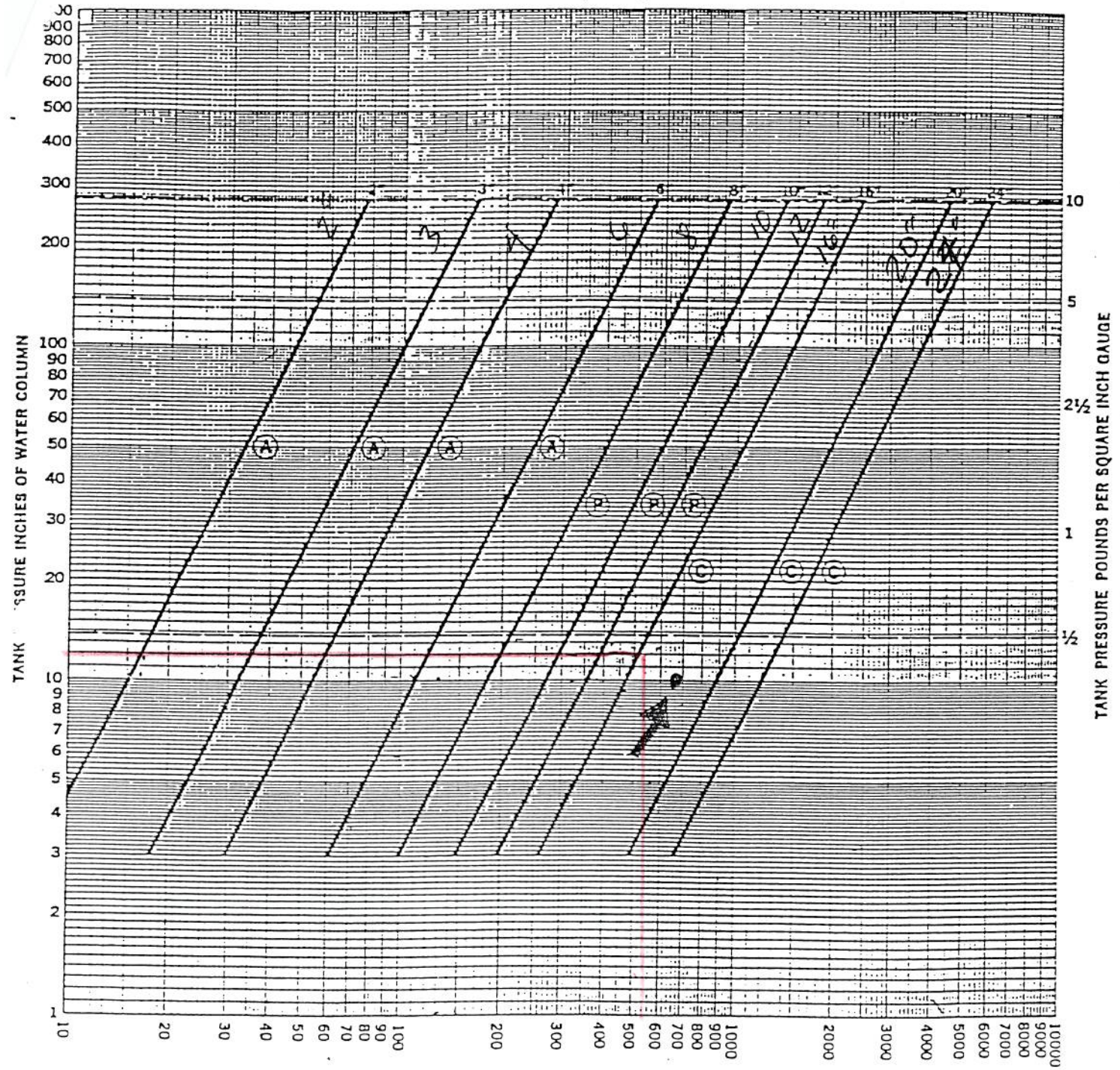
INSURANCE, HSB NO. _____ NAT'L BOARD NO: _____

P.O. NO: S 9211 099833 O-6641

LOCATION: BLDG: 160

RECEIVED: 7/15/93

AIR FLOW THROUGH PROTECTOSEAL SERIES 7800 EMERGENCY RELIEF VENTS



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7/16/97

Revised 7/03 AHB

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8331-017

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	3.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .03079 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 16019 lb/h at FTP
and 4484 lb/h @ backpressure of 152.5 psig

CALCULATED FLOWRATE = 4484 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = 1 Kp = 1

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln \ln \ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}} \right) K_w \right)}{1.12} \text{ psig}$$

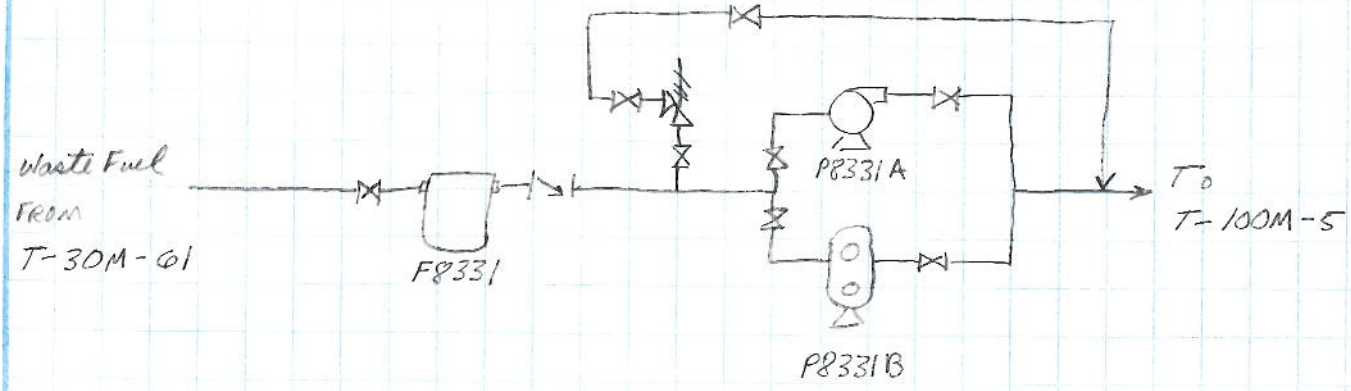
whichever is the smallest.

Nomenclature

A	Relief area, square inches
B	Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
D	Pipe diameter, inches
G_f	Specific gravity of the liquid at flowing temperature, dimensionless
K_d	Coefficient of discharge
K_p	Overpressure correction factor, dimensionless
K_w	Back-pressure correction factor, dimensionless
K_v	Viscosity correction factor, dimensionless
L	Pipe length, feet
P_{Bmax}	Maximum allowable back-pressure, psig
P_{IN}	Set pressure, psig
P_{OUT}	Back pressure, psig
R_D	Reynolds number, dimensionless
W_m	Flow through valve, pounds per hour
μ_{cp}	Absolute viscosity, centipoises

SUBJECT Over Pressure Protection for Waste Fuel Transfer Line
DWG: 25F010

FILE PSV-T8331-017
DATE 7/29/03
BY F. B. ISZARD



Design Basis : Thermal Expansion

Relief Valve

1½ x 1-177
P_{SET} = 150 PSIG (164.7 PSIA)
OVPR = 10%
P_{FLOW} = 150(1.1) + 14.7 = 179.7 PSIA
P_{BACK} = 0 PSIG

Transfer Piping

d = 3 IN ℓ = 30 FT
$A = \pi d \ell = \pi \left(\frac{3}{12}\right)(30) = 15.7\ FT^2$
Heat traced to 150 PSIG

Sizing Fluid

Waste Fuel
@ P_{FLOW} = 179.7 PSIA
T_{FLOW} = 600 F
SG = 42.3/62.4 = 0.678
C_p = 0.745 BTU/LB F
μ = 0.176 cP

Heat Transfer

$$Q = UA\Delta T = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)\left(15.7\ FT^2\right)(150 - 70)F$$

$$Q = 119{,}320\ BTU/HR$$

Excel estimates $A_{MIN} = 0.0005\ IN^2$ and $d_{MIN} = \sqrt{\frac{4(0.0005)}{\pi}} = 0.025\ IN$

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
1/2X1-177	150		1

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1975C-3	TE-29559	UV NB	T8331-017

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	MNPT	FNPT	

Air Capacity	Water Capacity	Steam Capacity
	15 GPM	

Base Matl	Body Matl	Spring Matl
	CARBON STEEL	CARBON STEEL

Bonnet Matl	Nozzle Matl	Trim Matl
		304SS

Comments	Originator
	Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
1/2X1-177	Boiler	UT	25	OR-UT-A-A-T8331 -PSV017	25F010	Oil

Level	Height	North	East	Location
G	3	80	1250	#4 BOILER, SUCTION ON FEED PUMP ON T-30M-66.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
150	1	Yes	8/26/02	8/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/26/02		Yes	No	No	Yes	
FG	10/11/01	125	Yes	Yes	Yes	Yes	
JEH	10/05/00	120	No	Yes	No	No	R.V. FAILED.
GMJ	07/09/98	110	Yes		No	No	
GS	07/29/96	121	Yes		No	No	CHANGED SPRING PRESSURE FROM 100 TO 150 P.S.I.G.AS PER PCO-03
FG	03/21/96	85	Yes		No	No	
GMJ	03/30/95		Yes		No	No	
FG	03/28/94	83	Yes		No	No	
TM	03/22/93	76	Yes		No	No	
GS	03/04/92	84	No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- T8331-017
Vessel ID:	T8331
P&ID No.:	25F010
Line No.:	3-FU-020-151
Engineer:	F.B.Iszard
Date:	7/29/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	76	N/A	0.001	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8331-017
Vessel ID:	T8331
P&ID No.	25F010
Line No.	3-FU-020-151
Engineer	F.B.Iszard
Date:	7/29/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	119,320	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.678	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.745	
Viscosity, cp	0.176	
System or Vessel MAWP	150	
PSV Set Pressure, psig	150	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	150	
Maximum Relieving Pressure, psig	165	
Liquid Expansion Rate, gpm	0.223	
Liquid Expansion Rate, lb/hr	75.7	
Orifice Reynolds Number	105524	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

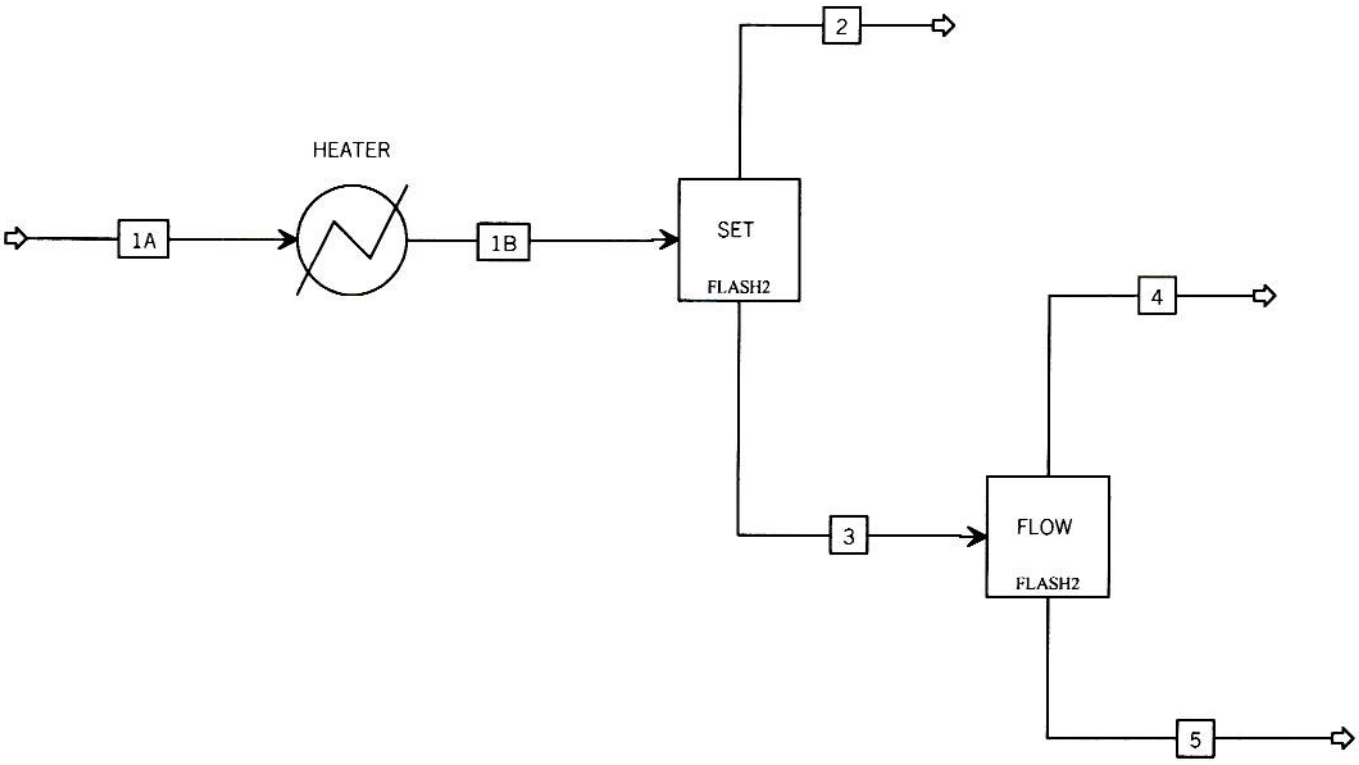
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0005 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.79097E-4
IBB	.1117559	.1117559	1.31627E-3
DETDA	.0841373	.0841373	8.21414E-5
TOLUENE	.1085299	.1085299	3.49681E-3
BP350	.0464626	.0464626	4.10822E-4
BP525	.0295767	.0295767	5.58372E-5
BP700	.0202392	.0202392	4.96159E-6
Mole Frac			
AN701	.3260920	.3260920	.0973936
IBB	.1879532	.1879532	.2213733
DETDA	.1415038	.1415038	.0138147
TOLUENE	.1825277	.1825277	.5881002
BP350	.0781418	.0781418	.0690929
BP525	.0497427	.0497427	9.39081E-3
BP700	.0340387	.0340387	8.34450E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1194677
IBB	15.00000	15.00000	.1766716
DETDA	15.00000	15.00000	.0146441
TOLUENE	10.00000	10.00000	.3221978
BP350	6.700000	6.700000	.0592413
BP525	6.600000	6.600000	.0124599
BP700	6.700000	6.700000	1.64249E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.7063251
Total Flow cuft/hr	1.624909	1.648377	.4075623
Temperature F	70.00000	100.0000	592.3172
Pressure psi	14.70000	.2100321	164.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	15998.67
Enthalpy Btu/lb	-535.4649	-524.0510	134.6790
Enthalpy Btu/hr	-53546.49	-52405.10	95.12717
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.68834
Entropy Btu/lb-R	-1.353130	-1.331779	-.6539911
Density lbmol/cuft	.3659245	.3607148	.0145890
Density lb/cuft	61.54191	60.66573	1.733048
Average MW	168.1820	168.1820	118.7911

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0125091
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	164.7000
Temperature F	70.00000	100.0000	592.3172
Average MW	168.1820	168.1820	118.7911
Density lb/cuft	61.54191	60.66573	1.733048
CPMX Btu/lb-R	.3695765	.3910039	.5412393
CPCVMX	1.000000	1.000000	1.031871
*** VAPOR PHASE ***			
Average MW			118.7911
Density lb/cuft			1.733048
CPMX Btu/lb-R			.5412393
CPCVMX			1.031937
MUMX cP			.0119738
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET	FLOW	FLOW
	LIQUID	VAPOR	LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933133	6.06606E-4	.1927067
IBB	.1104396	1.32458E-3	.1091150
DETDA	.0840551	8.94221E-5	.0839657
TOLUENE	.1050331	3.39544E-3	.1016376
BP350	.0460518	4.06447E-4	.0456454
BP525	.0295209	5.84533E-5	.0294624
BP700	.0202342	5.52880E-6	.0202287
Mole Frac			
AN701	.3284021	.1030506	.3306784
IBB	.1876156	.2250207	.1872378
DETDA	.1427936	.0151910	.1440825
TOLUENE	.1784310	.5768207	.1744069
BP350	.0782332	.0690475	.0783260
BP525	.0501503	9.93009E-3	.0505566
BP700	.0343741	9.39236E-4	.0347118
Mass Flow lb/hr			
AN701	39.88053	.1251427	39.75539
IBB	14.82333	.1777867	14.64554
DETDA	14.98536	.0159421	14.96941
TOLUENE	9.677802	.3128580	9.364944
BP350	6.640759	.0586104	6.582148
BP525	6.587540	.0130437	6.574496
BP700	6.698358	1.83025E-3	6.696527
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.29367	.7052140	98.58846
Total Flow cuft/hr	2.319241	.3746732	2.337077
Temperature F	592.3172	606.1609	606.1609
Pressure psi	164.7000	179.7000	179.7000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-41316.09	16053.19	-39370.99
Enthalpy Btu/lb	-244.9364	133.9973	-232.7240
Enthalpy Btu/hr	-24320.64	94.49679	-22943.90
Entropy Btu/lbmol-R	-166.6754	-78.42072	-165.2473
Entropy Btu/lb-R	-.9881109	-.6545844	-.9767854
Density lbmol/cuft	.2538107	.0157109	.2493549
Density lb/cuft	42.81300	1.882211	42.18452
Average MW	168.6809	119.8023	169.1746

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.562990	.0124523	1.550538
*** ALL PHASES ***			
Pressure psi	164.7000	179.7000	179.7000
Temperature F	592.3172	606.1609	606.1609
Average MW	168.6809	119.8023	169.1746
Density lb/cuft	42.81300	1.882211	42.18452
CPMX Btu/lb-R	.8519737	.5471507	.7444560
CPCVMX	1.000000	1.031242	1.000000
*** VAPOR PHASE ***			
Average MW		119.8023	
Density lb/cuft		1.882211	
CPMX Btu/lb-R		.5471507	
CPCVMX		1.031306	
MUMX cP		.0120768	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	92.04296		89.94487
IBB	84.27379		80.66786
DETDA	147.9820		146.2757
TOLUENE	44.00132		0.0
BP350	72.54401		68.34641
BP525	86.02781		84.21037
BP700	85.79770		84.66828
Average MW	168.6809		169.1746
Density lb/cuft	42.81300		42.18452
CPMX Btu/lb-R	.8519737		.7444560
CPCVMX	1.000000		1.000000
MUMX cP	.1812411		.1762739
SIGMAMX dyne/cm	6.290685		5.836650
ZMX	.0574799		.0630064

Design Basis

P&ID Loop No.
PSV-T8332-004

P&ID No.
OBH25F009

Relief Type
CV

Functional Location
OR-UT-A-A-T8332 -PSV004

PHA Title

☐ In SAP?

SAP No.

Orangeburg Equipment No.

Manufacturer
PROTECTOSEAL

Model No.
C8542H

Serial No.

Description
PSV-T8332-004; T-100M-5 Conservation Vent

○ Fire ◉ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid
Waste Fuel

Actual Fluid
Waste Fuel

Other Sizing
Tank Dimensions 27' x 24'

Required Size
2"

Actual Size
2"

P&ID Size

☑ PSV OK?

Design Pressure
11" wc

Existing Setpoint
8" wc

P&ID Set Pressure

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes
Flash Pt. set at 460F per Albemarle MSDS records; max fill and empty rates set at 200 GPM
Tank vacuum: 3" wc Vent vacuum: 3: wc
Calcs. performed using in-house soft. from Fred Iszard by Fred Iszard; field meas. ver. 7/03

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	#4 Boiler	Rev. Date:	
Job Name:	Waste Fuel Storage	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/28/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Waste Fuel Storage
Tank Identification:	T8332 (T-100M-5)
Relief Device No:	PSV-T8332-004
P&ID :	25F009
File Name:	PSV-T8332-004

Check Device: ☑ Conservation Vent ☐ Emergency Vent ☐ Flame Arrestor

Vessel:			
Tank MAWP (in.wc)	11.0 in. w.c.	0.397 psig	
Design Temperature(F)	450.0 F		
Vacuum Rating(in.wc)	3.0 in w.c.	0.108 psig	
Emergency Vent Dia.	24.0	in	
Conservation Vent Dia.	3.0	in	
Total Vessel Volume	100,000	gallons	
Max. Working Volume	90,000	gallons	
D_{TANK}	27.0	ft	
L_{T-T}	24.0	ft	
Percent liquid filled	90%	(Max. Opr. = 90%)	

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	8.0 in w.c.	(0.289 psig)
Set point for CV (vacuum), P_{Vset} (in.wc)	3.00 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	11.0 in w.c.	(0.397 psig)
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$ (fire case, ovpr=21%)	13.2 in w.c.	(0.485 psig)

Process Notes:

1. For atmospheric tanks, take Pmawp = 10 in. w.c.

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel
Phase (Liquid or Vapor)	Liquid
Flash point temperature (F)	460.0 F
Molecular Weight	168 lb/lbmol
Formula (i.e. CxHx)	Organic Mixture
Normal Boiling Temperature (F)	400 F
Heat of Vaporization (btu/lb)	140.0 btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

CONSERVATION VENT CALCULATIONS

In-breathing Capacity Estimation (Vacuum Relief Capacity)

Maximum Pump Out Rate = 200 gpm

$$Vi = \frac{Vpump(gpm)\ 60(min/hr)}{7.5\ (gal/hr/cf\ air)} = 1600 \text{ scfh}$$

Thermal effect, Table 2 in API 2000

V_{VAC} = 2381 scfh

total 3981 scfh of air

Out-breathing Capacity Estimation (Pressure Relief Capacity)

Maximum Fill Rate = 200 gpm

$$Vo = \frac{Vfill(gal/min)\ 60(min/hr)}{Cs\ (gal/hr/cf\ air)} = 1714 \text{ scfh}$$

Thermal effect, Table 2 in API 2000

V_{PRES} = 1429 scfh

total 3143 scfh

Required relief Capacity=	3981	scfh of air

Specified CV Device

From the manufacturers catalog, the following minimum size CV is identified

Manufacturer	Protectoseal
Size	2 in.
Model	C8542H
Pressure Drop at required flow capacity	28.0 in w.c.

CONSERVATION VENT DESIGN RECORD

Venting Conditions:

Maximum Positive Pressure	11.0 in w.c.
Maximum Vacuum	3.0 in w.c.
Maximum Normal Oper. Temperature	95.0 F

Vessel or System Characteristics

Vent Nozzle Diameter (D_{CV})	3.0 in.
MAWP	11.0 in w.c.
Maximum Vacuum	3.0 in w.c.

Conservation Vent Summary

Flame Arrester Included		No	
Available CV nozzle size		3.0	in
Required relief capacity		3,981	scfh air
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Installed Device			
Manufacturer		Protectoseal	
Size		2 in.	
Model		C8542H	
Maximum Flow Capacity	Pressure	15,000	scfh air @ 11.0 in w.c.
	Vacuum	5,400	scfh air @ 3.0 in w.c.

CONSERVATION VENT SPECIFICATION SHEET

Originated By: F.B.Iszard
Revision No:
Project:

Origin Date: 7/28/03
Revision Date:

1	Device Identification				PSV-T8332-004
2	System Name				Waste Fuel Storage
3	Process / Site	Plant Utilities			#4 Boiler
4	P&ID Sheet				25F009
5	Tank Identification				T8332 (T-100M-5)
6	Sizing with flame arrester				No
7	Tank design pressure (mawp), in. w.c.				11.0
8	Tank capacity, gallons				100,000
9	Tank diameter / height, ft		27.0		24.0
10	Fluid contained				Waste Fuel
11	Flash point temperature, F				460
12	Maximum operating temperature, F				95
13	Normal boiling temperature, F				400
14	Maximum fill rate, gpm				200
15	Out-breathing due to filling/thermal effect, scfh		1714		1429
16	Total outbreathing, scfh				3,143
17	CV pressure setting, in.w.c.				8.0
18	Maximum pump out rate, gpm				200
19	In-breathing - pump out/thermal effect,scfh		1,600		2381
20	Total in-breathing, scfh				3,981
21	CV vacuum setting, in.w.c.				3.00
22	Manufacturer / Model		Protectoseal		C8542H
23	Size (diameter), inches				2
24	Discharge to ...				atmosphere
25	Back pressure, psig				0
26	Body material				316 ss
27	Seat and trim material				316 ss
28	Diaphragm material				Teflon
29	Tank nozzle size, inches				3.0
30	Required flow capacity, scfh air				3,981
31	Maximum flow capacity, scfh air	(pressure)			15,000
32	at (inches of water column)				11.0
33	Maximum flow capacity, scfh air	(vacuum)			5,400
34	at (inches of water column)				3.0
35	In-line pressure drop, in w.c.				28.0
36	Flange facing				R.F.
37	Notes:				

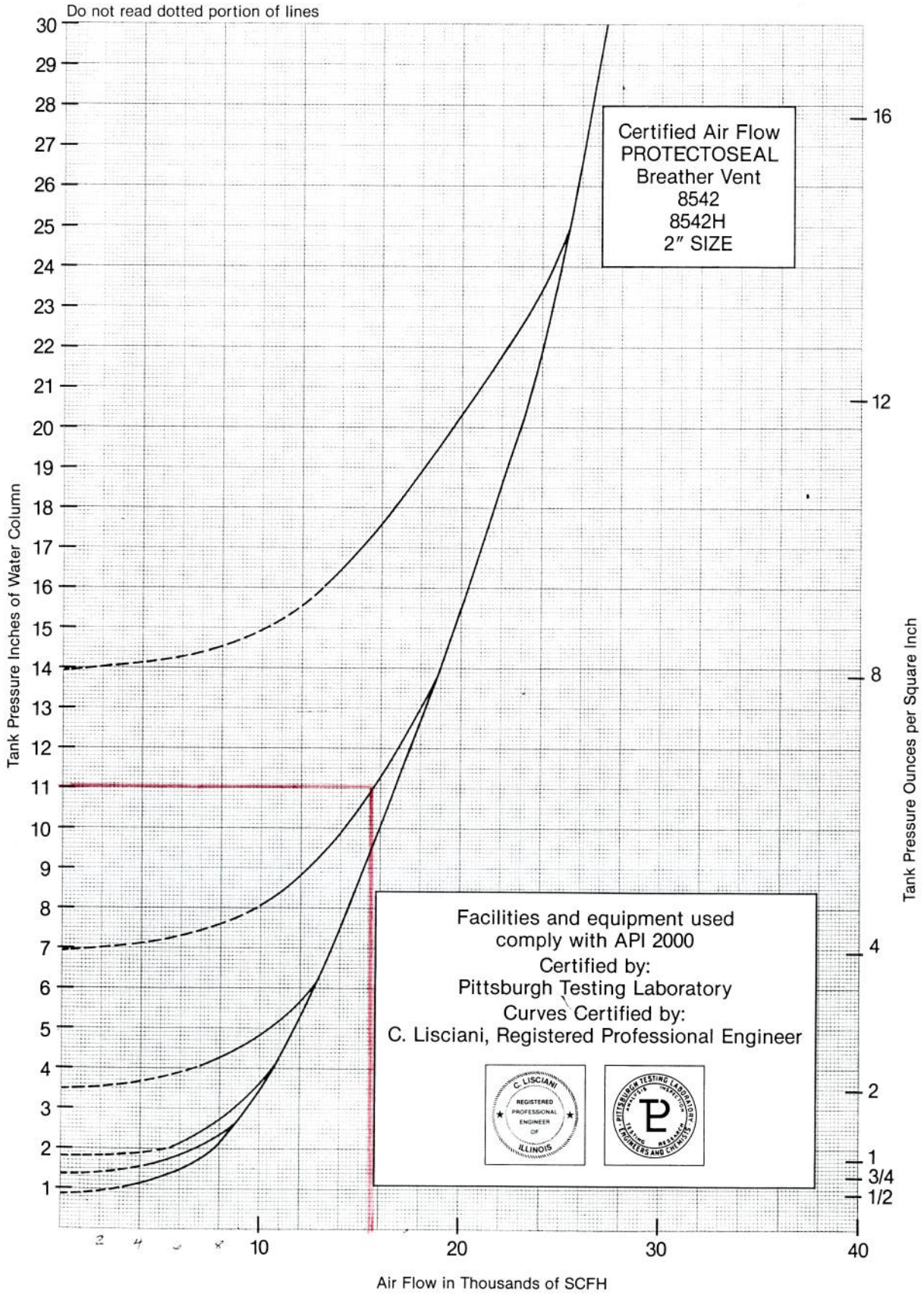
PROTECTOSEAL®
ISO 9001 CERTIFIED
SAFETY WITHOUT COMPROMISE

Series No. 8540

Conservation Breather Vent

Certified Air Flow Curves

PRESSURE



The Protectoseal Company / 225 Foster Avenue, Bensenville, IL 60106-1690 / 1-630-595-0800, Fax 630-595-8059

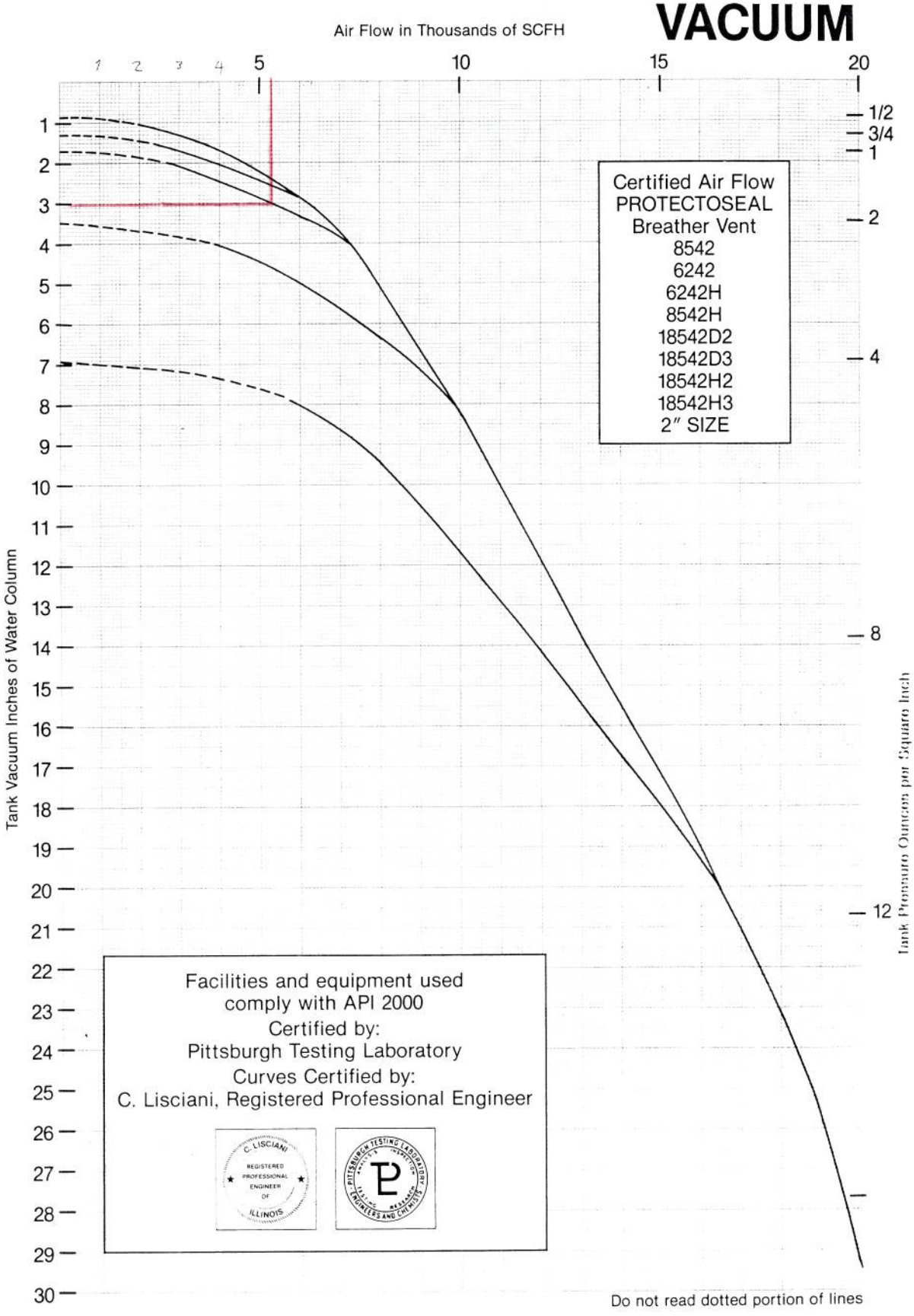
PROTECTOSEAL®
ISO 9001 CERTIFIED
SAFETY WITHOUT COMPROMISE

Series No. 8540

Conservation Breather Vent

Certified Air Flow Curves

VACUUM



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T-100M-5 file

		YEAR COMPLETED	1994
		REVISION NUMBER	———
NOMINAL DIAMETER	27'-0"	NOMINAL HEIGHT	24'-0"
NOM. CAP.	100,000 GALLONS	DESIGN LIQUID LEVEL	24'-0"
DESIGN SPECIFIC GRAVITY	1.0	MAXIMUM OPERATING TEMP	450°F
DESIGN PRESSURE	11" W.C.	PARTIAL STRESS RELIEF	———
MANUFACTURER'S SERIAL NO.	52049	PURCHASER'S TANK NO.	TM-100-5

FABRICATED AND ERECTED BY

FISHER TANK COMPANY

SHELL COURSE	MATERIAL
$\frac{3}{8}$"	A516 GR-70

Design Basis

P&ID Loop No.
PSV-T8332-024

P&ID No.
OBH25F009

Relief Type
EV

Functional Location
OR-UT-A-A-T8332 -PSV024

PHA Title

☐ In SAP?

SAP No.

Orangeburg Equipment No.

Manufacturer
PROTECTOSEAL

Model No.
C7820

Serial No.

Description
PSV-T8332-024; T-100M-5 Emergency Vent

◉ Fire ○ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid
Waste Fuel

Actual Fluid
Waste Fuel

Other Sizing
Tank Dimensions 27' x 24'

Required Size
20"

Actual Size
20"

P&ID Size

☑ PSV OK?

Design Pressure
11" wc

Existing Setpoint
11" wc

P&ID Set Pressure

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes
Flash Pt. set at 460F per Albemarle MSDS records
Calcs. performed using in-house soft. from Fred Iszard by Fred Iszard

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	#4 Boiler	Rev. Date:	
Job Name:	Waste Fuel Storage	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/28/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Waste Fuel Storage
Tank Identification:	T8332 (T-100M-5)
Relief Device No:	PSV-T8332-024
P&ID :	25F009
File Name:	PSV-T8332-024

Check Device: ☐ Conservation Vent ☑ Emergency Vent ☐ Flame Arrestor

Vessel:			
Tank MAWP (in.wc)	11.0 in. w.c.	0.397 psig	
Design Temperature(F)	450.0 F		
Vacuum Rating(in.wc)	3.0 in w.c.	0.108 psig	
Emergency Vent Dia.	24.0	in	
Conservation Vent Dia.	3.0	in	
Total Vessel Volume	100,000	gallons	
Max. Working Volume	90,000	gallons	
D_{TANK}	27.0	ft	
L_{T-T}	24.0	ft	
Percent liquid filled	90%	(Max. Opr. = 90%)	

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	8.0 in w.c.	(0.289 psig)
Set point for CV (vacuum), P_{Vset} (in.wc)	3.00 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	11.0 in w.c.	(0.397 psig)
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$ (fire case, ovpr=21%)	13.2 in w.c.	(0.485 psig)

Process Notes:

1. For atmospheric tanks, take Pmawp = 10 in. w.c.

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel	
Phase (Liquid or Vapor)	Liquid	
Flash point temperature (F)	460.0 F	
Molecular Weight	168	lb/lbmol
Formula (i.e. CxHx)	Organic Mixture	
Normal Boiling Temperature (F)	400 F	
Heat of Vaporization (btu/lb)	140.0	btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

Emergency Vent Calculations

Calculate Tank External Wetted Area

	Select One
A= p D H for vertical cylindrical tanks flat on ground	◉
A= p D H + p/4 D² for raised vertical cylindrical tanks.	○
A=(p D L + 2 p / 4 D^2) 0.75 for horz. cylindrical tanks	○

A = 2036 ft2

Heat Exposure to Tank

A(ft2)	MAWP(psig)	Q (btu/hr)
<200	all	20000 A
>200 & <1000	all	199300 $A^{0.566}$
>1000 & <2800	all	963400 $A^{0.338}$
>2800	>1	21000 $A^{0.82}$
>2800	<= 1	14090000

Q = 12,651,897 btu/hr

Required Vent Capacity

For tanks without a weak roof to shell attachment, and non-refrigerated storage

vent capacity requirement is determined by eqn. (1) API 2000, section 2.4.3.2

$$V = \frac{3.091 Q F}{L} (T/Mw)^{0.5}$$

F = 1.00 (no fireproof insulation)

T= Tboil = 860 R

Mw = 168.0

L=D Hvap= 140 btu/lb

Q = 12,651,897 btu/lb

V = 632,006 scfh air

Est. min. vent area = 228.6 in^2

Est. vent diameter = 17.1 in

Environmental Factors for Storage Tanks

"F" Factor	Tank Fireproof Insulation Data
1.0	Bare metal tank (default value)
0.30	Insul. Conductance = 4 btu/hr ft2 F (most common)
0.15	Insul. Conductance = 2 btu/hr ft2 F

Note: Fireproof insulation must be stainless steel and not aluminum, and resist dislodgment by fire fighting equipment, and not decompose at temperatures up to 1000 F.

EMERGENCY VENT DESIGN RECORD

Fluid Characteristics:

Name	Waste Fuel
Phase	Liquid
Flash point temperature	460 F

Hazards:

Environmental
Flammable

Venting Conditions:

Flowing Pressure = 15.2 psia
Flowing Temperature = 400 F

Physical Properties of Fluid at Venting Conditions

Stored Liquid

Name	Waste Fuel	
Molecular Weight	168	lb/lbmol
Formula	Organic Mixture	
Flash Point Temperature	460	F
Normal Boiling Temperature	400	F

Calculation Summary

Required relief capacity	632,006	scfh air @ <= 13.2 in w.c.

From a manufacturers catalog, this relief capacity at the flowing pressure can be provided by a 20 in. emergency vent.

Emergency Vent Summary

Available emergency vent diameter		24	in
Minimum vent size		20	in.
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Manufacturer		Protectoseal	
Selected or Existing Model		C7820	
Maximum Flow Capacity		900,000	scfh air
	at	10.0	in w.c.
Pressure drop at required capacity		< 30	in w.c.

EMERGENCY VENT SPECIFICATION SHEET

Originated By: F.B.Iszard
Revision No:
Project:

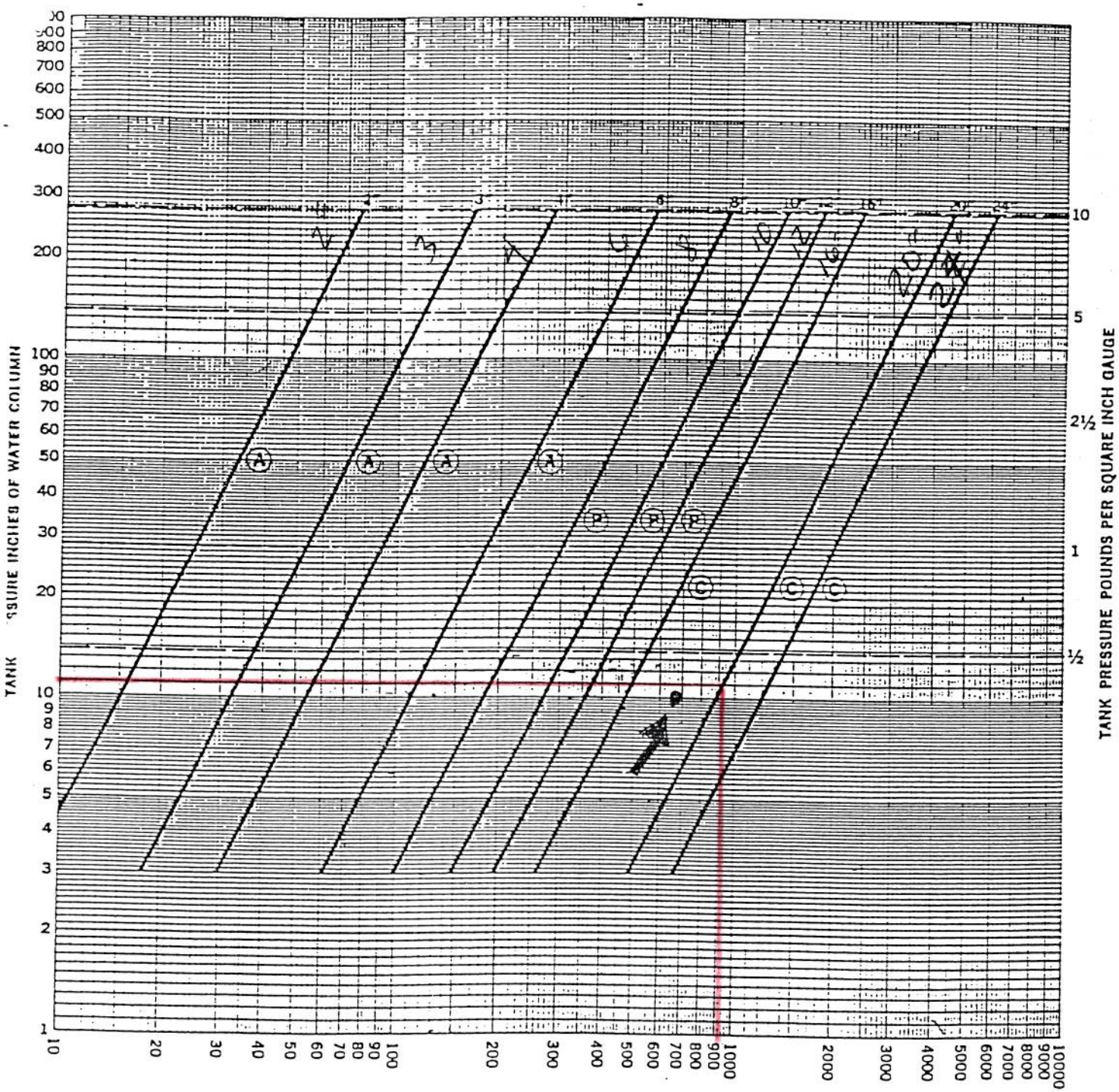
Origin Date: 7/28/03
Revision Date:

1	Device Identification			PSV-T8332-024
2	System Name			Waste Fuel Storage
3	Process / Site	Plant Utilities		#4 Boiler
4	P&ID Sheet			25F009
5	Tank identification			T8332 (T-100M-5)
6	Tank capacity, gallons			100,000
7	Tank design pressure (mawp), in. w.c.			11.0
8	Tank diameter / Height, ft		27.0	24.0
9	Fluid contained			Waste Fuel
10	Molecular weight			168
11	Flash point temperature, F			460
12	Maximum operating temperature, F			95
13	Set point for pressure relief, in. w.c.			11.0
14	Maximum flowing pressure during relief, in.w.c.			13.2
15	Required flow capacity (fire conditions), scfh air			632,006
16	Nozzle or Connection Size, in			24.0
17	Discharge to …			atmosphere
18	Back pressure, psig			0.0
19	Manufacturer / Model	Protectoseal		C7820
20	Size (diameter), inches			20.0
21	Body material			316 ss
22	Seat and trim material			316 ss
23	Diaphragm material			Teflon
24	Maximum flow capacity, scfh air			900,000
25	at inches water column			10.0
26	In-line pressure drop, in w.c.			< 30

Notes :

S 8332 02 28 03

AIR FLOW THROUGH PROTECTOSEAL SERIES 7800 EMERGENCY RELIEF VENTS



(A) Flow capacities determined by actual test and certified.

(P) Projected flow capacities not yet confirmed by tests.

(C) Calculated and based on a flow coefficient of 0.5 applied to the rated orifice area as specified in OSHA, par. 1910.106 (v) (i).

TANK

TANK NO. T-100,000-5

FISHER TANK HAZARDOUS WASTE STORAGE TANK

P&ID#:

CAPACITY: 1000,000 GAL.; WEIGHT EMPTY: 57,400 LB.

DIMENSIONS:

27'- 0" I.D.; 24'- 0" LENGTH,STR SHELL; OVERALL

DESIGN NOTES:

PRES. PSI: TANK: 11" H_2O ; JACKET: ; COIL:

VACUUM: TANK: ; JACKET: ; COIL:

TEMP,°F TANK: 450 ; JACKET: ; COIL:

HYDROSTATIC TEST,PSI: TANK: FILL/H_2O ; JACKET: ; COIL:

THICKNESS: SHELL: 3/8" HEAD: 3/8"

JACKET: COIL:

HEAD DESIGN: BOTTOM:FLAT,TOP:CONE CODE: API-650

STRESS RELIEVED: NO STAMP REQD.: NO X-RAY: SPOT

MATERIAL SPECIFICATIONS:

SHELL: SA-516 GR.70 C.S. HEAD: SA-516 GR.70 C.S.

JACKET: COIL:

DRAWING NO. 5204-1 THROUGH 5204-15

MANUFACTURER: FISHER TANK CO.
LEXINGTON, S.C.

VENDOR: SAME

SERIAL#: 52049 YEAR BUILT: 1994

NATIONAL BOARD#:

PO#: C ERLT 55763 PROCESS OR PROJECT: O-6821

LOCATION: BLDG.: 130 DATE RECEIVED: 10-27-94

T-100M-5 file

		YEAR COMPLETED	1994
		REVISION NUMBER	———
NOMINAL DIAMETER	27'-0"	NOMINAL HEIGHT	24'-0"
NOM. CAP.	100,000 GALLONS	DESIGN LIQUID LEVEL	24'-0"
DESIGN SPECIFIC GRAVITY	1.0	MAXIMUM OPERATING TEMP	450°F
DESIGN PRESSURE	11" W.C.	PARTIAL STRESS RELIEF	———
MANUFACTURER'S SERIAL NO.	52049	PURCHASER'S TANK NO.	TM-100-5

FABRICATED AND ERECTED BY

FISHER TANK COMPANY

SHELL COURSE	MATERIAL
$\frac{3}{8}$"	A516 GR-70

PSV-T8332-029

VER008118

R"PSV

ETHYL CORPORATION

700

ORANGEBURG
ENGINEERING
DEPARTMENT
ORANGEBURG
SOUTH CAROLINA

PRESSURE SAFETY RELIEF VALVES

REV	BY	DATE	REVISION
1	DRH	4/1/93	1

SHEET 2 OF 3

SPEC. NO. 700 REV 11

PROJECT NO. 06821 DATE: 3/8/93

REQ. P.O.

BY DRH CHK'D APPR. A.E

GENERAL	1	TAG NUMBER	PSV-T8332-029		PSV-T8345-332		PSV-P8345-337		PSV-F8332-A	
	2	MFD	25F009		25F015		25F015		25F009	
	3	LINE NO. / VESSEL NO.	2"FU-226-151		2"FU-315-151		2"FU-301-151		2"FU-231-151	
	4	CONV, BAL BLWS, PIL OP	CONV		CONV		CONV		CONV	
CONN	5	SIZE: INLET / OUTLET	3/4"	1"	3/4"	1"	3/4"	1"	3/4"	1"
	6	TYPE: INLET / OUTLET	NPT	NPT	NPT	NPT	NPT	NPT	NPT	NPT
	7	BLANK 1								
MATERIALS	8	BODY AND BONNET	CARBON STEEL		CARBON STEEL		CARBON STEEL		CARBON STEEL	
	9	NOZZLE AND DISC	316 SS		316 SS		316 SS		316 SS	
	10	SLEEVE GUIDE	316 SS		316 SS		316 SS		316 SS	
	11	BLOW DOWN RING(S)	316 SS		316 SS		316 SS		316 SS	
	12	SPRING	316 SS		316 SS		316 SS		316 SS	
	13	BELLOWS	NONE		NONE		NONE		NONE	
	14	RESILIENT SEAT SEAL	316 SS		316 SS		316 SS		316 SS	
	15	LIQUID TRIM (Y/N)	YES		YES		YES		YES	
CAP OR PLUG	16	SCREWED	X		X		X		X	
	17	BOLTED								
	18	OPEN LEVER								
	19	PACKED LEVER								
	20	BLANK 3								
BASIS	21	CODE								
	22	FIRE								
	23	OTHER	THERMAL EXPANSION		THERMAL EXPANSION		THERMAL EXPANSION		THERMAL EXPANSION	
	24	ASME STAMP REQ'D (?)	YES		YES		YES		YES	
SERVICE	25	PROCESS ENGINEER	DEH		DEH		DEH		DEH	
	26	UNITS: PRESS / TEMP	PSIG	DEGC	PSIG	DEGC	PSIG	DEGC	PISG	DEGC
	27	FLUID / STATE	WASTE	LIQUID	WASTE	LIQUID	WASTE	LIQUID	WASTE	LIQUID
	28	REQ'D CAPACITY (#/HR)	10		10		10		10	
	29	PRESS: OPER / SET	40	85	40	85	40	85	40	85
	30	TMP: MIN / NORM / MAX	0	80 / 150	0	80 / 150	0	80 / 150	0	80 / 150
	31	TMP: INLET / RELIEVING	100	80	100	80	100	80	100	80
	32	REL'V SP. GR.	.8718		.8718		.8718		.8718	
	33	GAS AVG M.W.	93		93		93		93	
	34	REL'V COMPRSS. @ FTP								
	35	RATIO OF SP. HEAT CP/CV	1.2		1.2		1.2		1.2	
	36	C (GAS FLOW COEFFICT)								
	37	VISC (CP) / % SOLIDS	10	1	10	1	10	1	10	1
	38	BACK PRESS: CONSTANT	15		15		15		15	
	39	BACK PRESS: VARIABLE	30		30		30		30	
	40	BACK PRESS: TOTAL	45		45		45		45	
	41	% ALLOWABLE OVER PRESS								
	42	SYSTEM / VESSEL MAWP	150		150		150		150	
	43	BLANK 4								
	44	BLANK 5								
	45	ABOVE RUPTURE DISC	NO		NO		NO		NO	
	46	CALC. AREA (SQ. IN.)	.000452		.000452		.000452		.000452	
	47	SELECTED AREA (SQ. IN)	.110		.110		.110		.110	
	48	ORIFICE DESIGNATION								
	49	MANUFACTURER	CONSOLIDATED		CONSOLIDATED		CONSOLIDATED		CONSOLIDATED	
	50	MODEL NUMBER	1990LS		1990LS		1990LS		1990LS	

NOTES: 1. ORIGINAL SET PRESSURE OF 100 PSIG WAS DERATED TO 85 PSIG TO COMPENSATE FOR THE 15 PSIG CONSTANT BACKPRESSURE.

PAGE : 2

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8332-029

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .01419 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 15791 lb/h at FTP
and 2037 lb/h @ backpressure of 162.3 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

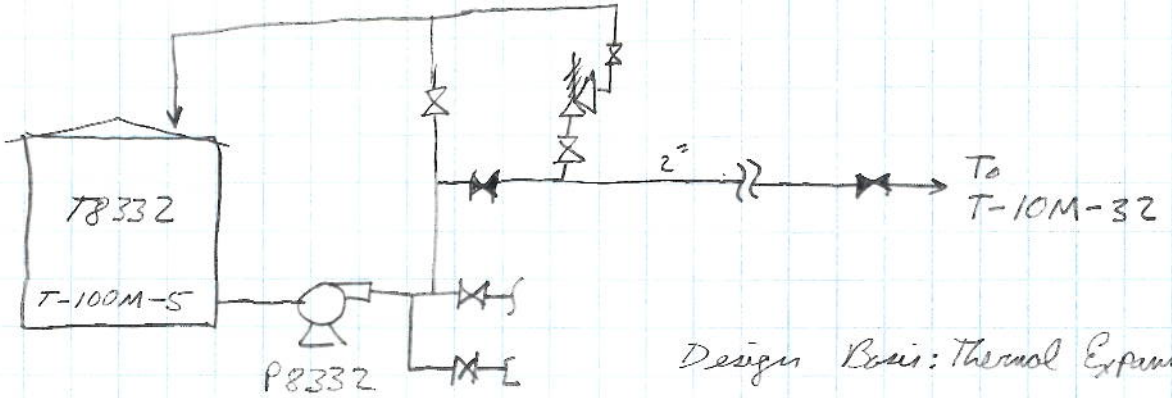
Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}} \right) K_w \right)}{1.12} \text{ psig}$$

whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

SUBJECT Over Pressure Protection For Transfer Line for hydraulic thermal expansion DWG: 25F009	FILE PSV-T8332-029
	DATE 7/28/03
	BY F.B. ISZARD



Design Basis: Thermal Expansion

Relief Valve

3/4 × 1-937

$P_{SET} = 85 PSIG (99.7 PSIA)$

$OVPR = 10\%$

$P_{FLOW} = 85(1.1) + 14.7 = 108.2 PSIA$

Transfer Line

$d = 2 IN$, $L = 45 FT$

Sizing Fluid

Waste fuel

$\beta = 0.000472 \frac{1}{F}$

$SG = 0.694$

$C_p = 0.725 \frac{BTU}{LB\,F}$

$\mu = 0.211 cP$

Heat Transfer Rate from Fire Exposure

$$Q = U A \Delta T = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)\left(\pi \times \frac{2}{12} \times 45\right) FT^2 (1000 F) = 2,238,385 \frac{BTU}{HR}$$

Excel estimates $A_{MIN} = 0.0132 IN^2$ and $d_{MIN} = \sqrt{\frac{4(0.0132)}{\pi}} = 0.129 IN$

∴ the existing 3/4 × 1 RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-937	85	6/15/93	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-XLS	TJ-89024	UV/NB	T8332-029

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4"MNPT	1"FNPT	

Air Capacity	Water Capacity	Steam Capacity
	27 GPM	

Base Matl	Body Matl	Spring Matl
C/S	C/S	C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S	S/S	S/S

Comments

Originator: RL THOMAS

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-937	Boiler	UT	25	OR-UT-A-A-T8332 -PSV029	25F009	Oil

Level	Height	North	East	Location
7FT. ABOVE SLA	0	98	1260	N.E. OF T-30M-66

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
85	2	Yes	8/15/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
JEH	08/15/02	68	Yes	No	No	No	
FG	08/29/00	65	Yes	Yes	No	No	
FG	08/12/98	70	Yes	No	No	No	
FG	08/01/96	70	Yes		No	No	
GS	06/06/95	70	Yes		No	No	
TOM	08/18/94	73	Yes		No	No	
GS	06/15/93		No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- T8332-029
Vessel ID:	T8332
P&ID No.:	25F009
Line No.:	2-FU-226-151
Engineer:	F.B.Iszard
Date:	7/28/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	1,459	N/A	0.013	0.110	0.14	0.01	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8332-029
Vessel ID:	T8332
P&ID No.	25F009
Line No.	2-FU-226-151
Engineer	F.B.Iszard
Date:	7/28/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	2,238,385	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.694	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.725	
Viscosity, cp	0.211	
System or Vessel MAWP	85	
PSV Set Pressure, psig	85	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	85	
Maximum Relieving Pressure, psig	93.5	
Liquid Expansion Rate, gpm	4.200	
Liquid Expansion Rate, lb/hr	1458.6	
Orifice Reynolds Number	337259	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

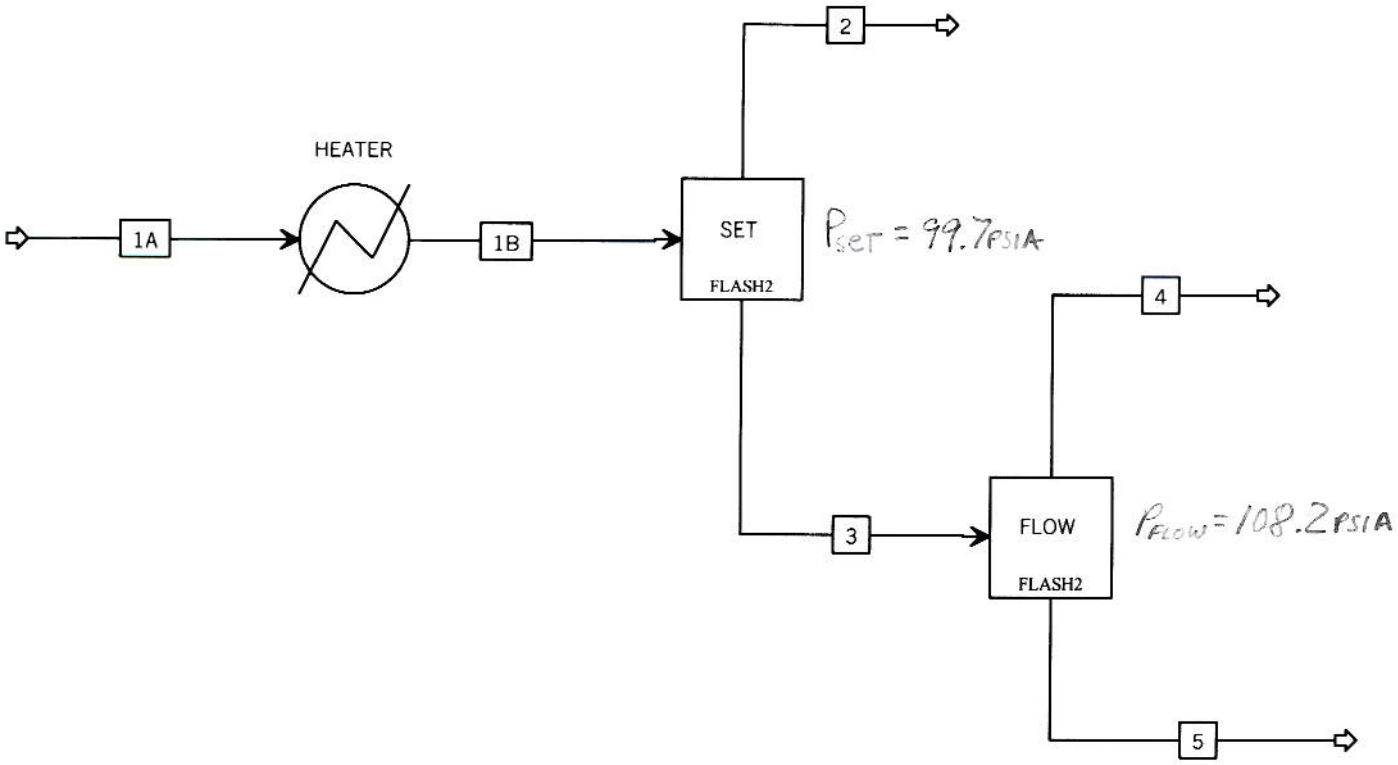
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0132 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	4.73701E-4
IBB	.1117559	.1117559	1.27252E-3
DETDA	.0841373	.0841373	5.61079E-5
TOLUENE	.1085299	.1085299	3.66561E-3
BP350	.0464626	.0464626	4.29826E-4
BP525	.0295767	.0295767	4.52548E-5
BP700	.0202392	.0202392	2.92397E-6
Mole Frac			
AN701	.3260920	.3260920	.0796679
IBB	.1879532	.1879532	.2140150
DETDA	.1415038	.1415038	9.43633E-3
TOLUENE	.1825277	.1825277	.6164891
BP350	.0781418	.0781418	.0722889
BP525	.0497427	.0497427	7.61104E-3
BP700	.0340387	.0340387	4.91759E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.0977244
IBB	15.00000	15.00000	.1707992
DETDA	15.00000	15.00000	.0100029
TOLUENE	10.00000	10.00000	.3377510
BP350	6.700000	6.700000	.0619816
BP525	6.600000	6.600000	.0100985
BP700	6.700000	6.700000	9.67951E-4
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.6893256
Total Flow cuft/hr	1.624909	1.648377	.6317055
Temperature F	70.00000	100.0000	527.3652
Pressure psi	14.70000	.2100321	99.70000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	14327.82
Enthalpy Btu/lb	-535.4649	-524.0510	123.5880
Enthalpy Btu/hr	-53546.49	-52405.10	85.19236
Entropy Btu/lbmol-R	-227.5721	-223.9813	-76.73057
Entropy Btu/lb-R	-1.353130	-1.331779	-.6618577
Density lbmol/cuft	.3659245	.3607148	9.41252E-3
Density lb/cuft	61.54191	60.66573	1.091214
Average MW	168.1820	168.1820	115.9321

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0123334
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	99.70000
Temperature F	70.00000	100.0000	527.3652
Average MW	168.1820	168.1820	115.9321
Density lb/cuft	61.54191	60.66573	1.091214
CPMX Btu/lb-R	.3695765	.3910039	.5147472
CPCVMX	1.000000	1.000000	1.034423
*** VAPOR PHASE ***			
Average MW			115.9321
Density lb/cuft			1.091214
CPMX Btu/lb-R			.5147472
CPCVMX			1.034494
MUMX cP			.0114078
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET	FLOW	FLOW
	LIQUID	VAPOR	LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1934187	4.99427E-4	.1929193
IBB	.1104833	1.28562E-3	.1091977
DETDA	.0840812	6.12685E-5	.0840199
TOLUENE	.1048643	3.55918E-3	.1013051
BP350	.0460328	4.29749E-4	.0456030
BP525	.0295314	4.79337E-5	.0294835
BP700	.0202363	3.30234E-6	.0202330
Mole Frac			
AN701	.3285812	.0848430	.3310432
IBB	.1876899	.2184021	.1873797
DETDA	.1428378	.0104083	.1441755
TOLUENE	.1781442	.6046364	.1738362
BP350	.0782009	.0730060	.0782534
BP525	.0501683	8.14302E-3	.0505928
BP700	.0343776	5.61003E-4	.0347191
Mass Flow lb/hr			
AN701	39.90228	.1030318	39.79924
IBB	14.82920	.1725574	14.65664
DETDA	14.99000	.0109229	14.97907
TOLUENE	9.662249	.3279448	9.334304
BP350	6.638018	.0619705	6.576048
BP525	6.589901	.0106963	6.579205
BP700	6.699032	1.09321E-3	6.697939
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.31067	.6882170	98.62246
Total Flow cuft/hr	2.166040	.5832089	2.172458
Temperature F	527.3652	539.2691	539.2691
Pressure psi	99.70000	108.2000	108.2000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-49692.77	14137.96	-48774.96
Enthalpy Btu/lb	-294.5459	120.9253	-288.2120
Enthalpy Btu/hr	-29251.56	83.22282	-28424.18
Entropy Btu/lbmol-R	-174.6712	-77.60804	-174.1163
Entropy Btu/lb-R	-1.035336	-.6637997	-1.028856
Density lbmol/cuft	.2717623	.0100932	.2682499
Density lb/cuft	45.84895	1.180052	45.39672
Average MW	168.7097	116.9148	169.2329

	3	4	5
	FLOW SET LIQUID	FLOW VAPOR	FLOW LIQUID
Liq Vol 60F cuft/hr	1.563166	.0122822	1.550884
*** ALL PHASES ***			
Pressure psi	99.70000	108.2000	108.2000
Temperature F	527.3652	539.2691	539.2691
Average MW	168.7097	116.9148	169.2329
Density lb/cuft	45.84895	1.180052	45.39672
CPMX Btu/lb-R	.7114150	.5203291	.7247545
CPCVMX	1.000000	1.033745	1.000000
*** VAPOR PHASE ***			
Average MW		116.9148	
Density lb/cuft		1.180052	
CPMX Btu/lb-R		.5203291	
CPCVMX		1.033815	
MUMX cP		.0114956	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	100.4782		99.08968
IBB	98.27328		95.98334
DETDA	154.6975		153.6157
TOLUENE	86.17004		80.95732
BP350	88.37478		85.82134
BP525	93.82166		92.47258
BP700	90.79921		89.91630
Average MW	168.7097		169.2329
Density lb/cuft	45.84895		45.39672
CPMX Btu/lb-R	.7114150		.7247545
CPCVMX	1.000000		1.000000
MUMX cP	.2167983		.2108143
SIGMAMX dyne/cm	8.875220		8.428515
ZMX	.0346351		.0376263

SI Group

Relief System Registration Sheet

Relief Device Tag PSV-T8332-A

This sheet will be filled out and serve as the cover sheet in every relief design paper file.

	Complete?
Create documentation file for the relief system	Wayne
Description of the protected system (i.e. C4200, MAWP 200 psig @ 650°F, P&ID 99F170)	Y
List of credible scenarios	Y
Governing relief scenario description and supporting calculations (which indicate the methodology used, including reactive relief calculations if appropriate)	Y
The design basis for the relief sizing	Y
The required (calculated) relief orifice area or relief rate capacity	Y
The actual relief orifice area or relief rate capacity	Y
Attach piping diagram (may be a hand sketch)	Y
For a PSV or PSV/PSE system, piping analysis showing compliance with 3% rule or alternative stability analysis for the valve.	Y
Bases for any mitigating factors given credit in the sizing calculations (insulation, drainage, heat up time, etc.).	Y
Attach a copy of the associated MOC (if not a part of a capital project)	Y
Attach a copy of the manufacturers information	Y
File electronic calculations with the PSA in S:\PSM Steering\PSV Calcs\Relief device files(master)	Wayne

Does this relief have any special requirements?

Fire proof insulation? No

Sprinkler protection? No

Other Should be install at a high point in the line to avoid heel buildup & plugging.

Has the installed system been inspected for conformance to the design? Yes / No

Designed by G. Baughman Date 10/18/2017

Approved by W. Zott Date 10/18/2017

Orangeburg MOC Request
Orangeburg MOC Title: Upgrades to Common Waste Heel Line to Boiler No. 4
Author: Lisa Luna

Submitted MOC Request
MOC Number: Area Maintenance-2016-12-1

Created 12/06/2016 02:19 PM Modified 08/24/2017 11:13 AM

Title	Upgrades to Common Waste Heel Line to Boiler No. 4		
MOC Number	Area Maintenance-2016-12-1		
Tier	Tier 1	Tier Description	Non GMP Operations
Department	PLANT SERVICES	Department Management	Harve Mobley; Jimmy Taylor
Unit	Area Maintenance	Area Superintendent	Jimmy Taylor
Work Area	Area Maintenance	Unit Leader(s)	Robert Johnson; Steve Cumbee
Section		Additional Line Approvers	Tom Kerr; Jimmy Taylor
Permanent / Temporary	Permanent		
Proposed Start Up Date	01/31/2017		
Charge to WO / Project Number		Estimated Cost ($)	100000
Drawing Attached	Yes		
Drawing Attachment	SK-XXXX-002 - Heel Line Upgrade.pdf SK-XXXX-001 - Heel Line Upgrade.pdf 25F009C - Heel Line Upgrade.pdf SK-XXXX-003 - Heel Line Upgrade.pdf		

Technical Basis for Change

The 330/702 Heel Line is a hazardous waste line with mechanical integrity issues resulting in numerous leaks. A PAF has been funded for the fabrication of expansion pots, installation of in-line cleanouts, replacement of a PSV, and replacement of existing carbon steel lines with stainless steel between T8332 and the 330/702 process connections.

Impact of Change on Safety, Health and Quality

.The intent of the project is to resolve these issues and positively impact site goals

Additional Information

ENV-01: SIGNIFICANT PROCESS CHANGE REVIEW Does this change: 1) Bring a new material on site (raw material, product or blend, maintenance chemical, cooling or boiler treatment chemical, lab reagent, WWT chemical, etc), even if just to store? 2) Generate a new product or a new co-product (including blends)? 3) Isolate an intermediate (puts an intermediate into a container not piped into the existing equipment? 4) Increase the inventory levels of any chemical?	No	Pre
ENV-02: LDAR IMMEDIATE IMPACT - (Pumps, Compressors, & Agitators)	Yes	Pre

SI Group
The Substance Inside

ENGINEERING DEPARTMENT

PRESSURE SAFETY RELIEF VALVE

SPEC NO.		700	
SHEET		OF 14	
PROJECT	ENGR	9467	GRIFFIN
P.O. NO.			
MR NO.			
DATE		10/31/2016	

R-PSV

REV	BY	DATE
1	RRG	10/31/16
FOR QUOTATION		

SAP TAG NUMBER

GEN	01	TAG NUMBER		PSV-T8332-A		
	02	P&ID		OBH25F009		
	03	LINE NUMBER		1"FU-XXX-184		
	04	CONV, BAL BLWS, PIL OP		CONVENTIONAL		
CONN/MATRLS	05	CONN. SIZE & RATING		1" X 2" 150# RF FLANGED		
	06	PIPE CL. IN	PIPE CL. OUT	184	184	
	07	BODY MATERIAL		316L SS		
	08	NOZZLE & DISC MATERIAL		316 SS		
	09	SLEEVE GUIDE MATERIAL		316 SS		
	10	BLOW DOWN RINGS		316 SS		
	11	SPRING MATERIAL		316 SS		
	12	BELLOWS MATERIAL		---		
	13	SEAT/ SEAL MATERIAL		316 SS		
PICK	14	SCREWED CAP MATERIAL		MFR. STD		
	15	BOLTED		---		
	16	OPEN LEVER		---		
	17	PACKED LEVER		---		
BASIS	18	CODE		ASME SECTION VIII		
	19	FIRE		YES		
	20	OTHER		---		
	21	ASME STAMP REQUIRED		YES		
SERVICE	22	PROC ENG / REV DATE		G.BAUGHMAN	10/31/16	
	23	PRESS UNITS	TEMP UNITS	PSIG	DEF F	
	24	FLUID	STATE	702/330 HEEL	LIQUID	
	25	REQUIRED CAPACITY & (UNITS)		0.106 (GPM)		
	26	OPERATING PRESSURE				
	27	BACK PRESSURE CONSTANT		3		
	28	BACK PRESSURE VARIABLE		0		
	29	BACK PRESSURE TOTAL		3		
	30	SET PRESSURE		150 PSIG		
	31	DIFF. SET PRESSURE		147 PSI		
	32	PERCENT (%) OVERPRESSURE		10%		
	33	TEMP: MIN / NORM / MAX		AMB	100	300
	34	TEMPERATURE RELIEVING				
	35	PERCENT (%) SOLIDS		0%		
	36	GAS: CP/CV				
	37	GAS: MOLECULAR WEIGHT				
	38	GAS: COMPRESS @ FTP				
	39	LIQUID: S.G. @ FTP		0.7		
	40	LIQUID: VISCOSITY (CP) @ FTP		1		
	41	SYSTEM / VESSEL MAWP		150 PSIG		
	42	ABOVE RUPTURE DISC (Y/N)		NO		
	43	CALCULATED AREA (SQ. IN.)		0.0003		
	44	SELECTED AREA (SQ. IN.)		0.11		
	45	ORIFICE DESIGNATION		D		
	46	MANUFACTURER		CONSOLIDATED		
	47	MODEL NUMBER		1X2-1905-00D-2-S4-MS-31-RF-LA-HP		

NOTES:
1. SET PRESSURE: SERVICE CONDITION RELIEF PRESSURE.
   DIFFERENTIAL SET PRESSURE. SET PRESSURE MINUS CONSTANT BACK PRESSURE FOR CONVENTIONAL VALVE.
2. PRIOR TO SHIPPING, THE VALVE IS TO BE LEAK TESTED PER API STANDARD 527, EXCEPT THAT THE VALVE SHALL HAVE ZERO LEAKAGE WHILE APPLYING THE LEAKAGE TEST PRESSURE.

Tag Information:	
Project No.:	
Tag No.:	PSV-
Vessel ID:	
P&ID No.:	0BH25F009
Line No.:	2" FU-XXX-183
Engineer:	Garrett E. Baughman
Date:	10/18/2016

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	37	N/A	0.000	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

PSV sized for case of steam tracing heating up heel/fuel oil throughout the day, causing expansion. This PSV will relieve the line pressure back to one of the haz waste tanks in the boiler #4 haz waste tank farm.

Project No.	0
Tag No.	PSV- 0
Vessel ID:	0
P&ID No.	0BH25F009
Line No.	2" FU-XXX-183
Engineer	Garrett E. Baughman
Date:	10/18/2016

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

702 heel & 330 heel (diluted with #2 Fuel Oil) can be trapped in 2" piping between the heel lines tie-in and the ball valve at the boiler #4 haz waste tank farm. This line is steam traced, which causes the heel to expand. Assume max temperature increase of 20 deg C per hour for 800 ft of 2" piping.

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	100
Specific Volume @ T1, ft3/lb	0.0233
Final Temperature (T2), F	300
Specific Volume @ T2, ft3/lb	0.0266
Cubical Expansion Coefficient (B), 1/F	0.000708

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000720	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	25,754	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.7	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.5	
Viscosity, cp	1	
System or Vessel MAWP	150	
PSV Set Pressure, psig	150	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	150	
Maximum Relieving Pressure, psig	165	
Liquid Expansion Rate, gpm	0.106	
Liquid Expansion Rate, lb/hr	37.1	
Orifice Reynolds Number	12012	Nre < 20,000, Viscosity Correction Required

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.62

Typical discharge coefficients
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4 5 1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	0.98

Minimum Relief Area Required 0.0003 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):			0.11	sq. in.

PSV Inlet Pressure Drop (Turbulent Flow, Isothermal)

Liquid flow, lb/hr: 37 | Liquid Viscosity, lbm/ft-s: 0.000672 | Nozzle Entrance K factor: | K=0.5 for sharp edged entrance (ie: most metal vessels)

PSV Inlet Pipe Section 1

Nominal Pipe Diameter, in.= 2 | Actual Pipe Diameter, in.= 2.157 | Schedule 10

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow	4	1.372	10.066
45 Deg. Elbow		1.568	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.686	0.000
Pipe Tee, thru branch	1	3.234	5.932
Rupture Disk			0.000
Other			0.000
Straight Pipe, ft	33	N/A	33.000
Total Equivalent Length, ft			48.998

Stop valves must be full area per ASME Sec VIII, Div. 1, Appen. M-5, ie: the minimum flow area through the stop valve must be equal to or greater than the nominal pipe size flow area of the pressure relief valve's inlet flange.

Note:For 75 pipe diameters (ie: PSD) enter K 7.349

Surface Roughness, ft= 0.00015 | PSV Inlet Pipe CSA, ft2= 0.0254

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Inlet	0.0	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
0	0.0	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
1	2.4	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
2	4.9	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
3	7.3	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
4	9.8	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
5	12.2	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
6	14.7	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
7	17.1	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
8	19.6	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
9	22.0	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
10	24.5	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
11	26.9	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
12	29.4	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
13	31.8	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
14	34.3	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
15	36.7	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
16	39.2	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
17	41.6	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
18	44.1	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
19	46.5	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
20	49.0	179.70		43.659	0.0			109	0.02450	0.00000	0.00000
Out		179.70		43.659	0.0					0.00001	0.00000

PSV Inlet Pipe Section 2

Nominal Pipe Diameter, in.= 1 | Actual Pipe Diameter, in.= 0.957 | Schedule 80

Reduce /Expand. Length, in.= 0.00 | Angle, deg.= 179.81 | Kred= 0.402 | Kexp= 16.648 | Kused= 0.402 | VELused= 0.0 | RHOused= 43.659

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow		1.120	0.000
45 Deg. Elbow		1.280	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.560	0.000
Pipe Tee, thru branch		2.639	0.000
Rupture Disk			0.000
Other	1	2.5	2.493
Straight Pipe, ft	1	N/A	1.000
Total Equivalent Length, ft			3.493

Stop valves must be full area per ASME Sec VIII, Div. 1, Appen. M-5, ie: the minimum flow area through the stop valve must be equal to or greater than the nominal pipe size flow area of the pressure relief valve's inlet flange.

Note:For 75 pipe diameters (ie: PSD) enter K 5.998

Surface Roughness, ft= 0.00015 | PSV Inlet Pipe CSA, ft2= 0.0050

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00001
0	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
1	0.17	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
2	0.35	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
3	0.52	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
4	0.70	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
5	0.87	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
6	1.05	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
7	1.22	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
8	1.40	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
9	1.57	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
10	1.75	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
11	1.92	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
12	2.10	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
13	2.27	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
14	2.45	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
15	2.62	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
16	2.79	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
17	2.97	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
18	3.14	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
19	3.32	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
20	3.49	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
Out		179.70		43.659	0.0					0.00004	0.00001

PSV Inlet Pipe Section 3

Nominal Pipe Diameter, in.= 1 | Actual Pipe Diameter, in.= 0.957 | Schedule 80

Reduce./Expand. Length, in.= 0.00 | Angle, deg = 0.00 | Kred= 0.000 | Kexp= 0.000 | Kused= 0.000

VELused= 0.0

RHOused= 43.659

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow		1.120	0.000
45 Deg. Elbow		1.280	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.560	0.000
Pipe Tee, thru branch		2.639	0.000
Rupture Disk			0.000
Other	1	0.07	0.070
Straight Pipe, ft		N/A	0.000
Total Equivalent Length, ft			0.070

Stop valves must be full area per ASME Sec VIII, Div. 1, Appen. M-5, ie: the minimum flow area through the stop valve must be equal to or greater than the nominal pipe size flow area of the pressure relief valve's inlet flange

Note:For 75 pipe diameters (ie: PSD) enter K 5.998

Surface Roughness, ft= 0.00015 | PSV Inlet Pipe CSA, ft2= 0.0050

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
0	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
1	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
2	0.01	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
3	0.01	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
4	0.01	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
5	0.02	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
6	0.02	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
7	0.02	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
8	0.03	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
9	0.03	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
10	0.03	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
11	0.04	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
12	0.04	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
13	0.05	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
14	0.05	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
15	0.05	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
16	0.06	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
17	0.06	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
18	0.06	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
19	0.07	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
20	0.07	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
Out		179.70		43.659	0.0					0.00000	0.00000

PSV Inlet Pipe Section 4

Nominal Pipe Diameter, in.= 1 | Actual Pipe Diameter, in.= 0.957 | Schedule 80

Reduce./Expand. Length, in.= 0.00 | Angle, deg = 0.00 | Kred= 0.000 | Kexp= 0.000 | Kused= 0.000

VELused= 0.0

RHOused= 43.659

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow		1.120	0.000
45 Deg. Elbow		1.280	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.560	0.000
Pipe Tee, thru branch		2.639	0.000
Rupture Disk			0.000
Other			0.000
Straight Pipe, ft		N/A	0.000
Total Equivalent Length, ft			0.000

Stop valves must be full area per ASME Sec VIII, Div. 1, Appen. M-5, ie: the minimum flow area through the stop valve must be equal to or greater than the nominal pipe size flow area of the pressure relief valve's inlet flange

Note:For 75 pipe diameters (ie: PSD) enter K 5.998

Surface Roughness, ft= 0.00015 | PSV Inlet Pipe CSA, ft2= 0.0050

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
0	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
1	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
2	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
3	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
4	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
5	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
6	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
7	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
8	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
9	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
10	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
11	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
12	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
13	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
14	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
15	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
16	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
17	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
18	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
19	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
20	0.00	179.70		43.659	0.0			245	0.01999	0.00000	0.00000
Out		179.70		43.659	0.0					0.00000	0.00000

PSV Outlet Pressure Drop (Turbulent Flow, Isothermal)

Inlet Pressure, psia= 14.705 Minimum Outlet Press., psia= 14.70

PSV Outlet Pipe Section 1

Nominal Pipe Diameter, in.= 2 Actual Pipe Diameter, in.= 2.157 Schedule 10

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow	6	1.372	15.099
45 Deg. Elbow		1.568	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.686	0.000
Pipe Tee, thru branch		3.234	0.000
Other			0.000
Straight Pipe, ft		N/A	0.000
Total Equivalent Length, ft			15.099

Surface Roughness, ft= 0.00015 PSV Outlet Pipe CSA, ft2= 0.0254

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
0	0.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
1	0.75	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
2	1.51	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
3	2.26	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
4	3.02	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
5	3.77	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
6	4.53	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
7	5.28	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
8	6.04	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
9	6.79	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
10	7.55	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
11	8.30	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
12	9.06	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
13	9.81	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
14	10.57	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
15	11.32	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
16	12.08	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
17	12.83	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
18	13.59	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
19	14.34	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
20	15.10	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
Out		14.71		43.659	0.0					0.00000	0.00000

PSV Outlet Pipe Section 2

Nominal Pipe Diameter, in.= 2 Actual Pipe Diameter, in.= 2.157 Schedule 10

Reduce./Expand. Length, in.= 0.00 Angle, deg.= 0.00 Kred= 0.000 Kexp= 0.000 Kused= 0.000

VELused= 0.0

RHOused= 43.659

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow		1.372	0.000
45 Deg. Elbow		1.568	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.686	0.000
Pipe Tee, thru branch		3.234	0.000
Other			0.000
Straight Pipe, ft	10	N/A	10.000
Total Equivalent Length, ft			10.000

Surface Roughness, ft= 0.00015 PSV Outlet Pipe CSA, ft2= 0.0254

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
0	0.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
1	0.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
2	1.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
3	1.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
4	2.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
5	2.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
6	3.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
7	3.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
8	4.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
9	4.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
10	5.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
11	5.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
12	6.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
13	6.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
14	7.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
15	7.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
16	8.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
17	8.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
18	9.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
19	9.50	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
20	10.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
Out		14.71		43.659	0.0					0.00000	0.00000

PSV Outlet Pipe Section 3

Nominal Pipe Diameter, in.= **2** Actual Pipe Diameter, in.= 2.157 Schedule **10**

Reduce./Expand. Length, in.= **0.00** Angle, deg.= 0.00 **Kred= 0.000** **Kexp= 0.000** **Kused= 0.000**

VELused= 0.0

RHOused= 43.659

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow		1.372	0.000
45 Deg. Elbow		1.568	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.686	0.000
Pipe Tee, thru branch		3.234	0.000
Other	1	0.06	0.110
Straight Pipe, ft		N/A	0.000
Total Equivalent Length, ft			0.110

Surface Roughness, ft= **0.00015** PSV Outlet Pipe CSA, ft2= 0.0254

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
0	0.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
1	0.01	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
2	0.01	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
3	0.02	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
4	0.02	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
5	0.03	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
6	0.03	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
7	0.04	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
8	0.04	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
9	0.05	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
10	0.06	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
11	0.06	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
12	0.07	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
13	0.07	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
14	0.08	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
15	0.08	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
16	0.09	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
17	0.09	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
18	0.10	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
19	0.10	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
20	0.11	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
Out		14.71		43.659	0.0					0.00000	0.00000

PSV Outlet Pipe Section 4

Nominal Pipe Diameter, in.= **2** Actual Pipe Diameter, in.= 2.157 Schedule **10**

Reduce./Expand. Length, in.= **0.00** Angle, deg.= 0.00 **Kred= 0.000** **Kexp= 0.000** **Kused= 0.000**

VELused= 0.0

RHOused= 43.659

Fittings	Number	K	Eq. Length, ft
90 Deg. Elbow		1.372	0.000
45 Deg. Elbow		1.568	0.000
Gate Valve (FP)		0.130	0.000
Ball Valve (FP)		0.050	0.000
Pipe Tee, thru run		0.686	0.000
Pipe Tee, thru branch	1	3.234	5.932
Other			0.000
Straight Pipe, ft		N/A	0.000
Total Equivalent Length, ft			5.932

Surface Roughness, ft= **0.00015** PSV Outlet Pipe CSA, ft2= 0.0254

Sec.	Length, ft	Pressure, psia	Temperature, Deg. F	Density, lbm/ft3	Velocity, ft/s	Acc. Vel., ft/s	Mach Number	Nre	f, fanning	DP (friction) psi	Dp (accel.) psi
Ent	0	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
0	0.00	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
1	0.30	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
2	0.59	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
3	0.89	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
4	1.19	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
5	1.48	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
6	1.78	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
7	2.08	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
8	2.37	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
9	2.67	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
10	2.97	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
11	3.26	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
12	3.56	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
13	3.86	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
14	4.15	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
15	4.45	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
16	4.75	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
17	5.04	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
18	5.34	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
19	5.64	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
20	5.93	14.71		43.659	0.0			109	0.02450	0.00000	0.00000
Out		14.71		43.659	0.0					0.00000	0.00000

Pressure Drop Summary

PSV Inlet Pipe

Section	Pipe ID in	Eq. Length, ft.	K	Friction psi	Accel., psi	Total, psi
Vessel Nozzle	2.157		0	0.00	0.00	0.000
Pipe Section 1	2.157	48.998		0.00	0.00	0.000
Red/Exp			0.402	0.00	0.00	0.000
Pipe Section 2	0.957	3.493		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 3	0.957	0.070		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 4	0.957	0.000		0.00	0.00	0.000
Total				0.00	0.00	0.00

Total Non-recoverable Losses, psi	0.00
Percent of Set Pressure	0.00

PSV Outlet Pipe

Section	Pipe ID in	Eq. Length, ft.	K	Friction psi	Accel., psi	Total, psi
Pipe Section 1	2.157	15.099		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 2	2.157	10.000		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 3	2.157	0.110		0.00	0.00	0.000
Red/Exp			0.000	0.00	0.00	0.000
Pipe Section 4	2.157	5.932		0.00	0.00	0.000
Total				0.00	0.00	0.00

Built Up Back Pressure, psi	0.00
Percent of Set Pressure	0.00
% of Gauge Back Pressure	0.00

ALBEMARLE
CORPORATION

PRESSURE SAFETY
RELIEF VALVE

SPEC NO.	
SHEET	
PROJECT ENGR.	0
P.O. NO.	
MR NO	
DATE	#########

G	01	TAG NUMBER		PSV- 0		
E	02	P&ID		0BH25F009		
N.	03	LINE NO.	VESSEL NO.	2" FU-XXX-183	0	
	04	CONV, BAL BLWS, PIL OP				
C	05	CONN. SIZE & RATING				
O	06	PIPE CL. IN	PIPE CL. OUT			
N.	07	BODY MATERIAL				
/	08	NOZZLE & DISC MATERIAL				
M	09	SLEEVE GUIDE MATERIAL				
A	10	BLOW DOWN RINGS				
T	11	SPRING MATERIAL				
R	12	BELLOWS MATERIAL				
L.	13	RESILIENT SEAT MATERIAL				
P	14	SCREWED CAP MATERIAL				
I	15	BOLTED				
C	16	OPEN LEVER				
K	17	PACKED LEVER				
B	18	CODE		ASME SECT. VIII		
A	19	FIRE				
S	20	OTHER		HYDRAULIC EXPANSION		
I	21	ASME STAMP REQUIRED				
	22	PROC ENG /REV DATE	REV DATE	Garrett E. Baughman	10/18/2016	
	23	PRESS UNITS	TEMP UNITS	PSIG	F	
	24	FLUID	STATE		LIQUID	
	25	REQUIRED CAPACITY (#/HR)		37		
	26	OPERATING PRESSURE				
	27	BACK PRESSURE CONSTANT		0.00		
	28	BACK PRESSURE VARIABLE		0.00		
S	29	BACK PRESSURE TOTAL		0.00		
E	30	SET PRESSURE		150		
R	31	DIFF. SET PRESSURE		150		
V	32	PERCENT(%) OVERPRESSURE		10		
I	33	TEMP: MIN/ NORM/ MAX				
C	34	TEMPERATURE RELIEVING				
E	35	PERCENT (%) SOLIDS				
	36	CAS: CP/CV		N/A		
	37	GAS: MOLECULAR WEIGHT		N/A		
	38	GAS: COMPRESS @ FTP		N/A		
	39	LIQUID: S.G. @ FTP		0.7		
	40	LIQUID: VISCOSITY (CP) @ FTP		1		
	41	SYSTEM/ VESSEL MAWP		150		
	42	ABOVE RUPTURE DISC (Y/N)		NO		
	43	CALCULATED AREA (SQ. IN.)		0.0003		
	44	SELECTED AREA (SQ. IN.)		0.11		
	45	ORIFICE DESIGNATION		D		
	46	MANUFACTURER				
	47	MODEL NUMBER				

NOTES:

1. SET PRESSURE: SERVICE CONDITION RELIEF PRESSURE.
   DIFFERENTIAL SET PRESSURE: SET PRESSURE MINUS CONSTANT BACK PRESSURE FOR CONVENTIONAL VALVE.
2. PRIOR TO SHIPPING, THE VALVE IS TO BE LEAK TESTED PER API STANDARD 527, EXCEPT THAT THE VALVE SHALL HAVE ZERO LEAKAGE WHILE APPLYING THE LEAKAGE TEST PRESSURE.

ALBEMARLE CORPORATION — RUPTURE DISC

			SPEC NO.		
			SHEET		
			PROJECT	ENGR.	0
			P.O. NO.		
			MR NO.		
			DATE		########
G	01 TAG NUMBER		PSD- 0		
E	02 P&ID		0BH25F009		
N.	03 LINE NO.	VESSEL NO.	2" FU-XXX-183	0	
	04 BLANK 1				
D	05 DISC SIZE				
I	06 DISC TYPE				
S	07 DISC MATERIAL				
C	08 LINER IN	LINER OUT			
	09 VACUUM SUPPORT				
A	10 VACUUM SUPPORT MATERIAL				
S	11 VACUUM SUPPORT LINER				
S	12 VAC. SUPP. ATTACH TO DISC				
E	13 MANUFACTURING RANGE				
M	14 BURST TOLERANCE (%)				
B	15 DISCS PER ASSEMBLY				
L	16 MANUFACTURER				
Y	17 DISC MODEL NUMBER				
H	18 HOLDER TYPE				
O	19 BASE MATERIAL				
L	20 BASE LINER				
D	21 HOLDDOWN MATERIAL				
/	22 HOLDDOWN LINER				
H	23 HOLDDOWN TAP (1/4" NPT)				
E	24 HOLDER SIZE & RATING				
D	25 HOLDER MODEL NUMBER				
O	26 PRE-ASSEMBLY SCREWS				
P	27 STUDS AND NUTS				
T	28 MICELLANEOUS				
B	29 CODE				
A	30 FIRE				
S	31 OTHER		HYDRAULIC EXPANSION		
	32 PROC ENG	REV DATE	Garrett E. Baughman	10/18/2016	
	33 PRESS UNITS	TEMP UNITS	PSIG	F	
	34 FLUID	STATE		LIQUID	
	35 REQUIRED CAPACITY	UNITS	37	PPH	
S	36 MIN PRESS	OPER PRESS			
E	37 BACK PRESSURE CONSTANT		0.00		
R	38 BACK PRESSURE VARIABLE		0.00		
V	39 BACK PRESSURE TOTAL		0.00		
I	40 SET PRESSURE		150		
C	41 PERCENT (%) OVERPRESSURE		10		
E	42 TEMP: MIN / NORM / MAX				
	43 TEMP BURST	TEMP REL.			
	44 GAS: CP/CV		N/A		
	45 GAS: MOLECULAR WEIGHT		N/A		
	46 LIQUID S.G. @ FTP		0.7		
	47 SYSTEM / VESSEL MAWP		150		
	48 BELOW RELIEF VALVE (Y/N)		NO		
	49 CALCULATED SIZE (SQ. IN.)		0.0003		
	50 SELECTED SIZE (SQ. IN.)				

NOTES:

1. SPARE DISCS ARE TO BE INDIVIDUALLY BOXED.

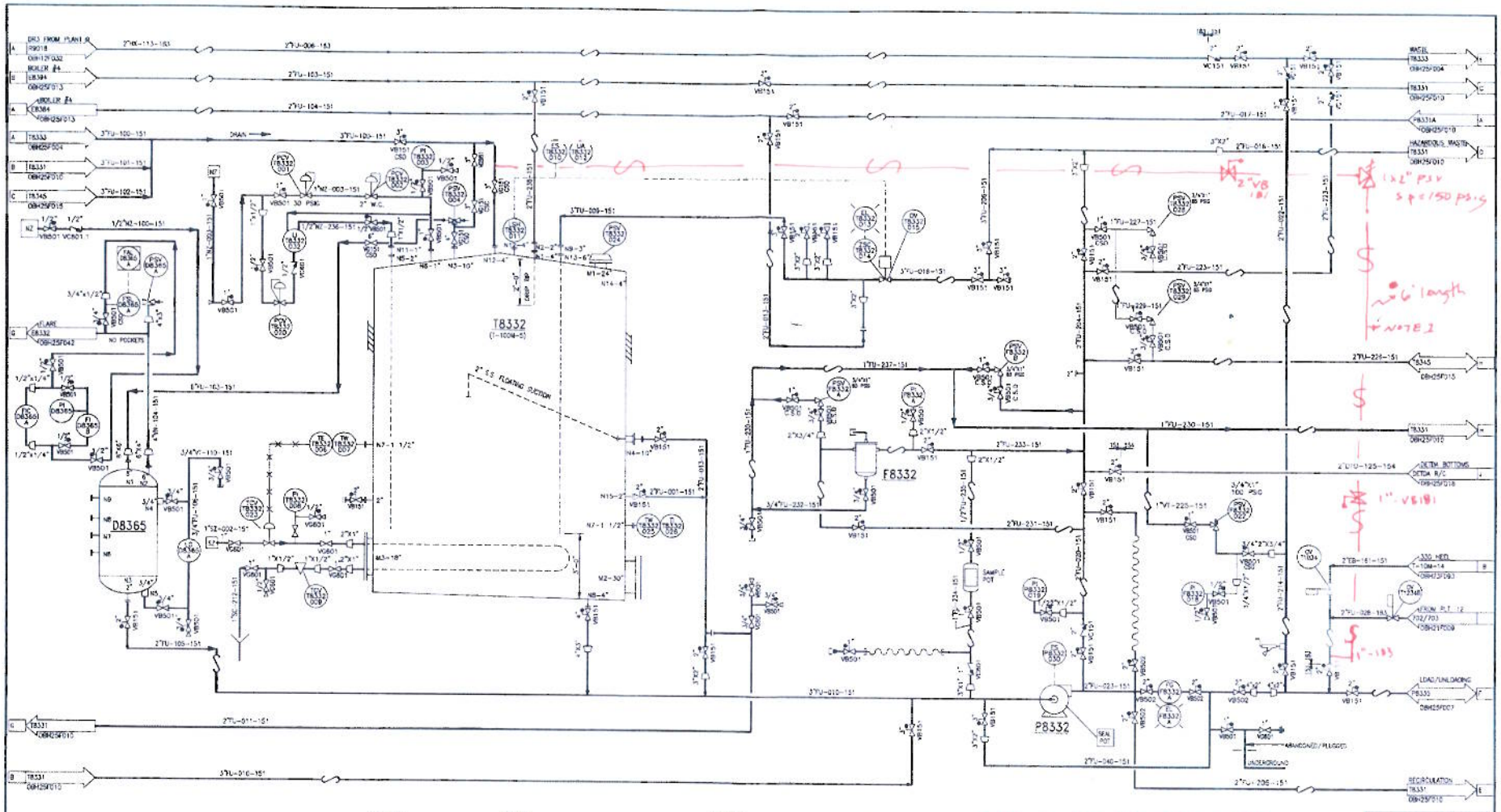


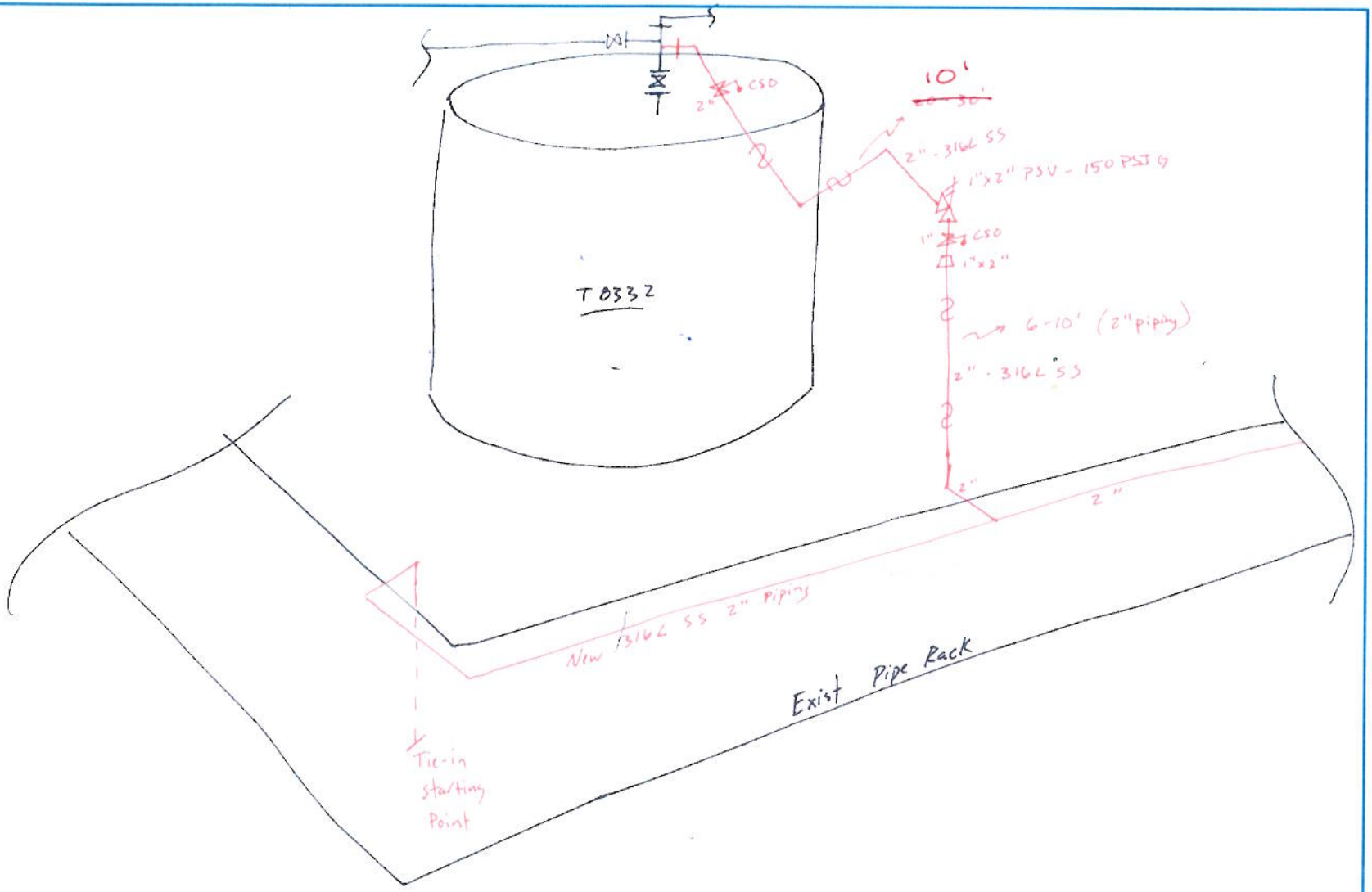
FIGURE D.2.6

SI Group

WASTE FUEL STORAGE
T-8332 (T-100M-5)
P&ID

03911	0BH25F009
PROJECT NUMBER	DRAWING NUMBER
SCALE: NONE	OPERATING AREA: – BUILDING NO.: –

REV: 29



CALCULATION SHEET	ALBEMARLE CORPORATION ORANGEBURG PLANT
SUBJECT	FILE
	DATE
	BY

Design Basis

P&ID Loop No.
PSV-T8333-5104

P&ID No.
OBH25F004

Relief Type
EV

Functional Location
OR-02-B-D-T8333 -PSV5104

PHA Title

☐ In SAP?

SAP No.

Orangeburg Equipment No.

Manufacturer
PROTECTOSEAL

Model No.

Serial No.

Description
PSV-T8333-5104; T-30M-61 Emergency Vent

◉ Fire ○ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid
Waste Fuel

Actual Fluid
Waste Fuel

Other Sizing
Tank Dim 12' x 36'

Required Size
20"

Actual Size
20"

P&ID Size

☑ PSV OK?

Design Pressure
10" wc

Existing Setpoint
10" wc

P&ID Set Pressure

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes
Flash Pt. set at 460F per Albemarle MSDS records
Calculations performed using in-house software from Fred Iszard by Fred Iszard; field measurements verified 7/30/03; file created 7/31/03

DESIGN BASIS

CV/EV No.	P&ID No	Description
PSV-T8333-5104	25F004	T-30M-61 Emergency Vent

MANUFACTURER	MODEL No.	SERIAL No.
Protectoseal		

☑ Fire ☐ Cooling Loss ☐ Pump In/Out ☐ Thermal ☐ Control Failure

Other Sizing

Tank Dim 12' x 36'

RELIEVING STATE

◉ VAPOR
○ LIQUID
○ BOTH

Sizing Fluid	Actual Fluid
Waste Fuel	Waste Fuel

Required Size	Design Pressure	Capacity
20"	10" wc	30000 gal

☑ Acceptable
☑ Filed

Actual Size	Set Pressure
20"	10" wc

Design Notes

Flash Pt. set at 460F per Albemarle MSDS records

Calculations performed using in-house software by Fred Iszard; field measurements verified on 07/30/02; file created 7/31/03

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	Waste Boiler #4	Rev. Date:	
Job Name:	Waste Fuel Storage	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/30/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Waste Fuel Storage
Tank Identification:	T8333 (T-30M-61)
Relief Device No:	PSV-T8333-5104
P&ID :	25F004
File Name:	PSV-T8333-5104

Check Device: ☐ Conservation Vent ☑ Emergency Vent ☐ Flame Arrestor

Vessel:			
	Tank MAWP (in.wc)	10.0 in. w.c.	0.361 psig
	Design Temperature(F)	70.0 F	
	Vacuum Rating(in.wc)	0.0 in w.c.	0.000 psig
	Emergency Vent Dia.	20.0	in
	Conservation Vent Dia.	2.0	in
	Total Vessel Volume	30,000	gallons
	Max. Working Volume	27,000	gallons
	D_{TANK}	12.0	ft
	L_{T-T}	36.0	ft
	Percent liquid filled	90%	(Max. Opr. = 90%)

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	8.0 in w.c.	(0.289 psig)
Set point for CV (vacuum), P_{Vset} (in.wc)	3.00 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	10.0 in w.c.	(0.361 psig)
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$ (fire case, ovpr=21%)	12.0 in w.c.	(0.441 psig)

Process Notes:

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel	
Phase (Liquid or Vapor)	Liquid	
Flash point temperature (F)	460.0 F	
Molecular Weight	168	lb/lbmol
Formula (i.e. CxHx)	Organic Mixture	
Normal Boiling Temperature (F)	400 F	
Heat of Vaporization (btu/lb)	140.0	btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

Emergency Vent Calculations

Calculate Tank External Wetted Area

	Select One
A= p D H for vertical cylindrical tanks flat on ground	○
A= p D H + p/4 D² for raised vertical cylindrical tanks.	◉
A=(p D L + 2 p / 4 D²) 0.75 for horz. cylindrical tanks	○

A = 1470 ft2

Heat Exposure to Tank

A(ft2)	MAWP(psig)	Q (btu/hr)
<200	all	20000 A
>200 & <1000	all	199300 $A^{0.566}$
>1000 & <2800	all	963400 $A^{0.338}$
>2800	>1	21000 $A^{0.82}$
>2800	<= 1	14090000

Q = 11,334,083 btu/hr

Required Vent Capacity

For tanks without a weak roof to shell attachment, and non-refrigerated storage

vent capacity requirement is determined by eqn. (1) API 2000, section 2.4.3.2

$$V = \frac{3.091 Q F}{L} (T/Mw)^{0.5}$$

F = 1.00 (no fireproof insulation)

T= Tboil = 860 R

Mw = 168.0

L=D Hvap= 140 btu/lb

Q = 11,334,083 btu/lb

V = 566,177 scfh air

Est. min. vent area = 214.8 in^2

Est. vent diameter = 16.5 in

Environmental Factors for Storage Tanks

"F" Factor	Tank Fireproof Insulation Data
1.0	Bare metal tank (default value)
0.30	Insul. Conductance = 4 btu/hr ft2 F (most common)
0.15	Insul. Conductance = 2 btu/hr ft2 F

Note: Fireproof insulation must be stainless steel and not aluminum, and resist dislodgment by fire fighting equipment, and not decompose at temperatures up to 1000 F.

EMERGENCY VENT DESIGN RECORD

Fluid Characteristics:

Name	Waste Fuel
Phase	Liquid
Flash point temperature	460 F

Hazards:

Environmental
Flammable

Venting Conditions:

Flowing Pressure = 15.1 psia
Flowing Temperature = 400 F

Physical Properties of Fluid at Venting Conditions

Stored Liquid

Name	Waste Fuel	
Molecular Weight	168	lb/lbmol
Formula	Organic Mixture	
Flash Point Temperature	460	F
Normal Boiling Temperature	400	F

Calculation Summary

Required relief capacity	566,177	scfh air @ <= 12.0 in w.c.

From a manufacturers catalog, this relief capacity at the flowing pressure can be provided by a 20 in. emergency vent.

Emergency Vent Summary

Available emergency vent diameter		20	in
Minimum vent size		20	in.
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Manufacturer		Protectoseal	
Selected or Existing Model		7820	
Maximum Flow Capacity		900,800	scfh air
	at	12.0	in w.c.
Pressure drop at required capacity		< 30	in w.c.

EMERGENCY VENT SPECIFICATION SHEET

Originated By: F.B.Iszard
Revision No:
Project:

Origin Date: 7/30/03
Revision Date:

1	Device Identification			PSV-T8333-5104
2	System Name			Waste Fuel Storage
3	Process / Site	Plant Utilities		Waste Boiler #4
4	P&ID Sheet			25F004
5	Tank identification			T8333 (T-30M-61)
6	Tank capacity, gallons			30,000
7	Tank design pressure (mawp), in. w.c.			10.0
8	Tank diameter / Height, ft		12.0	36.0
9	Fluid contained			Waste Fuel
10	Molecular weight			168
11	Flash point temperature, F			460
12	Maximum operating temperature, F			95
13	Set point for pressure relief, in. w.c.			10.0
14	Maximum flowing pressure during relief, in.w.c.			12.0
15	Required flow capacity (fire conditions), scfh air			566,177
16	Nozzle or Connection Size, in			20.0
17	Discharge to …			atmosphere
18	Back pressure, psig			0.0
19	Manufacturer / Model	Protectoseal		7820
20	Size (diameter), inches			20.0
21	Body material			316 ss
22	Seat and trim material			316 ss
23	Diaphragm material			Teflon
24	Maximum flow capacity, scfh air			900,800
25	at inches water column			12.0
26	In-line pressure drop, in w.c.			< 30

Notes :

TANK

T8333

TANK NO: T-30M-61

WASTE STORAGE TANK

CAPACITY 30,000 GALS; WEIGHT, EMPTY 28,000 LBS.

DIMENSIONS:

144" O.D.; _____ LENGTH, STR. SHELL; _____ OVERALL LENGTH

DESIGN NOTES:

PRES., PSI: TANK 10" H_2O; JACKET _____; COIL _____

VACUUM: TANK _____; JACKET _____; COIL _____

TEMP.,°F: TANK 250; JACKET _____; COIL _____

HYDROSTATIC TEST, PSI: TANK _____; JACKET _____; COIL _____

THICKNESS: SHELL _____; HEAD _____; JACKET _____; COIL _____

HEAD DESIGN _____; STRESS RELIEVED _____

CODE API 650, APPENDIX J; CODE STAMP REQD. _____; X-RAY NO

MATERIAL SPECIFICATIONS:

SHELL A-36 HEADS A-36

JACKET _____ COIL _____

NOZZLES _____ FLANGES A-36

DRAWINGS: DBH25F004

MANUFACTURER: HENDERS BOILER & TANK CO.
6500 E. CENTER ST.
HORN LAKE, MS 38637

VENDOR: SAME AS ABOVE

MFG., SERIAL, SHOP ORDER NO: 9370

INSURANCE, HSB NO: _____ NATIONAL BOARD NO. _____

YEAR MANUFACTURED: 1990

P.O. NO: S8909 057634 (0-7468)

LOCATION: BLDG: 155

RECEIVED: 03-14-90

GEN. ENG. PROJ. NO.	0-7466
GEN. ENG. PROB. NO.	
DRAWING NO.	08H25F004
PROC. ENG. BY AJI	DATE 5/30/89
GEN. ENG. BY	DATE

ETHYL CORPORATION

DL ALKYLATION RESIDUE BLEND TK.

DRUM SPECIFICATIONS

PAGE NO.	1 OF 1
SPEC NO.	
REV. NO.	
ITEM NO.	
NO. OF UNITS	1

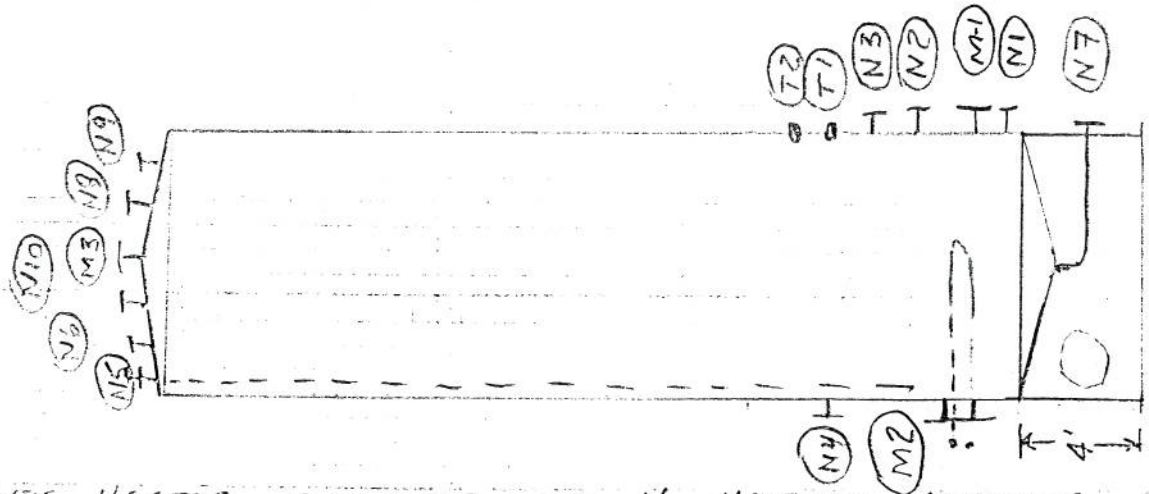
DESIGN CONDITIONS	
TYPE	VERTICAL API TYPE TANK
SHELL DIAM. (OD)	12'-0" LENGTH (TT) 36'-0"
VOLUME (GAL)	30000 (NOMINAL)
DENSITY (LB/GAL)	8.3
NORM LEVEL % FULL	90%
OPER. TEMP (°F)	210°F.
DESIGN TEMP (°F)	250 F
OPER. PRESSURE (PSIG)	5" H_2O
DESIGN PRESSURE (PSIG)	10" H_2O FULL VACUUM ☐

MATERIALS		CORR. ALLOW.
SHELL	CARBON STEEL	1/8 (IN.)
HEADS	CARBON STEEL	1/8 (IN.)
LINING	NONE	(IN.)
SUPPORTS	TYPE: SKIRT	
BOLTING: INTERNAL	SA193B7 EXTERNAL SA193B7	
GASKETS	1/16" GARLOCK 3200 OR EQUAL	
INSULATION	BY OTHERS THK. 2" (IN.)	
SANDBLAST	YES PRIME YES	
CODE	API 650 STAMP REQ'D	
STRESS RELIEVE	NO RADIOGRAPH NO	
JOINT EFF.	MAAP	
HYDROSTATIC TEST PSIG	FILL WITH WATER	
WEIGHTS: EMPTY	BY VENDOR (LBS)	
FULL OF WATER	BY VENDOR (LBS)	

NOZZLE	MARK	NO. REQ.	SIZE	RATING	FACING
INLET	N2	2	12"	150	RF
INLET	N3	1	2"	150	RF
VAPOR OUT	N10	1	1½"	150	RF
LIQUID OUT	N7	1	4"	150	RF
~~BYPASS~~ SPARE	N9	2	4"	150	RF
~~SAFETY~~ SPARE	N8	2	2"	150	RF
LEVEL	N4	1	4"	150	RF
LEVEL	N5*	1	2"	150	RF
PRESSURE					
VENT	N6	1	2"	150	RF
HANDHOLE					
MANHOLE	M1	1	24"	150	
THERMOWELL	T1	1	3/4"	2000#	NPT
THERMOWELL	T2	1	1"	2000#	NPT
OUTLET	N1	1	2"	150	RF
HEATER	M2	1	24"	150	RF
EM VENT	M3	1	20"	150	RF

* WITH 1" SCHED 80 DIP PIPE & 1/2" COUPLING ON SIDE

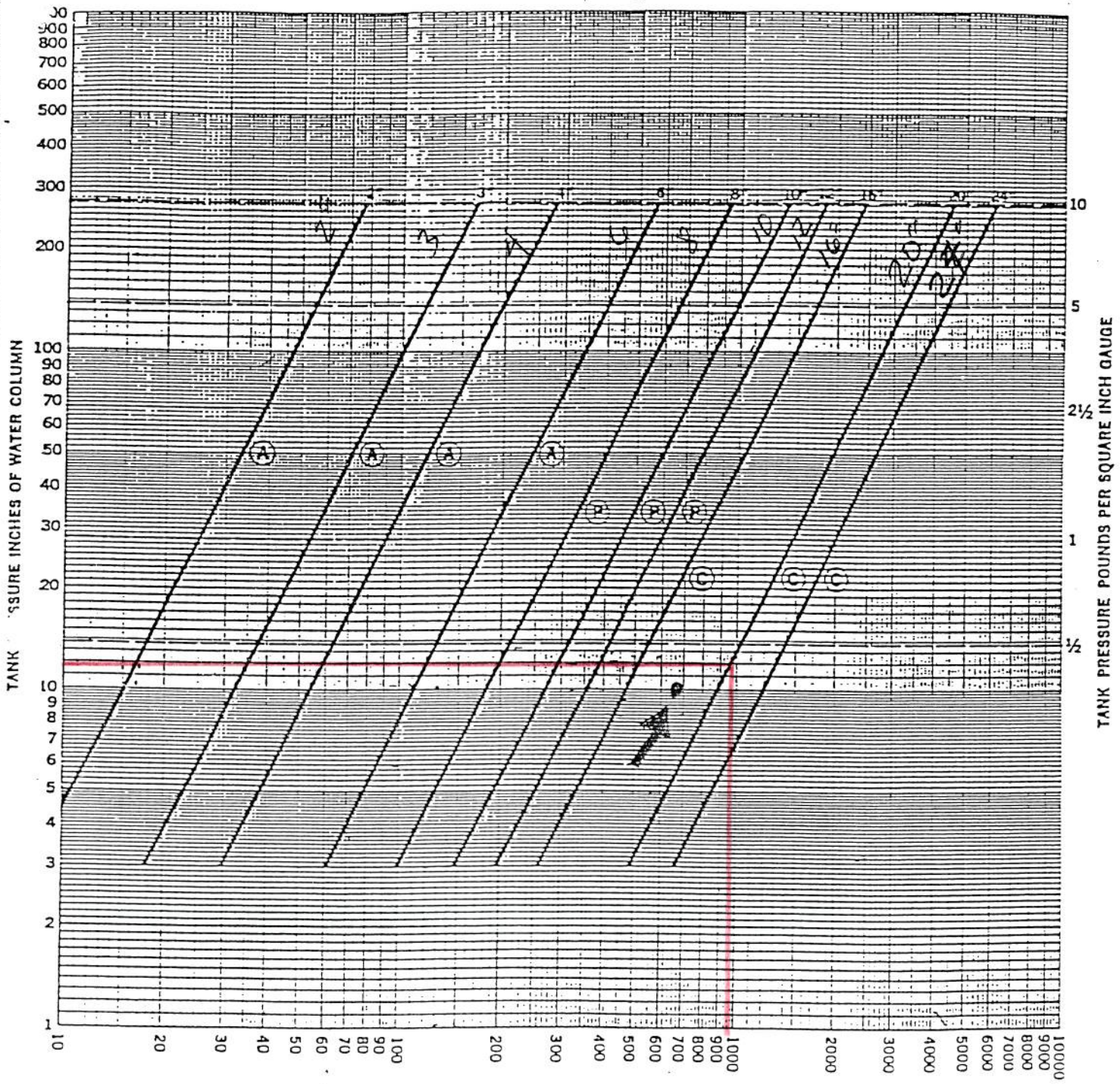
DESIGN IN ACCORDANCE WITH ETHYL STANDARD SPECIFICATION NOS:
SP 15-2 CLASS B



1. PROVIDE HEATER CONSISTING OF 4 HAIRPIN SECTIONS 8' LONG CONSTRUCTED OF 2" SCH 40 316 S/S PIPE. OUTSIDE CONNECTIONS FOR STEAM & CONDENSATE TO BE 2" 150LB FLANGED.
2. BOTTOM OF TANK TO BE A CONE WITH 12" DROP OR A DISHED HEAD. VENDOR TO QUOTE LOWEST PRICED ALTERNATIVE. HEAD TO HAVE INSULATION SUPPORTS (NUTS ON 12" CENTERS OR EQUIVALENT)
3. PROVIDE 4 INSULATION SUPPORT RINGS, LADDER & HANDRAIL.

REV.	APPROVED BY	DATE	(1)			(3)		
(0)			(2)			(4)		

AIR FLOW THROUGH PROTECTOSEAL SERIES 7800 EMERGENCY RELIEF VENTS



(A) Flow capacities determined by actual test and certified.

(P) Projected flow capacities not yet confirmed by tests.

(C) Calculated and based on a flow coefficient of 0.5 applied to the rated orifice area as specified in OSHA, par. 1910.106 (v) (i).

Design Basis

P&ID Loop No.
PSV-T8333-5105

P&ID No.
OBH25F004

Relief Type
CV

Functional Location
OR-02-B-D-T8333 -PSV5105

PHA Title

☐ In SAP?

SAP No.

Orangeburg Equipment No.

Manufacturer
PROTECTOSEAL

Model No.

Serial No.

Description
PSV-T8333-5105; T-30M-61 Conservation Vt

○ Fire ◉ Pump In/Out ○ Thermal Expansion ○ Vapor Relief

○ Liquid Relief ○ Regulator Failure ○ Unwetted Surface ○ Two Phase Flow

Sizing Fluid
Waste Fuel

Actual Fluid
Waste Fuel

Other Sizing
Tank Dim. 12'x36'

Required Size
2"

Actual Size
2"

P&ID Size

☑ PSV OK?

Design Pressure
10" wc

Existing Setpoint
8" wc

P&ID Set Pressure

☑ File Complete?

☑ Shown Correctly on P&ID?

Design Notes
Flash Pt. set at 460F per Albemarle MSDS records; max fill and empty rates set at 300 GPM
Tank not rated for vac. Vac. setting: 3" wc
Calcs. per. using in-house soft. from Fred Iszard by Fred Iszard; field meas. ver. 7/10/03; file created 7/31/03

DESIGN BASIS

CV/EV No.: **PSV-T8333-5105**

P&ID No: 25F004

Description: T-30M-61 Conservation Vent

MANUFACTURER: Protectoseal

MODEL No.:

SERIAL No.:

☐ Fire ☐ Cooling Loss ☑ Pump In/Out ☐ Thermal ☐ Control Failure

Other Sizing: Tank Dim. 12'x36'

RELIEVING STATE: ◉ VAPOR ○ LIQUID ○ BOTH

Sizing Fluid: Waste Fuel

Actual Fluid: Waste Fuel

Required Size	Design Pressure	Capacity
2"	10" wc	30000 gal

Actual Size	Set Pressure
2"	8" wc

☑ Acceptable

☑ Filed

Design Notes

Flash Pt. was set at 460F per Albemarle MSDS records; max fill and empty rates were set at 300 GPM

Tank not rated for vacuum Vacuum setting: 3" wc

Calculations performed using in-house software by Fred Iszard; field measurements verified on 07/10/02; file created 7/31/03

requested vacuum setting be lowered to 0.865" wc

PRESSURE RELIEF DEVICE RECORD

ALBEMARLE CORPORATION - ORANGEBURG, SC

(For atmospheric tank design pressure)

Process Area:	Plant Utilities	Rev. No:	
Location:	Waste Boiler #4	Rev. Date:	
Job Name:	Waste Fuel Storage	Prepared by:	F.B.Iszard
Project No:		Checked by:	
Origin Date:	7/30/03	Approved by:	N.Krzystowczyk

Last Form Revision, 11/02

System Name:	Waste Fuel Storage
Tank Identification:	T8333 (T-30M-61)
Relief Device No:	PSV-T8333-5105
P&ID :	25F004
File Name:	PSV-T8333-5105

Check Device: ☑ Conservation Vent ☐ Emergency Vent ☐ Flame Arrestor

Vessel:			
	Tank MAWP (in.wc)	10.0 in. w.c.	0.361 psig
	Design Temperature(F)	70.0 F	
	Vacuum Rating(in.wc)	0.0 in w.c.	0.000 psig
	Emergency Vent Dia.	20.0	in
	Conservation Vent Dia.	2.0	in
	Total Vessel Volume	30,000	gallons
	Max. Working Volume	27,000	gallons
	D_{TANK}	12.0	ft
	L_{T-T}	36.0	ft
	Percent liquid filled	90%	(Max. Opr. = 90%)

Design Basis for Relief Device:

API-2000, Venting Atmospheric and Low Pressure Storage Tanks

Maximum normal operating temp., T_{OP} (F)	95.0 F	
Set point for CV (pressure), P_{OP} (in.wc)	8.0 in w.c.	(0.289 psig)
Set point for CV (vacuum), P_{Vset} (in.wc)	3.00 in. w.c.	
Set point for EV pressure relief, Ppres (in. wc)	10.0 in w.c.	(0.361 psig)
Max.flowing pressure for EV (fully open), $P_{FLOW\ (in.wc)}$ (fire case, ovpr=21%)	12.0 in w.c.	(0.441 psig)

Process Notes:

Fluid Physical Properties

Fluid Characteristics:

Fluid Name	Waste Fuel	
Phase (Liquid or Vapor)	Liquid	
Flash point temperature (F)	460.0 F	
Molecular Weight	168	lb/lbmol
Formula (i.e. CxHx)	Organic Mixture	
Normal Boiling Temperature (F)	400 F	
Heat of Vaporization (btu/lb)	140.0	btu/lb

Hazards

None	☐
Corrosive	☐
Flammable	☑
Toxic	☐
Burn Hazard	☐
Prone to plug	☐
Environmental	☑
Pyrophoric	☐
Other (Specify)	☐

CONSERVATION VENT CALCULATIONS

In-breathing Capacity Estimation

(Vacuum Relief Capacity)

Maximum Pump Out Rate = 300 gpm

$$Vi = \frac{Vpump(gpm)\ 60(min/hr)}{7.5\ (gal/hr/cf\ air)} = 2400\ scfh$$

Thermal effect, Table 2 in API 2000

V_{VAC} = 730 scfh

total 3130 scfh of air

Out-breathing Capacity Estimation

(Pressure Relief Capacity)

Maximum Fill Rate = 300 gpm

$$Vo = \frac{Vfill(gal/min)\ 60(min/hr)}{Cs\ (gal/hr/cf\ air)} = 2571\ scfh$$

Thermal effect, Table 2 in API 2000

V_{PRES} = 425 scfh

total 2996 scfh

Required relief Capacity=	3130	scfh of air

Specified CV Device

From the manufacturers catalog, the following minimum size CV is identified

Manufacturer	Protectoseal
Size	2 in.
Model	8542H
Pressure Drop at required flow capacity	28.0 in w.c.

CONSERVATION VENT DESIGN RECORD

Venting Conditions:

Maximum Positive Pressure	10.0 in w.c.
Maximum Vacuum	0.0 in w.c.
Maximum Normal Oper. Temperature	95.0 F

Vessel or System Characteristics

Vent Nozzle Diameter (D_{CV})	2.0 in.
MAWP	10.0 in w.c.
Maximum Vacuum	0.0 in w.c.

Conservation Vent Summary

Flame Arrester Included		No	
Available CV nozzle size		2.0	in
Required relief capacity		3,130	scfh air
Relief vent discharge to...		atmosphere	
Backpressure		0	psig
Installed Device			
Manufacturer		Protectoseal	
Size		2 in.	
Model		8542H	
Maximum Flow Capacity	Pressure	14,000	scfh air @ 10.0 in w.c.
	Vacuum	5,400	scfh air @ 3.0 in w.c.

CONSERVATION VENT SPECIFICATION SHEET

Originated By: F.B.Iszard
Revision No:
Project:

Origin Date: 7/30/03
Revision Date:

1	Device Identification			PSV-T8333-5105
2	System Name			Waste Fuel Storage
3	Process / Site	Plant Utilities		Waste Boiler #4
4	P&ID Sheet			25F004
5	Tank Identification			T8333 (T-30M-61)
6	Sizing with flame arrester			No
7	Tank design pressure (mawp), in. w.c.			10.0
8	Tank capacity, gallons			30,000
9	Tank diameter / height, ft		12.0	36.0
10	Fluid contained			Waste Fuel
11	Flash point temperature, F			460
12	Maximum operating temperature, F			95
13	Normal boiling temperature, F			400
14	Maximum fill rate, gpm			300
15	Out-breathing due to filling/thermal effect, scfh		2571	425
16	Total outbreathing, scfh			2,996
17	CV pressure setting, in.w.c.			8.0
18	Maximum pump out rate, gpm			300
19	In-breathing - pump out/thermal effect,scfh		2,400	730
20	Total in-breathing, scfh			3,130
21	CV vacuum setting, in.w.c.			3.00
22	Manufacturer / Model	Protectoseal		8542H
23	Size (diameter), inches			2
24	Discharge to …			atmosphere
25	Back pressure, psig			0
26	Body material			316 ss
27	Seat and trim material			316 ss
28	Diaphragm material			Teflon
29	Tank nozzle size, inches			2.0
30	Required flow capacity, scfh air			3,130
31	Maximum flow capacity, scfh air	(pressure)		14,000
32	at (inches of water column)			10.0
33	Maximum flow capacity, scfh air	(vacuum)		5,400
34	at (inches of water column)			3.0
35	In-line pressure drop, in w.c.			28.0
36	Flange facing			R.F.
37	Notes:			

S 8333 0 C 30 03

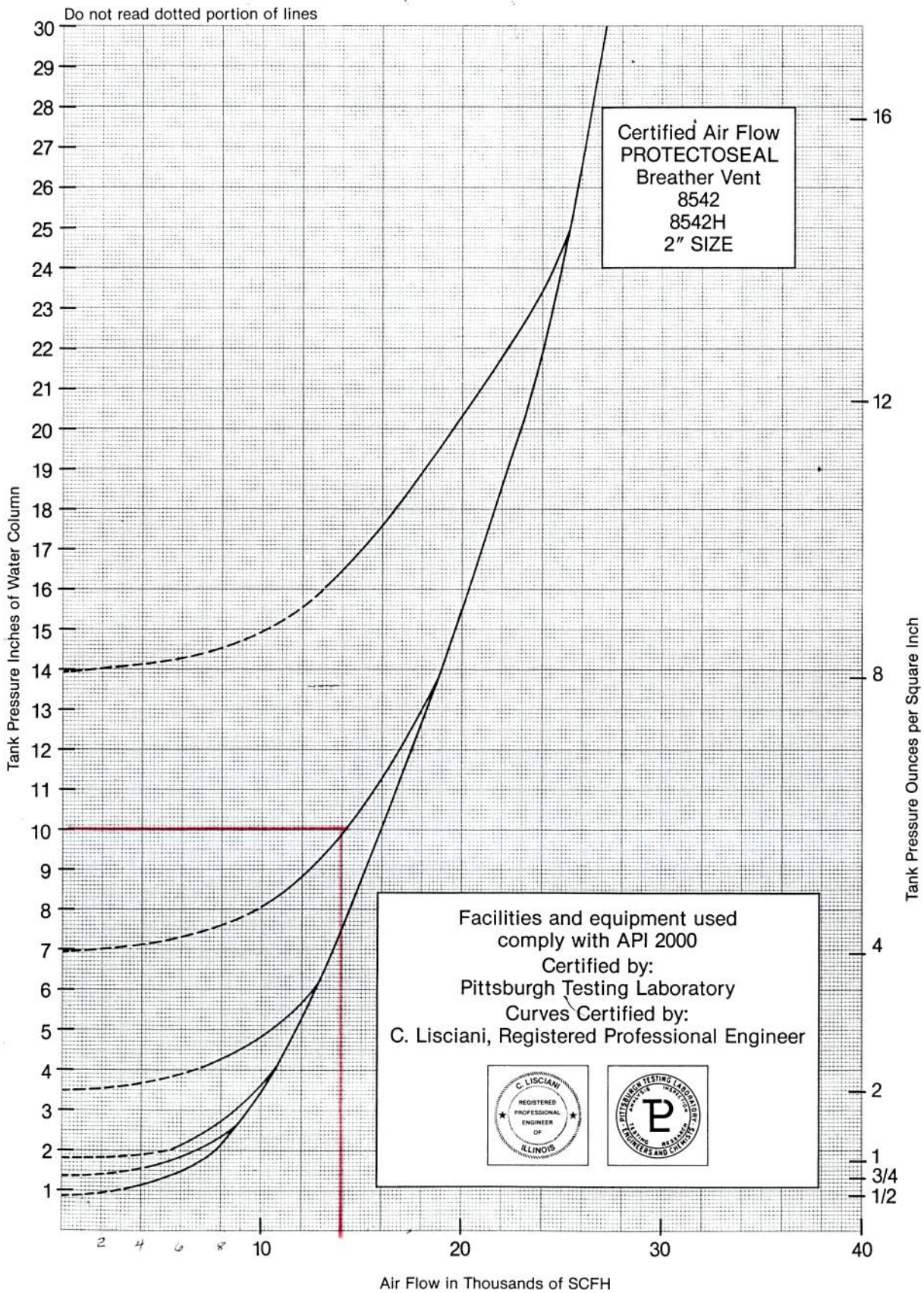
PROTECTOSEAL®
ISO 9001 CERTIFIED
SAFETY WITHOUT COMPROMISE

Series No. 8540

Conservation Breather Vent

Certified Air Flow Curves

PRESSURE



The Protectoseal Company / 225 Foster Avenue, Bensenville, IL 60106-1690 / 1-630-595-0800, Fax 630-595-8059

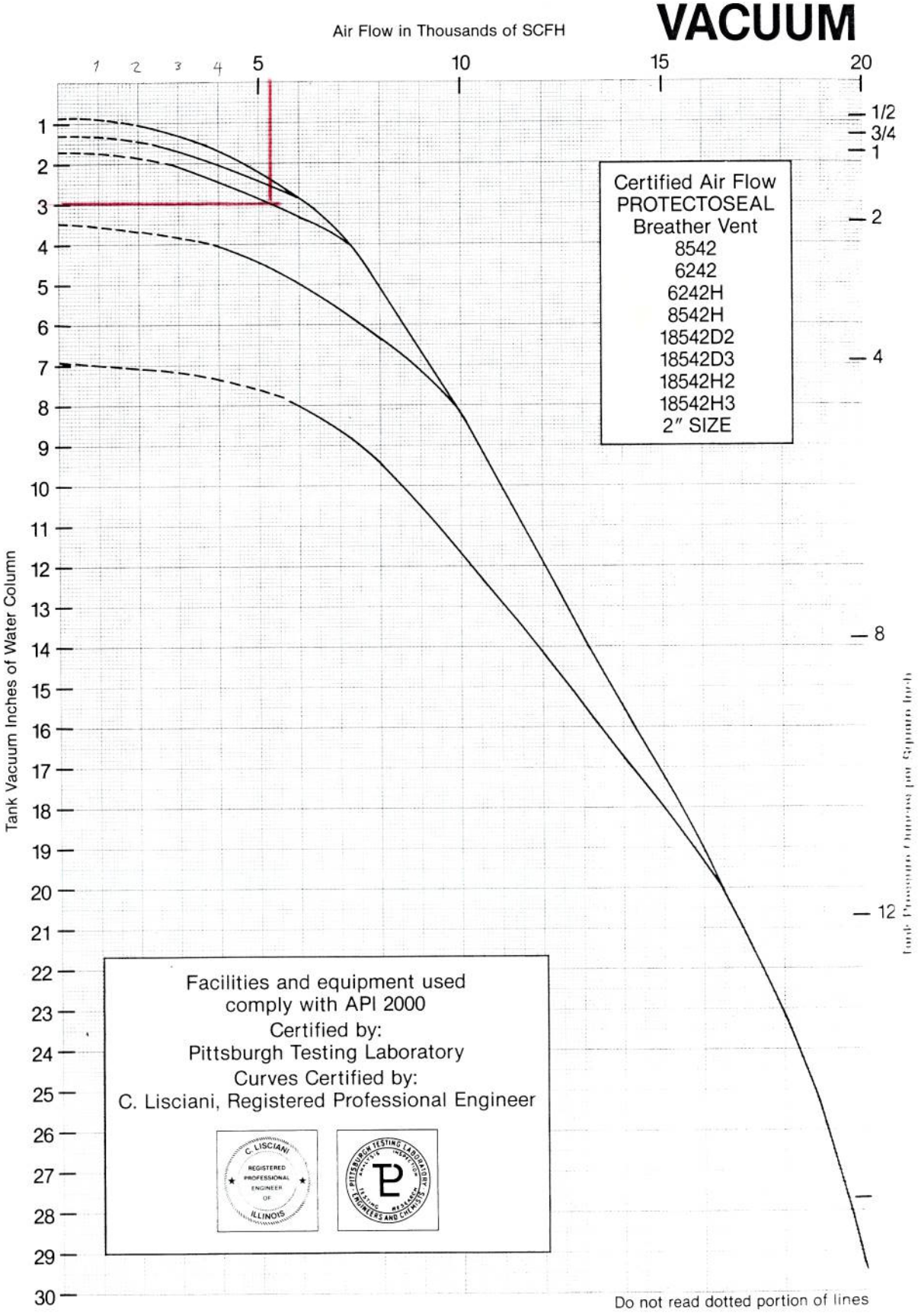
PROTECTOSEAL®
ISO 9001 CERTIFIED
SAFETY WITHOUT COMPROMISE

Series No. 8540

Conservation Breather Vent

Certified Air Flow Curves

VACUUM



The Protectoseal Company / 225 Foster Avenue, Bensenville, IL 60106-1690 / 1-630-595-0800, Fax 630-595-8059

ALBEMARLE™ CORPORATION

Details of Fire Exposure Calculations

Project #:	
Inst. Tg #:	V-T8333-5119
Vessel ID:	SEAL OIL
Date:	7/8/1997
Engineer:	T. B. Smith

Vessel Id #:	SEAL OIL POT ON PC-300-60-23
Vessel Type:	Drum
Vessel Head Type:	2:1 Ellipsoidal
Vessel Location:	Process Area
Vessel Geometry:	Vertical
Vessel Contents:	HEXANE
Operating Pressure (psi):	50
Design Pressure (psi):	100
Heat of Vaporization (Btu/lb):	107.5
Height Above Grade (ft):	2.0
Diameter (ft):	0.6
Height (ft):	0.8
Head Height (ft):	0.17
Maximum Level (ft):	0.8
Corrected Level (ft):	0.8
Calculated Wetted Area (sq ft):	2.1
Additional Wetted Area (sq ft):	0.0
Total Wetted Area (sq ft):	2.1
Fire Control (Environmental) Factor:	1.000
Base Heat Input to Vessel (Btu/hr):	64158
Heat Input to Vessel (Btu/hr):	64158

Relief Rate For Exposure to External Fire (lb/hr): 597

Fire Control Measures

Adequate Drainage

API RP 520 was used to obtain Fire Control Factor.
The CGA method was used to calculate area and heat input.
The formula used to calculate the base heat input was Q=34500*(Area)**0.82

ALBEMARLE™ CORPORATION

Vessel Relief Sizing Basis

Project #:	
Inst. Tg #:	V-T8333-5119
Vessel ID:	SEAL OIL
Date:	7/8/1997
Engineer:	T. B. Smith

Overpressure Causes	**Relief Rate lb/hr**
Closed outlet (overfilling) Maximum pump in rate	0
Buildup of noncondensibles Maximum pump in rate	0
Chemical Reaction of components Vapor generated by reaction or from heat of reaction	0
External Fire	597

Documentation of rate calculations must be attached for each overpressure cause.
All cases must be included, not just the maximum cases listed above.

Popoff Program Release 3.0 3/6/95

ALBEMARLE™ CORPORATION

Preliminary Safety Valve Sizes For Non-Zero Cases

Project #:	
Inst. Tg #:	V-T8333-5119
Vessel ID:	SEAL OIL
Date:	7/8/1997
Engineer:	T. B. Smith

Overpressure Case	Overpressure Cause	Relief Rate lb/hr	Calculated Orifice Area sq in	Orifice Letter	Valve Information Orifice Area sq in	Valve Information Body Size in
1	External Fire	597	0.045	D	0.110	1x2

Design Rate is 597 lb/hr from Case 1.

Popoff Program Release 3.0 3/6/95

ALBEMARLE™ CORPORATION

Preliminary Piping And Safety Valve Design

Project #:	
Inst. Tg #:	V-T8333-5119
Vessel ID:	SEAL OIL
Date:	7/8/1997
Engineer:	T. B. Smith

Design Relief Rate: 597 lb/hr

The design basis is due to external fire.

Average Molecular Weight	86.2	Operating Temperature, °F	100
Density, lb/cu ft	31.500	Operating Pressure, psig	50.0
Heat of Vaporization, Btu/lb	107.5	Relieving Temperature, °F	320
Viscosity, cp	0.0095	Relieving Pressure, psi	100
Cp/Cv	1.200		
Physical State	Gas or Vapor		

Preliminary Safety Valve Design

Design Pressure, psi	100
% Allowable Overpressure	10
Constant Back Pressure + Discharge Header Pressure Drop, psi	5.002
Inlet Piping Pressure Drop, psi	0.003
Discharge Piping (to header) Pressure Drop, psi	0.002
Valve Set Pressure, psig	100
Differential Set Pressure, psig	95
Above Rupture Disc	No
Calculated Orifice Area, sq in	**0.045**
Valve Orifice Designation	**D**
Actual Orifice Area, sq in	**0.110**
Valve Body Size, in	**1x2**

Valve orifice size and body size are based on Farris Catalog 187C

Preliminary Piping Design

	Inlet Pipe	Discharge Pipe
Inside Diameter, in	0.957	1.939
Surface Roughness, ft	0.000150	0.000150
Equivalent Length, ft	3.0	10.0
Reynolds Number	414597	204626
Darcy Friction Factor	0.0236	0.0209
Pressure Drop, psi	0.003	0.002
% of Set Pressure	0.00	0.00

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8333-5121

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	3.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .03079 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 16019 lb/h at FTP
and 4484 lb/h @ backpressure of 152.5 psig

CALCULATED FLOWRATE = 4484 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = 1 Kp = 1

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}} \right) K_w \right)}{1.12} \text{ psig}$$

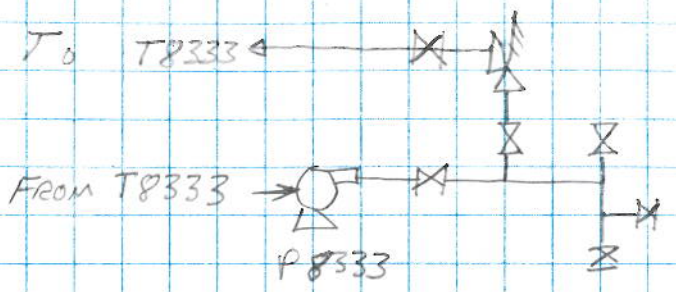
whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

SUBJECT Over Pressure Protection for Waste Fuel Transfer Line
DWG : 25F004

FILE PSV-T8333-5121
DATE 7/30/03
BY F. B. ISZARD



Design Basis : Thermal Expansion

Relief Valve

1½ x 1 - 374
P_{SET} = 150 PSIG
OVPR = 10%
P_{FLOW} = 150(1.1) + 14.7 = 179.7 PSIA

Transfer Piping

ν = 3"
R = 15 FT
$A = \pi 2R$ = 11.8 FT^2
Line is heat traced to 150 F

Sizing Fluid

Waste Fuel at
P_{FLOW} = 179.7 PSIA
SG = 0.676
C_p = 0.744 BTU/LB F
μ = 0.176 cP

Heat Transfer

$$Q = U A \Delta T$$

$$Q = \left(95 \frac{BTU}{HR\ FT^2\ F}\right)(11.8\ FT^2)(150-70)\ F$$

$$Q = 89680\ BTU/HR$$

Excel estimates $A_{MIN} = 0.0004\ IN^2$ ∴ the existing RV is adequate.

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
1/2X1-374	150	11/5/85	1

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CROSBY	JRL-C 1/2X1A	SHOP #68175		T8333-5121

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	1/2" MNPT	1" FNPT	

Air Capacity	Water Capacity	Steam Capacity
	26 GPM(10% OP)	

Base Matl	Body Matl	Spring Matl
	CYL. CARBON STEEL	CAR STL CAD PLATED

Bonnet Matl	Nozzle Matl	Trim Matl
		304-316-416SS

Comments	Originator
	Charge Code

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
1/2X1-374	Boiler	UT	25	OR-UT-A-A-T8333 -PSV5121	25F004	Oil

Level	Height	North	East	Location
G	4	0	0	DISCHARGE OF PC-300-60-23, E. SIDE OF T-30M-61.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
150	1	Yes	8/27/02	8/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	Yes	No	Yes	
FG	08/29/01	120	Yes	No	No	Yes	
JEH	08/29/00	118	No	No	No	Yes	
FG	08/19/98	118	Yes		No	No	
GS	08/01/96	118	Yes		No	No	
GMJ	06/06/95	118	Yes		No	No	
FG	04/20/94	117	Yes		No	No	
TOM	04/27/93	105	Yes		No	No	
GS	03/05/92	118	No		No	No	
GS	03/26/91	113	No		No	No	FROM STOCK, REPLACED 1/2X1-374-150 BOILER #4

Project No.	
Tag No.	PSV- T8333-5121
Vessel ID:	T8333
P&ID No.	25F004
Line No.	3-FU-5101-151
Engineer	F.B.Iszard
Date:	7/30/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	89,680	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.676	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.744	
Viscosity, cp	0.176	
System or Vessel MAWP	150	
PSV Set Pressure, psig	150	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	5	WARNING:If superimposed B.P. is variable, Bal. Blws. valve recommended.
Differential Set Pressure, psig	145	
Maximum Relieving Pressure, psig	165	
Liquid Expansion Rate, gpm	0.168	
Liquid Expansion Rate, lb/hr	56.9	
Orifice Reynolds Number	90776	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0004 sq. in. API RP 520 4.5.1

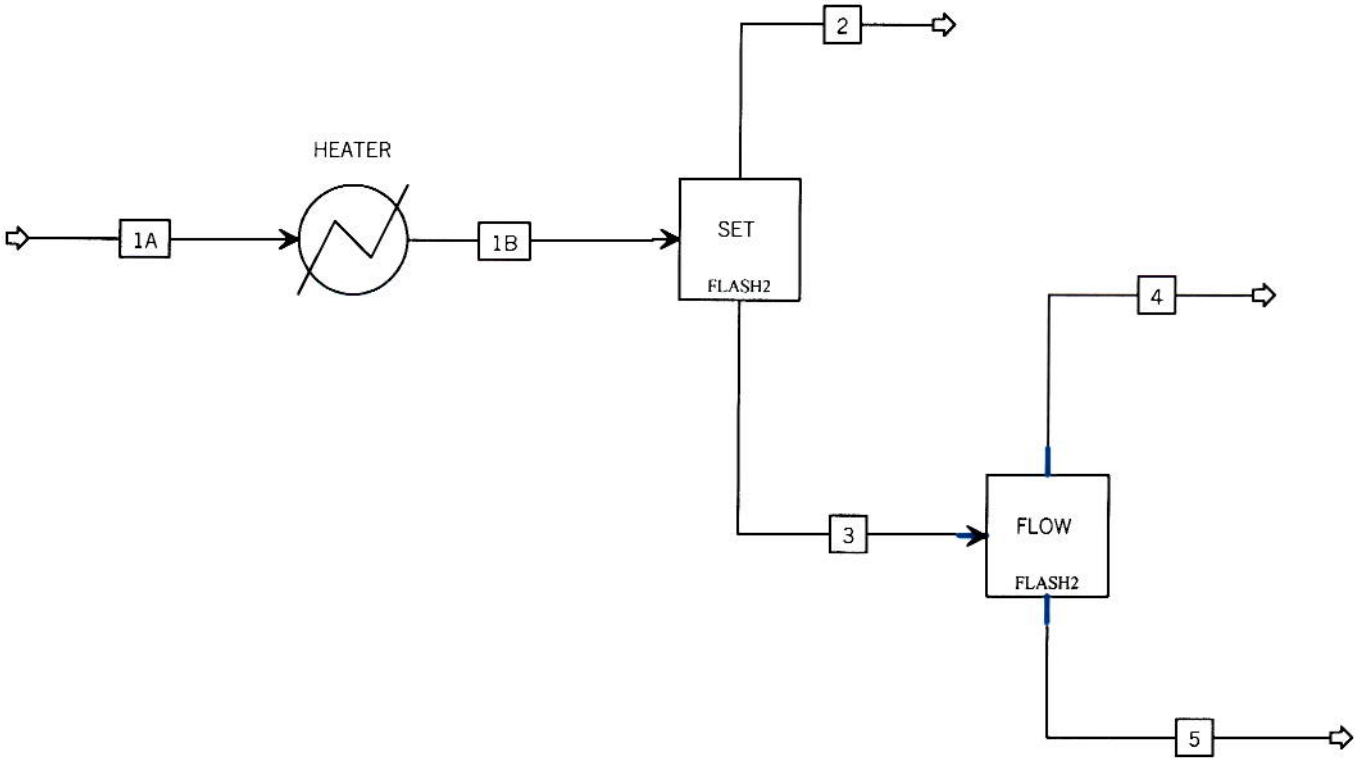
Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Tag Information:	
Project No.:	
Tag No.:	PSV- T8333-5121
Vessel ID:	T8333
P&ID No.:	25F004
Line No.:	3-FU-5101-151
Engineer:	F.B.Iszard
Date:	7/30/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	57	N/A	0.000	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.79097E-4
IBB	.1117559	.1117559	1.31627E-3
DETDA	.0841373	.0841373	8.21414E-5
TOLUENE	.1085299	.1085299	3.49681E-3
BP350	.0464626	.0464626	4.10822E-4
BP525	.0295767	.0295767	5.58372E-5
BP700	.0202392	.0202392	4.96159E-6
Mole Frac			
AN701	.3260920	.3260920	.0973936
IBB	.1879532	.1879532	.2213733
DETDA	.1415038	.1415038	.0138147
TOLUENE	.1825277	.1825277	.5881002
BP350	.0781418	.0781418	.0690929
BP525	.0497427	.0497427	9.39081E-3
BP700	.0340387	.0340387	8.34450E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1194677
IBB	15.00000	15.00000	.1766716
DETDA	15.00000	15.00000	.0146441
TOLUENE	10.00000	10.00000	.3221978
BP350	6.700000	6.700000	.0592413
BP525	6.600000	6.600000	.0124599
BP700	6.700000	6.700000	1.64249E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.7063251
Total Flow cuft/hr	1.624909	1.648377	.4075623
Temperature F	70.00000	100.0000	592.3172
Pressure psi	14.70000	.2100321	164.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	15998.67
Enthalpy Btu/lb	-535.4649	-524.0510	134.6790
Enthalpy Btu/hr	-53546.49	-52405.10	95.12717
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.68834
Entropy Btu/lb-R	-1.353130	-1.331779	-.6539911
Density lbmol/cuft	.3659245	.3607148	.0145890
Density lb/cuft	61.54191	60.66573	1.733048
Average MW	168.1820	168.1820	118.7911

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0125091
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	164.7000
Temperature F	70.00000	100.0000	592.3172
Average MW	168.1820	168.1820	118.7911
Density lb/cuft	61.54191	60.66573	1.733048
CPMX Btu/lb-R	.3695765	.3910039	.5412393
CPCVMX	1.000000	1.000000	1.031871
*** VAPOR PHASE ***			
Average MW			118.7911
Density lb/cuft			1.733048
CPMX Btu/lb-R			.5412393
CPCVMX			1.031937
MUMX cP			.0119738
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933133	6.06606E-4	.1927067
IBB	.1104396	1.32458E-3	.1091150
DETDA	.0840551	8.94221E-5	.0839657
TOLUENE	.1050331	3.39544E-3	.1016376
BP350	.0460518	4.06447E-4	.0456454
BP525	.0295209	5.84533E-5	.0294624
BP700	.0202342	5.52880E-6	.0202287
Mole Frac			
AN701	.3284021	.1030506	.3306784
IBB	.1876156	.2250207	.1872378
DETDA	.1427936	.0151910	.1440825
TOLUENE	.1784310	.5768207	.1744069
BP350	.0782332	.0690475	.0783260
BP525	.0501503	9.93009E-3	.0505566
BP700	.0343741	9.39236E-4	.0347118
Mass Flow lb/hr			
AN701	39.88053	.1251427	39.75539
IBB	14.82333	.1777867	14.64554
DETDA	14.98536	.0159421	14.96941
TOLUENE	9.677802	.3128580	9.364944
BP350	6.640759	.0586104	6.582148
BP525	6.587540	.0130437	6.574496
BP700	6.698358	1.83025E-3	6.696527
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.29367	.7052140	98.58846
Total Flow cuft/hr	2.319241	.3746732	2.337077
Temperature F	592.3172	606.1609	606.1609
Pressure psi	164.7000	179.7000	179.7000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-41316.09	16053.19	-39370.99
Enthalpy Btu/lb	-244.9364	133.9973	-232.7240
Enthalpy Btu/hr	-24320.64	94.49679	-22943.90
Entropy Btu/lbmol-R	-166.6754	-78.42072	-165.2473
Entropy Btu/lb-R	-.9881109	-.6545844	-.9767854
Density lbmol/cuft	.2538107	.0157109	.2493549
Density lb/cuft	42.81300	1.882211	42.18452
Average MW	168.6809	119.8023	169.1746

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.562990	.0124523	1.550538
*** ALL PHASES ***			
Pressure psi	164.7000	179.7000	179.7000
Temperature F	592.3172	606.1609	606.1609
Average MW	168.6809	119.8023	169.1746
Density lb/cuft	42.81300	1.882211	42.18452
CPMX Btu/lb-R	.8519737	.5471507	.7444560
CPCVMX	1.000000	1.031242	1.000000
*** VAPOR PHASE ***			
Average MW		119.8023	
Density lb/cuft		1.882211	
CPMX Btu/lb-R		.5471507	
CPCVMX		1.031306	
MUMX cP		.0120768	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	92.04296		89.94487
IBB	84.27379		80.66786
DETDA	147.9820		146.2757
TOLUENE	44.00132		0.0
BP350	72.54401		68.34641
BP525	86.02781		84.21037
BP700	85.79770		84.66828
Average MW	168.6809		169.1746
Density lb/cuft	42.81300		42.18452
CPMX Btu/lb-R	.8519737		.7444560
CPCVMX	1.000000		1.000000
MUMX cP	.1812411		.1762739
SIGMAMX dyne/cm	6.290685		5.836650
ZMX	.0574799		.0630064

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8333-5132

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .01419 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 15791 lb/h at FTP
and 2037 lb/h @ backpressure of 162.3 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62\,D^2\,L\,B\,G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6\,W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}} \right) K_w \right)}{1.12} \text{ psig}$$

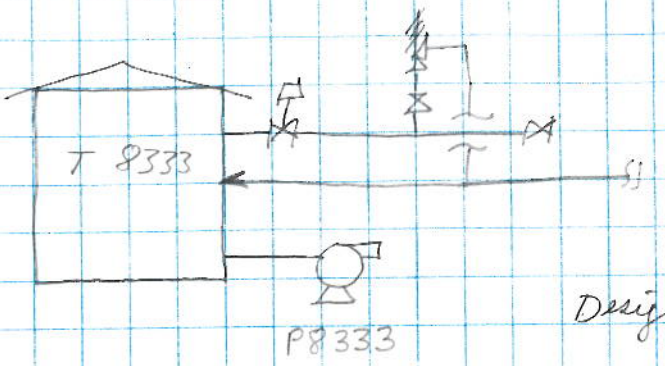
whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

SUBJECT Over Pressure Protection for Waste fuel Transfer Line
DWG: 25F004

FILE PSV-T8333-5132
DATE 7/30/03
BY F.B. ISZARD



Design Basis: Thermal Expansion

Relief Valve

3/4 x 1 - 9360
P_{SET} = 85 PSIG (99.7 PSIA)
OVPR = 10%
P_{FLOW} = 85(1.1) + 14.7
P_{FLOW} = 108.2 PSIA

Transfer Line

d = 2"
ℓ = 300 FT
$A = \pi d \ell$ = 157 FT^2
heat traced to 150F

Sizing Fluid

Waste fuel at
P_{FLOW} = 108.2 PSIA
SG = 0.728
C_p = 0.725 BTU/LB°F
μ = 0.21 cP

Heat Transfer

$$Q = UA\Delta T = \left(95 \frac{BTU}{HR\,FT^2\,°F}\right)(157\,FT^2)(150-70)°F$$

$$Q = 1{,}193{,}200 \ BTU/HR$$

Excel estimates A_{min} = 6.0068 IN^2 ∴ the existing RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-936	85	6/15/93	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-XLS	TJ-88999	UV/NB	T8333-5132

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4"MNPT	1"FNPT	

Air Capacity	Water Capacity	Steam Capacity
	27 GPM	

Base Matl	Body Matl	Spring Matl
C/S	C/S	C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S	S/S	S/S

Comments

Originator: RL THOMAS

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-936	Boiler	UT	25	OR-UT-A-A-T8333 -PSV5132	25F004	Oil

Level	Height	North	East	Location
8FT. ABOVE SLA	0	61	1260	EAST SIDE OF T-30,000-61.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
85	2	Yes	8/27/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	Yes	No	Yes	
JEH	09/28/00	69	Yes	No	No	No	
GMJ	07/08/98	64	Yes		No	No	
FG	07/31/96	72	Yes		No	No	
GMJ	06/06/95	68	Yes		No	No	
RK	08/23/94	77	Yes		No	No	
GS	06/15/93		No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- T8333-5132
Vessel ID:	T8333
P&ID No.:	25F004
Line No.:	2-FU-5115-151
Engineer:	F.B.Iszard
Date:	7/30/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	778	N/A	0.007	0.110	0.04	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8333-5132
Vessel ID:	T8333
P&ID No.	25F004
Line No.	2-FU-5115-151
Engineer	F.B.Iszard
Date:	7/30/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	1,193,200	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.728	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.725	
Viscosity, cp	0.211	
System or Vessel MAWP	85	
PSV Set Pressure, psig	85	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	85	
Maximum Relieving Pressure, psig	93.5	
Liquid Expansion Rate, gpm	2.134	
Liquid Expansion Rate, lb/hr	777.5	
Orifice Reynolds Number	249199	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

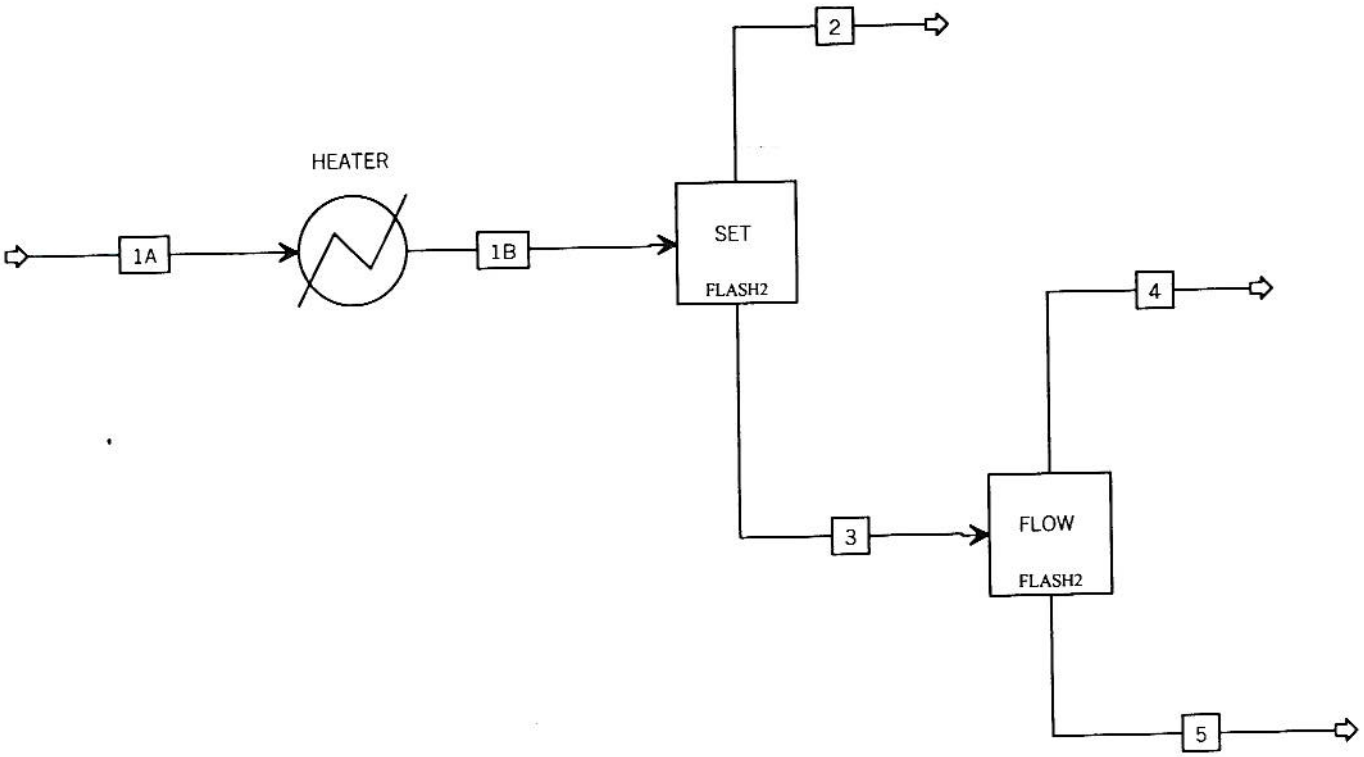
Typical discharge coefficients
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0068 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	4.73701E-4
IBB	.1117559	.1117559	1.27252E-3
DETDA	.0841373	.0841373	5.61079E-5
TOLUENE	.1085299	.1085299	3.66561E-3
BP350	.0464626	.0464626	4.29826E-4
BP525	.0295767	.0295767	4.52548E-5
BP700	.0202392	.0202392	2.92397E-6
Mole Frac			
AN701	.3260920	.3260920	.0796679
IBB	.1879532	.1879532	.2140150
DETDA	.1415038	.1415038	9.43633E-3
TOLUENE	.1825277	.1825277	.6164891
BP350	.0781418	.0781418	.0722889
BP525	.0497427	.0497427	7.61104E-3
BP700	.0340387	.0340387	4.91759E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.0977244
IBB	15.00000	15.00000	.1707992
DETDA	15.00000	15.00000	.0100029
TOLUENE	10.00000	10.00000	.3377510
BP350	6.700000	6.700000	.0619816
BP525	6.600000	6.600000	.0100985
BP700	6.700000	6.700000	9.67951E-4
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.6893256
Total Flow cuft/hr	1.624909	1.648377	.6317055
Temperature F	70.00000	100.0000	527.3652
Pressure psi	14.70000	.2100321	99.70000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	14327.82
Enthalpy Btu/lb	-535.4649	-524.0510	123.5880
Enthalpy Btu/hr	-53546.49	-52405.10	85.19236
Entropy Btu/lbmol-R	-227.5721	-223.9813	-76.73057
Entropy Btu/lb-R	-1.353130	-1.331779	-.6618577
Density lbmol/cuft	.3659245	.3607148	9.41252E-3
Density lb/cuft	61.54191	60.66573	1.091214
Average MW	168.1820	168.1820	115.9321

Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0123334
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	99.70000
Temperature F	70.00000	100.0000	527.3652
Average MW	168.1820	168.1820	115.9321
Density lb/cuft	61.54191	60.66573	1.091214
CPMX Btu/lb-R	.3695765	.3910039	.5147472
CPCVMX	1.000000	1.000000	1.034423
*** VAPOR PHASE ***			
Average MW			115.9321
Density lb/cuft			1.091214
CPMX Btu/lb-R			.5147472
CPCVMX			1.034494
MUMX cP			.0114078
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET	FLOW	FLOW
	LIQUID	VAPOR	LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1934187	4.99427E-4	.1929193
IBB	.1104833	1.28562E-3	.1091977
DETDA	.0840812	6.12685E-5	.0840199
TOLUENE	.1048643	3.55918E-3	.1013051
BP350	.0460328	4.29749E-4	.0456030
BP525	.0295314	4.79337E-5	.0294835
BP700	.0202363	3.30234E-6	.0202330
Mole Frac			
AN701	.3285812	.0848430	.3310432
IBB	.1876899	.2184021	.1873797
DETDA	.1428378	.0104083	.1441755
TOLUENE	.1781442	.6046364	.1738362
BP350	.0782009	.0730060	.0782534
BP525	.0501683	8.14302E-3	.0505928
BP700	.0343776	5.61003E-4	.0347191
Mass Flow lb/hr			
AN701	39.90228	.1030318	39.79924
IBB	14.82920	.1725574	14.65664
DETDA	14.99000	.0109229	14.97907
TOLUENE	9.662249	.3279448	9.334304
BP350	6.638018	.0619705	6.576048
BP525	6.589901	.0106963	6.579205
BP700	6.699032	1.09321E-3	6.697939
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.31067	.6882170	98.62246
Total Flow cuft/hr	2.166040	.5832089	2.172458
Temperature F	527.3652	539.2691	539.2691
Pressure psi	99.70000	108.2000	108.2000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-49692.77	14137.96	-48774.96
Enthalpy Btu/lb	-294.5459	120.9253	-288.2120
Enthalpy Btu/hr	-29251.56	83.22282	-28424.18
Entropy Btu/lbmol-R	-174.6712	-77.60804	-174.1163
Entropy Btu/lb-R	-1.035336	-.6637997	-1.028856
Density lbmol/cuft	.2717623	.0100932	.2682499
Density lb/cuft	45.84895	1.180052	45.39672
Average MW	168.7097	116.9148	169.2329

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.563166	.0122822	1.550884
*** ALL PHASES ***			
Pressure psi	99.70000	108.2000	108.2000
Temperature F	527.3652	539.2691	539.2691
Average MW	168.7097	116.9148	169.2329
Density lb/cuft	45.84895	1.180052	45.39672
CPMX Btu/lb-R	.7114150	.5203291	.7247545
CPCVMX	1.000000	1.033745	1.000000
*** VAPOR PHASE ***			
Average MW		116.9148	
Density lb/cuft		1.180052	
CPMX Btu/lb-R		.5203291	
CPCVMX		1.033815	
MUMX cP		.0114956	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	100.4782		99.08968
IBB	98.27328		95.98334
DETDA	154.6975		153.6157
TOLUENE	86.17004		80.95732
BP350	88.37478		85.82134
BP525	93.82166		92.47258
BP700	90.79921		89.91630
Average MW	168.7097		169.2329
Density lb/cuft	45.84895		45.39672
CPMX Btu/lb-R	.7114150		.7247545
CPCVMX	1.000000		1.000000
MUMX cP	.2167983		.2108143
SIGMAMX dyne/cm	8.875220		8.428515
ZMX	.0346351		.0376263

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8333-5137

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .01419 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 15791 lb/h at FTP
and 2037 lb/h @ backpressure of 162.3 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62\,D^2\,L\,B\,G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f(P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6\,W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $$P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right) \text{ psig.}$$

Bellows valves: Same as for conv. valves, or $$P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}} \right) K_w \right)}{1.12} \text{ psig}$$

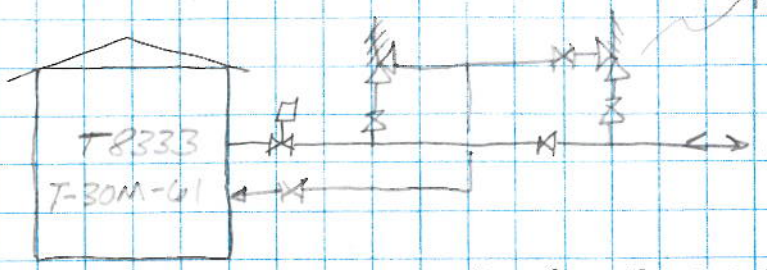
whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

SUBJECT Over Pressure Protection on Wastefuel Transfer Line
DWG: 25F004

FILE PSV-T8333-5137
DATE 7/30/03
BY F.B. ISZARD



Design Basis: Thermal Expansion

Relief Valve

3/4 X 1-934
$P_{SET} = 85 PSIG (99.7 PSIA)$
OVPR = 10%
$P_{FLOW} = 85(1.1) + 14.7 = (108.2 PSIA)$
$P_{BACK} = 0 PSIG$

Transfer Line

d = 2"
ℓ = 500 FT
$A = \pi(\frac{2}{12})(500) = 262 FT^2$
Line traced to 150F

Spilling Fluid

Wastefuel
@ P_{FLOW} = 108.2 PSIA
T_{FLOW} = 539 F
$SG = 45.4/62.4 = 0.728$
$C_p = 0.725$ BTU/LBR
μ = 0.21 cP

Heat Transfer

$Q = 2\ell A \Delta T = (95 \frac{BTU}{HR\,FT^2\,F})(262 FT^2)(150-70)F$

$Q = 1,991,200$ BTU/HR

Excel estimates $A_{MIN} = 0.0114 IN^2$ or $d_{MIN} = \sqrt{\frac{4(0.0114)}{\pi}} = 0.120 IN$

∴ the existing PSV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-934	85	6/15/93	1

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-XLS	TJ-89002	UV/NB	T8333-5137

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4"MNPT	1"FNPT	

Air Capacity	Water Capacity	Steam Capacity
	27 GPM	

Base Matl	Body Matl	Spring Matl
C/S	C/S	C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S	S/S	S/S

Comments

Originator: RL THOMAS

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-934	Boiler	UT	25	OR-UT-A-A-T8333 -PSV5137	25F004	Oil

Level	Height	North	East	Location
13FT. ABOVE SL	0	62	1259	ADJACENT TO VESSEL T-30M-61, PIPE RACK. (BOILER # 4)

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
85	1	Yes	8/27/02	8/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	Yes	No	Yes	
JEH	10/03/01	70	Yes	No	No	No	
JEH	09/28/00	69	No	Yes	No	No	
GS	07/08/98	68	Yes		No	No	
GS	07/30/96	69	Yes		No	No	
GMJ	06/06/95	67	Yes		No	No	
TOM	08/23/94	76	Yes		No	No	
GS	06/15/93		No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- T8333-5137
Vessel ID:	T8333
P&ID No.:	25F004
Line No.:	2-FU-5123-151
Engineer:	F.B.Iszard
Date:	7/30/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	1,298	N/A	0.011	0.110	0.11	0.01	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8333-5137
Vessel ID:	T8333
P&ID No.	25F004
Line No.	2-FU-5123-151
Engineer	F.B.Iszard
Date:	7/30/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	1,991,200	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.728	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.725	
Viscosity, cp	0.211	
System or Vessel MAWP	85	
PSV Set Pressure, psig	85	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	85	
Maximum Relieving Pressure, psig	93.5	
Liquid Expansion Rate, gpm	3.561	
Liquid Expansion Rate, lb/hr	1297.6	
Orifice Reynolds Number	321919	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

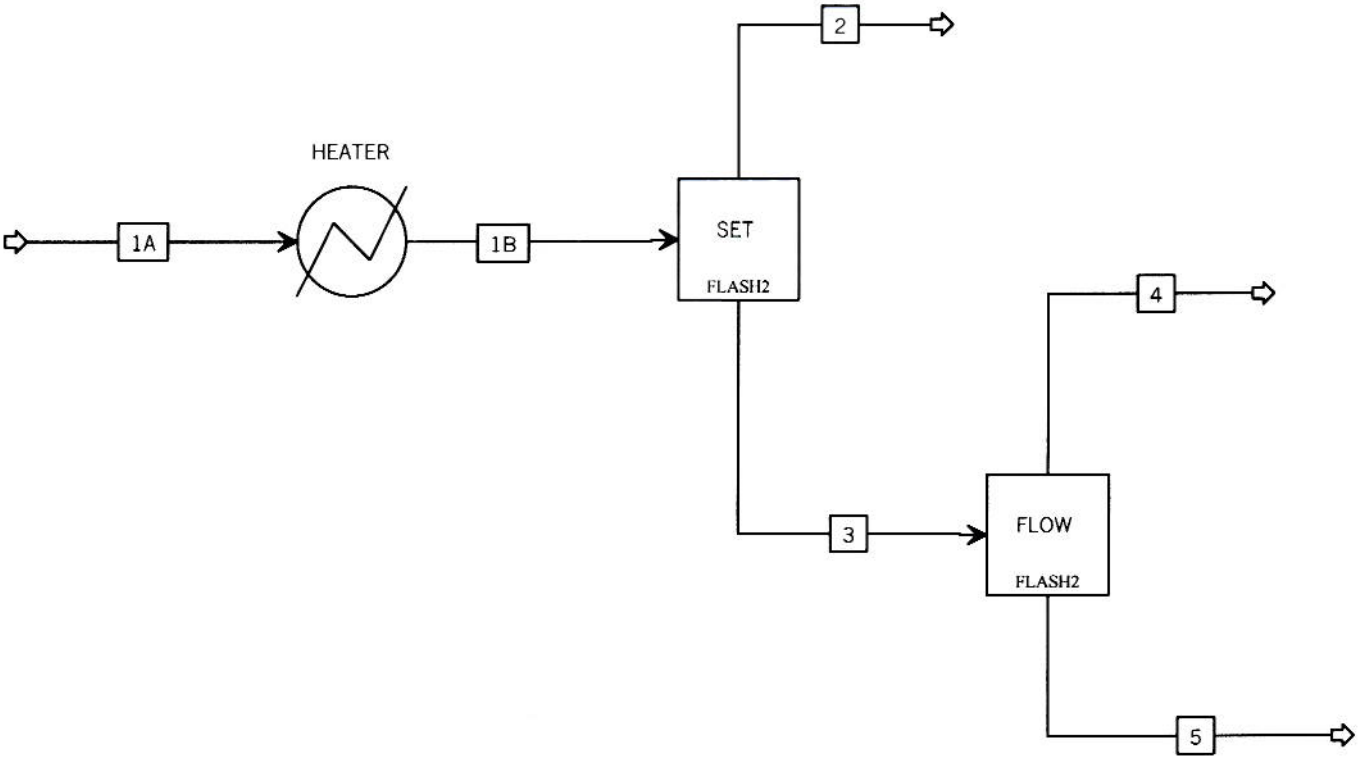
Typical discharge coefficients
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required **0.0114** sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in.
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	4.73701E-4
IBB	.1117559	.1117559	1.27252E-3
DETDA	.0841373	.0841373	5.61079E-5
TOLUENE	.1085299	.1085299	3.66561E-3
BP350	.0464626	.0464626	4.29826E-4
BP525	.0295767	.0295767	4.52548E-5
BP700	.0202392	.0202392	2.92397E-6
Mole Frac			
AN701	.3260920	.3260920	.0796679
IBB	.1879532	.1879532	.2140150
DETDA	.1415038	.1415038	9.43633E-3
TOLUENE	.1825277	.1825277	.6164891
BP350	.0781418	.0781418	.0722889
BP525	.0497427	.0497427	7.61104E-3
BP700	.0340387	.0340387	4.91759E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.0977244
IBB	15.00000	15.00000	.1707992
DETDA	15.00000	15.00000	.0100029
TOLUENE	10.00000	10.00000	.3377510
BP350	6.700000	6.700000	.0619816
BP525	6.600000	6.600000	.0100985
BP700	6.700000	6.700000	9.67951E-4
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.6893256
Total Flow cuft/hr	1.624909	1.648377	.6317055
Temperature F	70.00000	100.0000	527.3652
Pressure psi	14.70000	.2100321	99.70000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	14327.82
Enthalpy Btu/lb	-535.4649	-524.0510	123.5880
Enthalpy Btu/hr	-53546.49	-52405.10	85.19236
Entropy Btu/lbmol-R	-227.5721	-223.9813	-76.73057
Entropy Btu/lb-R	-1.353130	-1.331779	-.6618577
Density lbmol/cuft	.3659245	.3607148	9.41252E-3
Density lb/cuft	61.54191	60.66573	1.091214
Average MW	168.1820	168.1820	115.9321

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0123334
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	99.70000
Temperature F	70.00000	100.0000	527.3652
Average MW	168.1820	168.1820	115.9321
Density lb/cuft	61.54191	60.66573	1.091214
CPMX Btu/lb-R	.3695765	.3910039	.5147472
CPCVMX	1.000000	1.000000	1.034423
*** VAPOR PHASE ***			
Average MW			115.9321
Density lb/cuft			1.091214
CPMX Btu/lb-R			.5147472
CPCVMX			1.034494
MUMX cP			.0114078
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3	4	5
	FLOW SET LIQUID	FLOW VAPOR	FLOW LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1934187	4.99427E-4	.1929193
IBB	.1104833	1.28562E-3	.1091977
DETDA	.0840812	6.12685E-5	.0840199
TOLUENE	.1048643	3.55918E-3	.1013051
BP350	.0460328	4.29749E-4	.0456030
BP525	.0295314	4.79337E-5	.0294835
BP700	.0202363	3.30234E-6	.0202330
Mole Frac			
AN701	.3285812	.0848430	.3310432
IBB	.1876899	.2184021	.1873797
DETDA	.1428378	.0104083	.1441755
TOLUENE	.1781442	.6046364	.1738362
BP350	.0782009	.0730060	.0782534
BP525	.0501683	8.14302E-3	.0505928
BP700	.0343776	5.61003E-4	.0347191
Mass Flow lb/hr			
AN701	39.90228	.1030318	39.79924
IBB	14.82920	.1725574	14.65664
DETDA	14.99000	.0109229	14.97907
TOLUENE	9.662249	.3279448	9.334304
BP350	6.638018	.0619705	6.576048
BP525	6.589901	.0106963	6.579205
BP700	6.699032	1.09321E-3	6.697939
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.31067	.6882170	98.62246
Total Flow cuft/hr	2.166040	.5832089	2.172458
Temperature F	527.3652	539.2691	539.2691
Pressure psi	99.70000	108.2000	108.2000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-49692.77	14137.96	-48774.96
Enthalpy Btu/lb	-294.5459	120.9253	-288.2120
Enthalpy Btu/hr	-29251.56	83.22282	-28424.18
Entropy Btu/lbmol-R	-174.6712	-77.60804	-174.1163
Entropy Btu/lb-R	-1.035336	-.6637997	-1.028856
Density lbmol/cuft	.2717623	.0100932	.2682499
Density lb/cuft	45.84895	1.180052	45.39672
Average MW	168.7097	116.9148	169.2329

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.563166	.0122822	1.550884
*** ALL PHASES ***			
Pressure psi	99.70000	108.2000	108.2000
Temperature F	527.3652	539.2691	539.2691
Average MW	168.7097	116.9148	169.2329
Density lb/cuft	45.84895	1.180052	45.39672
CPMX Btu/lb-R	.7114150	.5203291	.7247545
CPCVMX	1.000000	1.033745	1.000000
*** VAPOR PHASE ***			
Average MW		116.9148	
Density lb/cuft		1.180052	
CPMX Btu/lb-R		.5203291	
CPCVMX		1.033815	
MUMX cP		.0114956	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	100.4782		99.08968
IBB	98.27328		95.98334
DETDA	154.6975		153.6157
TOLUENE	86.17004		80.95732
BP350	88.37478		85.82134
BP525	93.82166		92.47258
BP700	90.79921		89.91630
Average MW	168.7097		169.2329
Density lb/cuft	45.84895		45.39672
CPMX Btu/lb-R	.7114150		.7247545
CPCVMX	1.000000		1.000000
MUMX cP	.2167983		.2108143
SIGMAMX dyne/cm	8.875220		8.428515
ZMX	.0346351		.0376263

****

7/16/97

ALBEMARLE CORPORATION

RELIEF VALVES

Entrapped liquid - Pipeline

Tag number PSV-T8333-5138

1)	% Overpressure	10
2)	Balanced bellows valve Y/N?	N
3)	Rupture disc allowance Y/N?	N
4)	Line diameter	2.067 in
5)	Line length	5000 ft
6)	Cubical expansion	0.01 /degF
7)	SG @ flow conditions	0.7
8)	Viscosity @ FTP	1 cp
9)	Set pressure	150 psig
10)	Total back pressure	5 psig
11)	Selected valve area	0.110 in2

CALCULATED AREA = .01419 in2
RELIEF PRESSURE = 165 psig

Selected valve capacity = 15791 lb/h at FTP
and 2037 lb/h @ backpressure of 162.3 psig

CALCULATED FLOWRATE = 2037 lb/h

Selection Based on - ASME Liquid Trim Standard valve.

Capacity coefficient 0.724
Ku = .9853 Kp = 1

Correction applied for viscosity

****

THERMAL RELIEF OF ENTRAPPED LIQUID IN A PIPELINE

DESCRIPTION OF CALCULATIONS

"Instru Calc" calculates the required size of a relief valve to allow for liquid expansion in a pipeline with block valves closed on each end. A temperature rise of 5°F/hr is assumed. The design basis is taken from API RP 520 and ANSI B31 (American National Standard Code for Pressure Piping).

Sequence of Calculations

1. Calculation of the flowrate: $W_m = 13.62 D^2 L B G_f$ pounds per hour for a temp. rise of 5°F/hr.

2. Calculation of the back-pressure factor:

   Conventional valves: $K_w = 1$.

   Bellows valves: $K_w = 1.36 - 1.2\left(\frac{P_{OUT}}{P_{IN}}\right)$.

3. Calculation of the required relief area:

   $A = \frac{W_m}{19{,}006 K_d K_p K_w \sqrt{G_f (P_{IN} - P_{OUT})}}$ square inches. Note: $K_p = 1$ for 10% overpressure.

4. Calculation of the viscosity correction factor: $R_D = \frac{5.6 W_m}{\sqrt{A}\,\mu_{cp}}$.

   If $R_D < 50{,}000$: $K_v = 1$,

   Otherwise: $K_v = \frac{\left(1.892 \ln\ln\ln R_D\right) - R_D^{-.6}}{R_D^{.047}}$.

5. Divide A by K_v for viscosity correction.

6. Calculation of the maximum allowable back pressure for selected valve area:

Conventional valves: $P_{B_{max}} = P_{IN} - \left(\frac{\left(\frac{W_m}{19{,}006 K_d K_p K_w A K_v} \right)^2}{G_f} \right)$ psig.

Bellows valves: Same as for conv. valves, or $P_{B_{max}} = \frac{P_{IN}\left(1.36 - \left(\frac{A_{visc}}{A_{valve}}\right) K_w\right)}{1.12}$ psig

whichever is the smallest.

Nomenclature

- A Relief area, square inches
- B Cubical expansion coefficient per °F for the liquid at the flowing temperature, dimensionless
- D Pipe diameter, inches
- G_f Specific gravity of the liquid at flowing temperature, dimensionless
- K_d Coefficient of discharge
- K_p Overpressure correction factor, dimensionless
- K_w Back-pressure correction factor, dimensionless
- K_v Viscosity correction factor, dimensionless
- L Pipe length, feet
- P_{Bmax} Maximum allowable back-pressure, psig
- P_{IN} Set pressure, psig
- P_{OUT} Back pressure, psig
- R_D Reynolds number, dimensionless
- W_m Flow through valve, pounds per hour
- μ_{cp} Absolute viscosity, centipoises

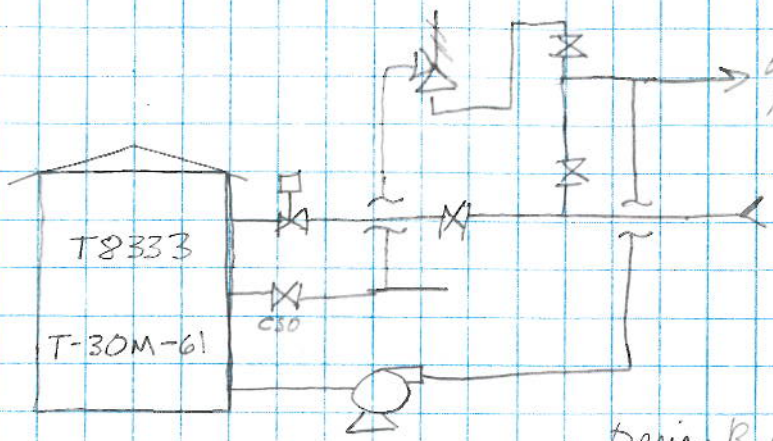
SUBJECT Over Pressure Protection for Waste fuel Transfer Line

FILE PSV-T8333-5138

DATE 7/30/03

DWG: 2SF004

BY F. B. ISZARD



Design Basis: Thermal Expansion

Relief Valve

3/4 x 1-933

P_{SET} = 85 PSIG (99.7 PSIA)

OVPR = 10%

P_{FLOW} = 85(1.1) + 14.7 = 108.2 PSIA

Transfer Line

d = 2"

ℓ = 300 FT

$A = \pi\left(\frac{3}{12}\right)(300) = 157\ FT^2$

heat traced to 150F

Sizing Fluid

Waste fuel at

P_{FLOW} = 108.2 PSIA

SG = 0.728

C_p = 0.725 BTU/LB F

μ = 0.211 cP

Heat Transfer

$$Q = UA\Delta T = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)(157\ FT^2)(150-70)F$$

$$Q = 1,193,200\ BTU/HR$$

Excel estimates A_{min} = 0.0608 IN^2 ∴ the existing RV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
3/4X1-933	85	6/15/93	1

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
CONSOLIDATED	1990C-XLS	TJ-89009	UV/NB	T8333-5138

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	3/4"MNPT	1"FNPT	

Air Capacity	Water Capacity	Steam Capacity
	27 GPM	

Base Matl	Body Matl	Spring Matl
C/S	C/S	C/S

Bonnet Matl	Nozzle Matl	Trim Matl
C/S	S/S	S/S

Comments

Originator: RL THOMAS

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
3/4X1-933	Boiler	UT	25	OR-UT-A-A-T8333 -PSV5138	25F004	Oil

Level	Height	North	East	Location
13FT. ABOVE SL	0	60	1259	ADJACENT TO VESSEL T-30M-61

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
85	1	Yes	8/27/02	8/2003

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	Yes	No	Yes	
FG	10/03/01		Yes	No	No	No	
JEH	09/28/00	67	No	Yes	No	No	
GMJ	07/09/98	62	No		No	No	OUTLET PLUGGED.
GS	07/30/96	72	Yes		No	No	
GS	06/06/95	69	Yes		No	No	
FG	08/23/94	61	Yes		No	No	
GS	06/15/93		No		No	No	

Tag Information:	
Project No.:	
Tag No.:	PSV- T8333-5138
Vessel ID:	T8333
P&ID No.:	25F004
Line No.:	2-FU-5123-151
Engineer:	F.B.Iszard
Date:	7/30/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	778	N/A	0.007	0.110	0.04	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8333-5138
Vessel ID:	T8333
P&ID No.	25F004
Line No.	2-FU-5123-151
Engineer	F.B.Iszard
Date:	7/30/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	1,193,200	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.728	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.725	
Viscosity, cp	0.211	
System or Vessel MAWP	85	
PSV Set Pressure, psig	85	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	0	
Differential Set Pressure, psig	85	
Maximum Relieving Pressure, psig	93.5	
Liquid Expansion Rate, gpm	2.134	
Liquid Expansion Rate, lb/hr	777.5	
Orifice Reynolds Number	249199	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

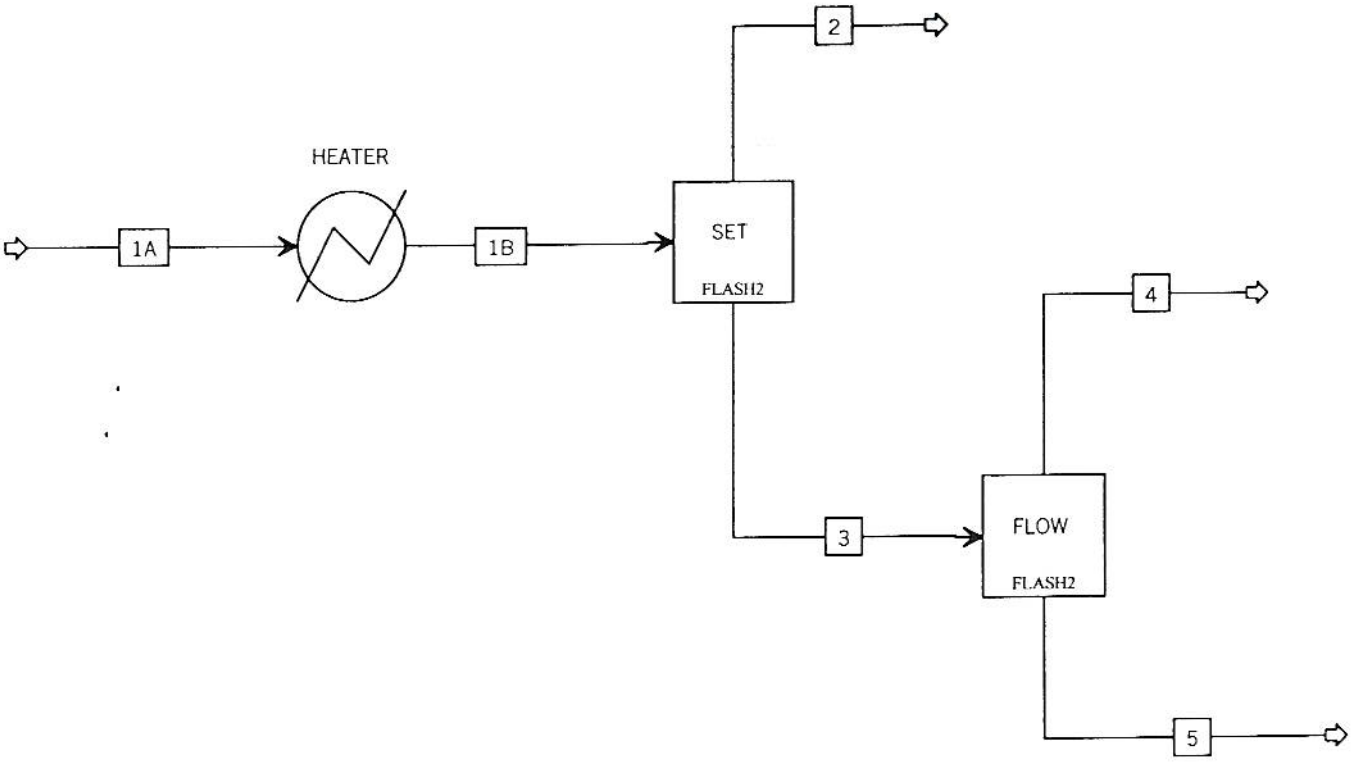
Typical discharge coefficients
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required 0.0068 sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode): 1X2 D 0.11 sq. in.
Actual Installed Orifice Size (Rating Mode): sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	4.73701E-4
IBB	.1117559	.1117559	1.27252E-3
DETDA	.0841373	.0841373	5.61079E-5
TOLUENE	.1085299	.1085299	3.66561E-3
BP350	.0464626	.0464626	4.29826E-4
BP525	.0295767	.0295767	4.52548E-5
BP700	.0202392	.0202392	2.92397E-6
Mole Frac			
AN701	.3260920	.3260920	.0796679
IBB	.1879532	.1879532	.2140150
DETDA	.1415038	.1415038	9.43633E-3
TOLUENE	.1825277	.1825277	.6164891
BP350	.0781418	.0781418	.0722889
BP525	.0497427	.0497427	7.61104E-3
BP700	.0340387	.0340387	4.91759E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.0977244
IBB	15.00000	15.00000	.1707992
DETDA	15.00000	15.00000	.0100029
TOLUENE	10.00000	10.00000	.3377510
BP350	6.700000	6.700000	.0619816
BP525	6.600000	6.600000	.0100985
BP700	6.700000	6.700000	9.67951E-4
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.6893256
Total Flow cuft/hr	1.624909	1.648377	.6317055
Temperature F	70.00000	100.0000	527.3652
Pressure psi	14.70000	.2100321	99.70000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	14327.82
Enthalpy Btu/lb	-535.4649	-524.0510	123.5880
Enthalpy Btu/hr	-53546.49	-52405.10	85.19236
Entropy Btu/lbmol-R	-227.5721	-223.9813	-76.73057
Entropy Btu/lb-R	-1.353130	-1.331779	-.6618577
Density lbmol/cuft	.3659245	.3607148	9.41252E-3
Density lb/cuft	61.54191	60.66573	1.091214
Average MW	168.1820	168.1820	115.9321

Results Summary Streams Material

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0123334
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	99.70000
Temperature F	70.00000	100.0000	527.3652
Average MW	168.1820	168.1820	115.9321
Density lb/cuft	61.54191	60.66573	1.091214
CPMX Btu/lb-R	.3695765	.3910039	.5147472
CPCVMX	1.000000	1.000000	1.034423
*** VAPOR PHASE ***			
Average MW			115.9321
Density lb/cuft			1.091214
CPMX Btu/lb-R			.5147472
CPCVMX			1.034494
MUMX cP			.0114078
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

Results Summary Streams Material

	3	4	5
	FLOW SET	FLOW	FLOW
	LIQUID	VAPOR	LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1934187	4.99427E-4	.1929193
IBB	.1104833	1.28562E-3	.1091977
DETDA	.0840812	6.12685E-5	.0840199
TOLUENE	.1048643	3.55918E-3	.1013051
BP350	.0460328	4.29749E-4	.0456030
BP525	.0295314	4.79337E-5	.0294835
BP700	.0202363	3.30234E-6	.0202330
Mole Frac			
AN701	.3285812	.0848430	.3310432
IBB	.1876899	.2184021	.1873797
DETDA	.1428378	.0104083	.1441755
TOLUENE	.1781442	.6046364	.1738362
BP350	.0782009	.0730060	.0782534
BP525	.0501683	8.14302E-3	.0505928
BP700	.0343776	5.61003E-4	.0347191
Mass Flow lb/hr			
AN701	39.90228	.1030318	39.79924
IBB	14.82920	.1725574	14.65664
DETDA	14.99000	.0109229	14.97907
TOLUENE	9.662249	.3279448	9.334304
BP350	6.638018	.0619705	6.576048
BP525	6.589901	.0106963	6.579205
BP700	6.699032	1.09321E-3	6.697939
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.31067	.6882170	98.62246
Total Flow cuft/hr	2.166040	.5832089	2.172458
Temperature F	527.3652	539.2691	539.2691
Pressure psi	99.70000	108.2000	108.2000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-49692.77	14137.96	-48774.96
Enthalpy Btu/lb	-294.5459	120.9253	-288.2120
Enthalpy Btu/hr	-29251.56	83.22282	-28424.18
Entropy Btu/lbmol-R	-174.6712	-77.60804	-174.1163
Entropy Btu/lb-R	-1.035336	-.6637997	-1.028856
Density lbmol/cuft	.2717623	.0100932	.2682499
Density lb/cuft	45.84895	1.180052	45.39672
Average MW	168.7097	116.9148	169.2329

Results Summary Streams Material

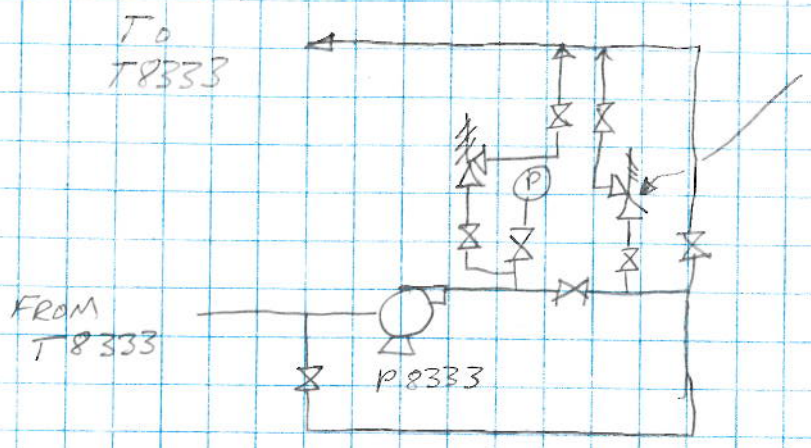
	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Liq Vol 60F cuft/hr	1.563166	.0122822	1.550884
*** ALL PHASES ***			
Pressure psi	99.70000	108.2000	108.2000
Temperature F	527.3652	539.2691	539.2691
Average MW	168.7097	116.9148	169.2329
Density lb/cuft	45.84895	1.180052	45.39672
CPMX Btu/lb-R	.7114150	.5203291	.7247545
CPCVMX	1.000000	1.033745	1.000000
*** VAPOR PHASE ***			
Average MW		116.9148	
Density lb/cuft		1.180052	
CPMX Btu/lb-R		.5203291	
CPCVMX		1.033815	
MUMX cP		.0114956	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	100.4782		99.08968
IBB	98.27328		95.98334
DETDA	154.6975		153.6157
TOLUENE	86.17004		80.95732
BP350	88.37478		85.82134
BP525	93.82166		92.47258
BP700	90.79921		89.91630
Average MW	168.7097		169.2329
Density lb/cuft	45.84895		45.39672
CPMX Btu/lb-R	.7114150		.7247545
CPCVMX	1.000000		1.000000
MUMX cP	.2167983		.2108143
SIGMAMX dyne/cm	8.875220		8.428515
ZMX	.0346351		.0376263

SUBJECT Over Pressure Protection For Pump Transfer Line DWG: 25F004

FILE PSV-T8333-5139

DATE 7/30/03

BY F.B. ISZARD



Relief Valve

1½ × 1 - 426

P_{SET} = 150 PSIG (164.7 PSIA)

OVPR = 10%

P_{FLOW} = 150(1.1) + 14.7 = 179.7 PSIA

Transfer Piping

d = 3 IN

ℓ = 15 FT

$A = \pi d \ell = \pi\left(\frac{3}{12}\right)(15)$

A = 11.8 FT^2

heat traced to 150F

Sizing Fluid

Waste Fuel @ P_{FLOW}

SG = 42 #/62.4 = 0.676

C_p = 0.744 $\frac{BTU}{LB\,F}$

μ = 0.176 cP

Heat Transfer

$Q = U A \Delta T$

$Q = \left(95 \frac{BTU}{HR\,FT^2\,F}\right)\left(11.8\,FT^2\right)(150-70)F$

$Q = 89{,}680\ BTU/HR$

Excel estimates A_{min} = 0.0004 IN^2 ∴ the existing PSV is adequate

RELIEF VALVE INFORMATION

RV No.	Set Pressure	Date Rec'd	Cycle
1/2X1-426	150	1/15/90	2

Manufacturer	Model No.	Serial No.	Code Stamp	Fifth Level Func Loc
TELEDYNE FARRIS	2740UL	10858-KC-MTC	UV/NB	T8333-5136

Relief Type	Inlet Connection	Outlet Connection	Orifice Size
C	1/2"MNPT	1"FNPT	1/2X 1.06

Air Capacity	Water Capacity	Steam Capacity
	24.3 GPM	

Base Matl	Body Matl	Spring Matl

Bonnet Matl	Nozzle Matl	Trim Matl

Comments

Originator: RLT

Charge Code:

RV Location

RV No.	Plant	Area	Block No.	Functional Location	P&ID No.	Service
1/2X1-426	Boiler	UT	25	OR-UT-A-A-T8333 -PSV5139	25F004	Unknown

Level	Height	North	East	Location
G	12	0	0	PIPE RACK EAST SIDE T-30M-61.

RV History

Set Pressure	Cycle	Active	Last Inspected	Due
150	2	Yes	8/27/02	8/2004

Inspector	Date	Reset	Accepted	Hot Tracing	Inlet Plugged	Outlet Plugged	Memo
FG	08/27/02		Yes	Yes	No	Yes	
JEH	10/17/00	135	Yes	No	Yes	No	
FG	10/19/98	130	Yes	Yes	No	No	
FG	10/19/98	130	Yes	Yes	No	No	
FG	07/31/96	130	Yes		No	No	
FG	07/31/96	130	Yes		No	No	
FG	04/12/95	125	Yes		No	No	
FG	04/12/95	125	Yes				
TOM	04/20/94	130	Yes		No	No	
TOM	04/20/94	130	Yes				

Tag Information:	
Project No.:	
Tag No.:	PSV- T8333-5139
Vessel ID:	T8333
P&ID No.:	25F004
Line No.:	3 in.
Engineer:	F.B.Iszard
Date:	7/30/03

PSV/PSD SIZING SUMMARY

Sizing Basis	Considered	Fluid State	Flow Rate Required lb/hr	Flow Rate Rated lb/hr	Orifice Area Required sq. in.	Orifice Area Actual sq. in.	Piping Pressure Drop Inlet % of set	Piping Pressure Drop Outlet % of set	Accumulation %
Fire (All Vapor Flow)	NO								
Regulator Failure	NO								
Hydraulic Expansion	YES	LIQUID	57	N/A	0.000	0.110	0.00	0.00	10.0
Liquid Relief	NO								
Vapor Relief (other than fire)	NO								
Unwetted Surface	NO								
Two Phase Flow	NO								

Project No.	
Tag No.	PSV- T8333-5139
Vessel ID:	T8333
P&ID No.	25F004
Line No.	3 in.
Engineer	F.B.Iszard
Date:	7/30/03

PSV sizing for hydraulic expansion (liquid-full equipment can be blocked in and continued heat input cannot be avoided).

Comments:

Overpressure protection for wastefuel transfer line

Liquid Expansion Rate (gpm) = B * H / (500 * G * C) API RP 520 Part 1, Appendix C.2.1

Calculate Cubical Expansion Coefficient of Liquid

Initial Temperature (T1), F	70
Specific Volume @ T1, ft3/lb	0.01625
Final Temperature (T2), F	100
Specific Volume @ T2, ft3/lb	0.01648
Cubical Expansion Coefficient (B), 1/F	0.000472

Size PSV

B = Cubical Expansion Coefficient, 1/F	0.000472	Calculate B from above or enter known value.
H = Total Heat Transfer Rate, Btu/hr	89,680	For heat exchangers, maximum exchanger duty
G = Specific Gravity referrenced to water @ 60 F	0.676	
C = Specific Heat of Trapped Fluid, Btu/lb-F	0.744	
Viscosity, cp	0.176	
System or Vessel MAWP	150	
PSV Set Pressure, psig	150	
% Overpressure	10	
% Accumulation	10	
Superimposed Back Pressure, psig	5	WARNING:If superimposed B.P. is variable, Bal. Blws. valve recommended.
Differential Set Pressure, psig	145	
Maximum Relieving Pressure, psig	165	
Liquid Expansion Rate, gpm	0.168	
Liquid Expansion Rate, lb/hr	56.9	
Orifice Reynolds Number	90776	

Calculation Mode:	DESIGN NEW PSV/PSD
System Type	PSV
Discharge Coefficient, Cd	0.724

Typical discharge coefficients

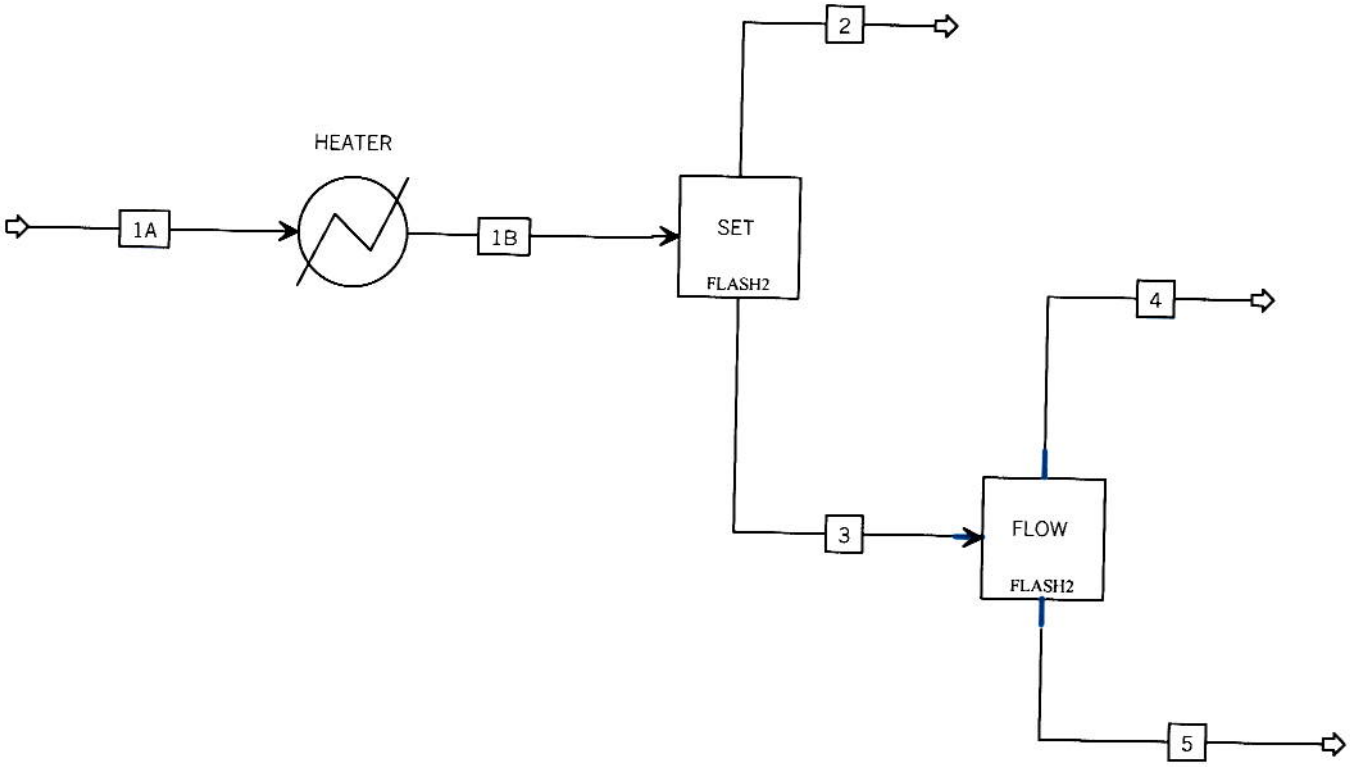
PSV Kd = 0.724 for liquids (Farris Series 2600 Pressure Relief Valves)
PSV Kd = 0.65 for liquids, if not available from valve manufacturer (API RP 520 4.5.1)
PSD Kd = 0.62 for vapor & liquids (API RP-520 4.8.1)
PSV/PSD Combination: Multiply Kd by 0.9, ie: Kd = 0.9 X 0.724 (=0.652) API RP520 2.6.2.1

Back pressure correction factor, Kw	1
Viscosity correction factor, Kv	1

Minimum Relief Area Required **0.0004** sq. in. API RP 520 4.5.1

Minimum Flanged PSV Selected (Design Mode):	1X2	D	0.11	sq. in
Actual Installed Orifice Size (Rating Mode):				sq. in.

Wastefuel Physical Properties During Pressure Relief



Filename:WasteFuel_Htr.apw

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1938924	.1938924	5.79097E-4
IBB	.1117559	.1117559	1.31627E-3
DETDA	.0841373	.0841373	8.21414E-5
TOLUENE	.1085299	.1085299	3.49681E-3
BP350	.0464626	.0464626	4.10822E-4
BP525	.0295767	.0295767	5.58372E-5
BP700	.0202392	.0202392	4.96159E-6
Mole Frac			
AN701	.3260920	.3260920	.0973936
IBB	.1879532	.1879532	.2213733
DETDA	.1415038	.1415038	.0138147
TOLUENE	.1825277	.1825277	.5881002
BP350	.0781418	.0781418	.0690929
BP525	.0497427	.0497427	9.39081E-3
BP700	.0340387	.0340387	8.34450E-4
Mass Flow lb/hr			
AN701	40.00000	40.00000	.1194677
IBB	15.00000	15.00000	.1766716
DETDA	15.00000	15.00000	.0146441
TOLUENE	10.00000	10.00000	.3221978
BP350	6.700000	6.700000	.0592413
BP525	6.600000	6.600000	.0124599
BP700	6.700000	6.700000	1.64249E-3
Total Flow lbmol/hr	.5945941	.5945941	5.94594E-3
Total Flow lb/hr	100.0000	100.0000	.7063251
Total Flow cuft/hr	1.624909	1.648377	.4075623
Temperature F	70.00000	100.0000	592.3172
Pressure psi	14.70000	.2100321	164.7000
Vapor Frac	0.0	0.0	1.000000
Liquid Frac	1.000000	1.000000	0.0
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-90055.53	-88135.93	15998.67
Enthalpy Btu/lb	-535.4649	-524.0510	134.6790
Enthalpy Btu/hr	-53546.49	-52405.10	95.12717
Entropy Btu/lbmol-R	-227.5721	-223.9813	-77.68834
Entropy Btu/lb-R	-1.353130	-1.331779	-.6539911
Density lbmol/cuft	.3659245	.3607148	.0145890
Density lb/cuft	61.54191	60.66573	1.733048
Average MW	168.1820	168.1820	118.7911

	1A HEATER LIQUID	1B SET HEATER LIQUID	2 SET VAPOR
Liq Vol 60F cuft/hr	1.575500	1.575500	.0125091
*** ALL PHASES ***			
Pressure psi	14.70000	.2100321	164.7000
Temperature F	70.00000	100.0000	592.3172
Average MW	168.1820	168.1820	118.7911
Density lb/cuft	61.54191	60.66573	1.733048
CPMX Btu/lb-R	.3695765	.3910039	.5412393
CPCVMX	1.000000	1.000000	1.031871
*** VAPOR PHASE ***			
Average MW			118.7911
Density lb/cuft			1.733048
CPMX Btu/lb-R			.5412393
CPCVMX			1.031937
MUMX cP			.0119738
ZMX			1.000000
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	121.2613	121.2384	
IBB	152.4417	149.8996	
DETDA	162.5356	163.4449	
TOLUENE	178.1899	174.3544	
BP350	147.5467	144.7814	
BP525	131.6131	129.6551	
BP700	117.6061	116.1439	
Average MW	168.1820	168.1820	
Density lb/cuft	61.54191	60.66573	
CPMX Btu/lb-R	.3695765	.3910039	
CPCVMX	1.000000	1.000000	
MUMX cP	4.702627	3.206674	
SIGMAMX dyne/cm	30.32899	28.82893	
ZMX	7.06747E-3	9.69467E-5	

	3 FLOW SET LIQUID	4 FLOW VAPOR	5 FLOW LIQUID
Substream: MIXED			
Mole Flow lbmol/hr			
AN701	.1933133	6.06606E-4	.1927067
IBB	.1104396	1.32458E-3	.1091150
DETDA	.0840551	8.94221E-5	.0839657
TOLUENE	.1050331	3.39544E-3	.1016376
BP350	.0460518	4.06447E-4	.0456454
BP525	.0295209	5.84533E-5	.0294624
BP700	.0202342	5.52880E-6	.0202287
Mole Frac			
AN701	.3284021	.1030506	.3306784
IBB	.1876156	.2250207	.1872378
DETDA	.1427936	.0151910	.1440825
TOLUENE	.1784310	.5768207	.1744069
BP350	.0782332	.0690475	.0783260
BP525	.0501503	9.93009E-3	.0505566
BP700	.0343741	9.39236E-4	.0347118
Mass Flow lb/hr			
AN701	39.88053	.1251427	39.75539
IBB	14.82333	.1777867	14.64554
DETDA	14.98536	.0159421	14.96941
TOLUENE	9.677802	.3128580	9.364944
BP350	6.640759	.0586104	6.582148
BP525	6.587540	.0130437	6.574496
BP700	6.698358	1.83025E-3	6.696527
Total Flow lbmol/hr	.5886481	5.88648E-3	.5827617
Total Flow lb/hr	99.29367	.7052140	98.58846
Total Flow cuft/hr	2.319241	.3746732	2.337077
Temperature F	592.3172	606.1609	606.1609
Pressure psi	164.7000	179.7000	179.7000
Vapor Frac	0.0	1.000000	0.0
Liquid Frac	1.000000	0.0	1.000000
Solid Frac	0.0	0.0	0.0
Enthalpy Btu/lbmol	-41316.09	16053.19	-39370.99
Enthalpy Btu/lb	-244.9364	133.9973	-232.7240
Enthalpy Btu/hr	-24320.64	94.49679	-22943.90
Entropy Btu/lbmol-R	-166.6754	-78.42072	-165.2473
Entropy Btu/lb-R	-.9881109	-.6545844	-.9767854
Density lbmol/cuft	.2538107	.0157109	.2493549
Density lb/cuft	42.81300	1.882211	42.18452
Average MW	168.6809	119.8023	169.1746

	3	4	5
	FLOW		
	SET	FLOW	FLOW
	LIQUID	VAPOR	LIQUID
Liq Vol 60F cuft/hr	1.562990	.0124523	1.550538
*** ALL PHASES ***			
Pressure psi	164.7000	179.7000	179.7000
Temperature F	592.3172	606.1609	606.1609
Average MW	168.6809	119.8023	169.1746
Density lb/cuft	42.81300	1.882211	42.18452
CPMX Btu/lb-R	.8519737	.5471507	.7444560
CPCVMX	1.000000	1.031242	1.000000
*** VAPOR PHASE ***			
Average MW		119.8023	
Density lb/cuft		1.882211	
CPMX Btu/lb-R		.5471507	
CPCVMX		1.031306	
MUMX cP		.0120768	
ZMX		1.000000	
*** LIQUID PHASE ***			
DHVL Btu/lb			
AN701	92.04296		89.94487
IBB	84.27379		80.66786
DETDA	147.9820		146.2757
TOLUENE	44.00132		0.0
BP350	72.54401		68.34641
BP525	86.02781		84.21037
BP700	85.79770		84.66828
Average MW	168.6809		169.1746
Density lb/cuft	42.81300		42.18452
CPMX Btu/lb-R	.8519737		.7444560
CPCVMX	1.000000		1.000000
MUMX cP	.1812411		.1762739
SIGMAMX dyne/cm	6.290685		5.836650
ZMX	.0574799		.0630064

Boiler #4 Tank Farm System PSV Set Points

Tank	Pressure Relief Valve	Set Pressure
T8331	PSV-T8331-012	10"WC
	PSV-T8331-003	8" WC
	PSV-P8331-A	150 PSIG
	PSV-P8331A-B	125 PSIG
	PSV-P8331A-020	150 PSIG
	PSV-T8331-002	100 PSIG
	PSV-T8331-017	150 PSIG
T8332	PSV-T8332-024	11"WC
	PSV-T8332-004	8"WC
	PSV-D8365-A	415.5 IN WC (VACUUM)
	PSV-F8332-022	125 PSIG
	PSV-F8332-A	85 PSIG
	PSV-T8332-B	85 PSIG
	PSV-T8332-029	85 PSIG
	PSV-T8332-028	85 PSIG
	PSV-T8332-A	150 PSIG
T8333	PSV-T8333-5104	10"WC
	PSV-T8333-5105	8"WC
	PSV-T8333-5119	100 PSIG
	PSV-T8333-5121	150 PSIG
	PSV-T8333-5132	85 PSIG
	PSV-T8333-5137	85 PSIG
	PSV-T8333-5138	85 PSIG
	PSV-T8333-5139	150 PSIG

Appendix N-4
Historical Sampling Results

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F009	000527	VALVE	4/12/2018 10:00:08 AM	0.6	Add		2	7	7	Passed	Jenai	4/12/2018 9:59:51 AM
RCRA	OBH25F009	003895	VALVE	4/12/2018 10:01:13 AM	1.1	Add		2	0	0	Passed	Jenai	4/12/2018 10:00:55 AM
RCRA	OBH25F009	000473	VALVE	4/12/2018 10:01:54 AM	0.7	Add		2	0	0	Passed	Jenai	4/12/2018 10:01:35 AM
RCRA	OBH25F009	001847	VALVE	4/12/2018 10:02:38 AM	0.7	Add		0.75	0	0	Passed	Jenai	4/12/2018 10:02:22 AM
RCRA	OBH25F009	001844	VALVE	4/12/2018 10:03:07 AM	0.5	Add		3	0	0	Passed	Jenai	4/12/2018 10:02:47 AM
RCRA	OBH25F009	001846	VALVE	4/12/2018 10:04:09 AM	1.0	Add		3	0	0	Passed	Jenai	4/12/2018 10:03:13 AM
RCRA	OBH25F009	001845	VALVE	4/12/2018 10:04:47 AM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 10:04:17 AM
RCRA	OBH25F009	000826	VALVE	4/12/2018 10:08:54 AM	4.1	Add		2	0	0	Passed	Jenai	4/12/2018 10:08:38 AM
RCRA	OBH25F009	017854	VALVE	4/12/2018 10:09:44 AM	0.8	Add		2	0	0	Passed	Jenai	4/12/2018 10:09:18 AM
RCRA	OBH25F009	000509	VALVE	4/12/2018 10:10:11 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:09:57 AM
RCRA	OBH25F009	000472	VALVE	4/12/2018 10:10:42 AM	0.5	Add		2	46	46	Passed	Jenai	4/12/2018 10:10:21 AM
RCRA	OBH25F009	000605	VALVE	4/12/2018 10:12:01 AM	1.3	Add		3	10	10	Passed	Jenai	4/12/2018 10:11:23 AM
RCRA	OBH25F009	000606	VALVE	4/12/2018 10:12:49 AM	0.8	Add		3	2	2	Passed	Jenai	4/12/2018 10:12:16 AM
RCRA	OBH25F009	000607	VALVE	4/12/2018 10:15:37 AM	2.8	Add		3	0	0	Passed	Jenai	4/12/2018 10:15:04 AM
RCRA	OBH25F009	000150	VALVE	4/12/2018 10:16:35 AM	1.0	Add		2	0	0	Passed	Jenai	4/12/2018 10:16:15 AM
RCRA	OBH25F009	000602	VALVE	4/12/2018 10:17:25 AM	0.8	Add		2	18	18	Passed	Jenai	4/12/2018 10:17:08 AM
RCRA	OBH25F009	003591	VALVE	4/12/2018 10:18:03 AM	0.6	Add		2	9	9	Passed	Jenai	4/12/2018 10:17:43 AM
RCRA	OBH25F009	000565	VALVE	4/12/2018 10:19:11 AM	1.1	Add		2	0	0	Passed	Jenai	4/12/2018 10:18:57 AM
RCRA	OBH25F009	000572	VALVE	4/12/2018 10:19:40 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:19:23 AM
RCRA	OBH25F009	004701	VALVE	4/12/2018 10:20:30 AM	0.8	Add		2	4	4	Passed	Jenai	4/12/2018 10:20:11 AM
RCRA	OBH25F009	000553	VALVE	4/12/2018 10:20:58 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:20:40 AM
RCRA	OBH25F009	000594	VALVE	4/12/2018 10:22:21 AM	1.4	Add		2	0	0	Passed	Jenai	4/12/2018 10:21:56 AM
RCRA	OBH25F009	000598	VALVE	4/12/2018 10:22:50 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:22:30 AM
RCRA	OBH25F009	004162	VALVE	4/12/2018 10:24:00 AM	1.2	Add		2	0	0	Passed	Jenai	4/12/2018 10:23:42 AM
RCRA	OBH25F009	003854	VALVE	4/12/2018 10:24:55 AM	0.9	Add		3	0	0	Passed	Jenai	4/12/2018 10:24:26 AM
RCRA	OBH25F009	000610	VALVE	4/12/2018 10:25:57 AM	1.0	Add		3	0	0	Passed	Jenai	4/12/2018 10:25:38 AM
RCRA	OBH25F009	000613	VALVE	4/12/2018 10:26:35 AM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 10:26:14 AM
RCRA	OBH25F009	004158	VALVE	4/12/2018 10:27:05 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:26:47 AM
RCRA	OBH25F009	000619	VALVE	4/12/2018 10:28:24 AM	1.3	Add		3	0	0	Passed	Jenai	4/12/2018 10:28:04 AM
RCRA	OBH25F009	001177	VALVE	4/12/2018 10:28:50 AM	0.4	Add		2	2	2	Passed	Jenai	4/12/2018 10:28:38 AM
RCRA	OBH25F010	003883	VALVE	4/12/2018 10:42:15 AM	13.4	Add		0.5	0	0	Passed	Jenai	4/12/2018 10:42:01 AM
RCRA	OBH25F010	003860	VALVE	4/12/2018 10:42:36 AM	0.4	Add		0.5	0	0	Passed	Jenai	4/12/2018 10:42:21 AM
RCRA	OBH25F010	003858	VALVE	4/12/2018 10:43:14 AM	0.6	Add		3	1	1	Passed	Jenai	4/12/2018 10:42:51 AM
RCRA	OBH25F010	003899	VALVE	4/12/2018 10:44:02 AM	0.8	Add		3	0	0	Passed	Jenai	4/12/2018 10:43:41 AM
RCRA	OBH25F010	003837	VALVE	4/12/2018 10:44:40 AM	0.6	Add		1	0	0	Passed	Jenai	4/12/2018 10:44:20 AM
RCRA	OBH25F010	003847	VALVE	4/12/2018 10:45:20 AM	0.7	Add		3	0	0	Passed	Jenai	4/12/2018 10:44:58 AM
RCRA	OBH25F010	003842	VALVE	4/12/2018 10:46:06 AM	0.8	Add		2	0	0	Passed	Jenai	4/12/2018 10:45:47 AM
RCRA	OBH25F010	003845	VALVE	4/12/2018 10:48:33 AM	2.5	Add		4	0	0	Passed	Jenai	4/12/2018 10:47:47 AM
RCRA	OBH25F010	000620	VALVE	4/12/2018 10:49:12 AM	0.7	Add		3	0	0	Passed	Jenai	4/12/2018 10:48:44 AM
RCRA	OBH25F010	001620	VALVE	4/12/2018 10:50:15 AM	1.1	Add		1	0	0	Passed	Jenai	4/12/2018 10:49:53 AM
RCRA	OBH25F010	000564	VALVE	4/12/2018 10:50:47 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:50:30 AM
RCRA	OBH25F010	001603	VALVE	4/12/2018 10:51:21 AM	0.6	Add		2	0	0	Passed	Jenai	4/12/2018 10:51:03 AM
RCRA	OBH25F010	000652	VALVE	4/12/2018 10:51:50 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 10:51:32 AM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F010	004616	VALVE	4/12/2018 10:52:48 AM	1.0	Add		1	0	0	Passed	Jenai	4/12/2018 10:52:32 AM
RCRA	OBH25F010	000659	VALVE	4/12/2018 10:53:13 AM	0.4	Add		0.5	0	0	Passed	Jenai	4/12/2018 10:52:59 AM
RCRA	OBH25F009	000622	VALVE	4/12/2018 10:53:58 AM	0.8	Add		2	0	0	Passed	Jenai	4/12/2018 10:53:24 AM
RCRA	OBH25F010	000653	VALVE	4/12/2018 10:54:33 AM	0.6	Add		2	0	0	Passed	Jenai	4/12/2018 10:54:17 AM
RCRA	OBH25F010	001870	VALVE	4/12/2018 10:55:39 AM	1.1	Add		2	0	0	Passed	Jenai	4/12/2018 10:55:00 AM
RCRA	OBH25F010	002175	VALVE	4/12/2018 10:56:45 AM	1.1	Add		1	0	0	Passed	Jenai	4/12/2018 10:55:54 AM
RCRA	OBH25F010	004160	VALVE	4/12/2018 10:57:23 AM	0.6	Add		0.75	0	0	Passed	Jenai	4/12/2018 10:57:00 AM
RCRA	OBH25F010	000710	VALVE	4/12/2018 10:58:02 AM	0.7	Add		0.75	0	0	Passed	Jenai	4/12/2018 10:57:39 AM
RCRA	OBH25F010	000118	VALVE	4/12/2018 10:59:28 AM	1.4	Add		2	0	0	Passed	Jenai	4/12/2018 10:59:10 AM
RCRA	OBH25F010	004245	VALVE	4/12/2018 10:59:59 AM	0.5	Add		0.75	0	0	Passed	Jenai	4/12/2018 10:59:42 AM
RCRA	OBH25F010	006233	VALVE	4/12/2018 11:01:07 AM	1.1	Add		1	0	0	Passed	Jenai	4/12/2018 11:00:50 AM
RCRA	OBH25F010	000724	VALVE	4/12/2018 11:02:45 AM	1.6	Add		1.5	0	0	Passed	Jenai	4/12/2018 11:02:11 AM
RCRA	OBH25F010	000726	VALVE	4/12/2018 11:03:10 AM	0.4	Add		1	3	3	Passed	Jenai	4/12/2018 11:02:53 AM
RCRA	OBH25F010	000727	VALVE	4/12/2018 11:03:46 AM	0.6	Add		1.5	0	0	Passed	Jenai	4/12/2018 11:03:23 AM
RCRA	OBH25F010	000723	VALVE	4/12/2018 11:05:59 AM	2.2	Add		0.75	0	0	Passed	Jenai	4/12/2018 11:03:54 AM
RCRA	OBH25F010	002506	VALVE	4/12/2018 11:06:30 AM	0.5	Add		1.5	0	0	Passed	Jenai	4/12/2018 11:06:08 AM
RCRA	OBH25F010	000738	VALVE	4/12/2018 11:07:04 AM	0.6	Add		0.75	0	0	Passed	Jenai	4/12/2018 11:06:39 AM
RCRA	OBH25F010	000776	VALVE	4/12/2018 11:07:32 AM	0.5	Add		0.75	0	0	Passed	Jenai	4/12/2018 11:07:16 AM
RCRA	OBH25F010	000728	VALVE	4/12/2018 11:08:00 AM	0.5	Add		0.75	0	0	Passed	Jenai	4/12/2018 11:07:40 AM
RCRA	OBH25F010	000798	VALVE	4/12/2018 11:08:28 AM	0.5	Add		0.75	0	0	Passed	Jenai	4/12/2018 11:08:08 AM
RCRA	OBH25F010	000824	VALVE	4/12/2018 11:10:39 AM	2.2	Add		1.5	0	0	Passed	Jenai	4/12/2018 11:09:39 AM
RCRA	OBH25F010	005132	VALVE	4/12/2018 11:11:48 AM	1.2	Add		3	0	0	Passed	Jenai	4/12/2018 11:10:57 AM
RCRA	OBH25F010	000823	VALVE	4/12/2018 11:12:46 AM	1.0	Add		1.5	0	0	Passed	Jenai	4/12/2018 11:12:30 AM
RCRA	OBH25F004	005130	VALVE	4/12/2018 11:18:24 AM	5.6	Add		4	0	0	Passed	Jenai	4/12/2018 11:18:02 AM
RCRA	OBH25F004	001931	VALVE	4/12/2018 11:19:09 AM	0.8	Add		2	0	0	Passed	Jenai	4/12/2018 11:18:40 AM
RCRA	OBH25F004	000828	VALVE	4/12/2018 11:19:55 AM	0.8	Add		2	6	6	Passed	Jenai	4/12/2018 11:19:31 AM
RCRA	OBH25F004	003953	VALVE	4/12/2018 11:21:05 AM	1.2	Add		3	0	0	Passed	Jenai	4/12/2018 11:20:46 AM
RCRA	OBH25F004	000983	VALVE	4/12/2018 11:21:46 AM	0.7	Add		1	0	0	Passed	Jenai	4/12/2018 11:21:19 AM
RCRA	OBH25F004	001932	VALVE	4/12/2018 11:22:24 AM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 11:21:55 AM
RCRA	OBH25F004	000979	VALVE	4/12/2018 11:22:59 AM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 11:22:31 AM
RCRA	OBH25F004	000833	VALVE	4/12/2018 11:23:25 AM	0.4	Add		0.5	0	0	Passed	Jenai	4/12/2018 11:23:11 AM
RCRA	OBH25F004	004703	VALVE	4/12/2018 11:24:00 AM	0.6	Add		1	2	2	Passed	Jenai	4/12/2018 11:23:36 AM
RCRA	OBH25F004	001837	VALVE	4/12/2018 11:25:17 AM	1.3	Add		1	0	0	Passed	Jenai	4/12/2018 11:24:20 AM
RCRA	OBH25F004	000982	VALVE	4/12/2018 11:26:11 AM	0.9	Add		3	0	0	Passed	Jenai	4/12/2018 11:25:51 AM
RCRA	OBH25F004	005099	VALVE	4/12/2018 11:26:55 AM	0.7	Add		0.75	8	8	Passed	Jenai	4/12/2018 11:26:38 AM
RCRA	OBH25F004	001839	VALVE	4/12/2018 11:27:40 AM	0.8	Add		1	0	0	Passed	Jenai	4/12/2018 11:27:16 AM
RCRA	OBH25F004	000973	VALVE	4/12/2018 11:30:01 AM	2.4	Add		2	7	7	Passed	Jenai	4/12/2018 11:29:43 AM
RCRA	OBH25F004	000982	VALVE	4/12/2018 11:31:35 AM	1.6	Add		3	0	0	Passed	Jenai	4/12/2018 11:31:15 AM
RCRA	OBH25F004	000679	VALVE	4/12/2018 11:33:22 AM	1.8	Add		2	0	0	Passed	Jenai	4/12/2018 11:33:02 AM
RCRA	OBH25F004	003875	VALVE	4/12/2018 11:36:16 AM	2.9	Add		3	4	4	Passed	Jenai	4/12/2018 11:35:57 AM
RCRA	OBH25F004	000832	VALVE	4/12/2018 11:37:23 AM	1.1	Add		3	0	0	Passed	Jenai	4/12/2018 11:36:55 AM
RCRA	OBH25F004	000829	VALVE	4/12/2018 11:38:25 AM	1.0	Add		3	0	0	Passed	Jenai	4/12/2018 11:37:40 AM
RCRA	OBH25F007	000964	VALVE	4/12/2018 11:42:08 AM	3.7	Add		0.5	3	3	Passed	Jenai	4/12/2018 11:41:51 AM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F007	000962	VALVE	4/12/2018 11:42:29 AM	0.4	Add		0.5	0	0	Passed	Jenai	4/12/2018 11:42:14 AM
RCRA	OBH25F007	000963	VALVE	4/12/2018 11:42:51 AM	0.4	Add		0.5	0	0	Passed	Jenai	4/12/2018 11:42:37 AM
RCRA	OBH25F007	019823	VALVE	4/12/2018 11:43:20 AM	0.5	Add		0.5	0	0	Passed	Jenai	4/12/2018 11:43:07 AM
RCRA	OBH25F007	000849	VALVE	4/12/2018 11:43:50 AM	0.5	Add		3	1	1	Passed	Jenai	4/12/2018 11:43:30 AM
RCRA	OBH25F007	000953	VALVE	4/12/2018 11:44:14 AM	0.4	Add		0.5	2	2	Passed	Jenai	4/12/2018 11:43:59 AM
RCRA	OBH25F007	000148	VALVE	4/12/2018 11:44:40 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 11:44:22 AM
RCRA	OBH25F007	000952	VALVE	4/12/2018 11:45:16 AM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 11:44:46 AM
RCRA	OBH25F007	000850	VALVE	4/12/2018 11:46:16 AM	1.0	Add		2	0	0	Passed	Jenai	4/12/2018 11:45:44 AM
RCRA	OBH25F007	003648	VALVE	4/12/2018 11:47:18 AM	1.0	Add		3	0	0	Passed	Jenai	4/12/2018 11:46:57 AM
RCRA	OBH25F007	003865	VALVE	4/12/2018 11:47:53 AM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 11:47:28 AM
RCRA	OBH25F007	000951	VALVE	4/12/2018 11:48:21 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 11:48:05 AM
RCRA	OBH25F007	000955	VALVE	4/12/2018 11:48:46 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 11:48:28 AM
RCRA	OBH25F007	000956	VALVE	4/12/2018 11:49:11 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 11:48:53 AM
RCRA	OBH25F007	000965	VALVE	4/12/2018 11:50:43 AM	1.5	Add		2	0	0	Passed	Jenai	4/12/2018 11:50:23 AM
RCRA	OBH25F007	000966	VALVE	4/12/2018 11:51:08 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 11:50:50 AM
RCRA	OBH25F015	000988	VALVE	4/12/2018 2:06:53 PM	135.8	Add		2	0	0	Passed	Jenai	4/12/2018 2:06:37 PM
RCRA	OBH25F015	001916	VALVE	4/12/2018 2:07:28 PM	0.6	Add		2	0	0	Passed	Jenai	4/12/2018 2:07:03 PM
RCRA	OBH25F015	000986	VALVE	4/12/2018 2:08:02 PM	0.6	Add		2	1	1	Passed	Jenai	4/12/2018 2:07:44 PM
RCRA	OBH25F015	000984	VALVE	4/12/2018 2:08:29 PM	0.5	Add		2	3	3	Passed	Jenai	4/12/2018 2:08:12 PM
RCRA	OBH25F015	000985	VALVE	4/12/2018 2:09:15 PM	0.8	Add		2	3	3	Passed	Jenai	4/12/2018 2:08:37 PM
RCRA	OBH25F015	000989	VALVE	4/12/2018 2:09:59 PM	0.7	Add		0.5	0	0	Passed	Jenai	4/12/2018 2:09:41 PM
RCRA	OBH25F015	000990	VALVE	4/12/2018 2:10:28 PM	0.5	Add		0.5	0	0	Passed	Jenai	4/12/2018 2:10:11 PM
RCRA	OBH25F015	000997	VALVE	4/12/2018 2:11:00 PM	0.5	Add		2	1	1	Passed	Jenai	4/12/2018 2:10:44 PM
RCRA	OBH25F015	000998	VALVE	4/12/2018 2:11:22 PM	0.4	Add		0.75	1	1	Passed	Jenai	4/12/2018 2:11:07 PM
RCRA	OBH25F015	000999	VALVE	4/12/2018 2:11:53 PM	0.5	Add		1	1	1	Passed	Jenai	4/12/2018 2:11:35 PM
RCRA	OBH25F015	000996	VALVE	4/12/2018 2:12:31 PM	0.6	Add		2	1	1	Passed	Jenai	4/12/2018 2:12:06 PM
RCRA	OBH25F015	006502	VALVE	4/12/2018 2:13:33 PM	1.0	Add		2	1	1	Passed	Jenai	4/12/2018 2:13:13 PM
RCRA	OBH25F015	000103	VALVE	4/12/2018 2:14:33 PM	1.0	Add		2	1	1	Passed	Jenai	4/12/2018 2:14:12 PM
RCRA	OBH25F015	008037	VALVE	4/12/2018 2:15:29 PM	0.9	Add		2	2	2	Passed	Jenai	4/12/2018 2:15:13 PM
RCRA	OBH25F015	005332	VALVE	4/12/2018 2:20:17 PM	4.8	Add		2	1	1	Passed	Jenai	4/12/2018 2:20:00 PM
RCRA	OBH25F015	002985	VALVE	4/12/2018 2:21:57 PM	1.7	Add		2	1	1	Passed	Jenai	4/12/2018 2:20:44 PM
RCRA	OBH25F015	019669	VALVE	4/12/2018 2:23:39 PM	1.7	Add		1	1	1	Passed	Jenai	4/12/2018 2:22:53 PM
RCRA	OBH25F015	019668	VALVE	4/12/2018 2:27:33 PM	3.9	Add		1	1	1	Passed	Jenai	4/12/2018 2:27:16 PM
RCRA	OBH25F009	007386	VALVE	4/12/2018 2:35:10 PM	7.6	Add		1	6	6	Passed	Jenai	4/12/2018 2:34:30 PM
RCRA	OBH25F009	008527	VALVE	4/12/2018 2:36:44 PM	1.6	Add		3	1	1	Passed	Jenai	4/12/2018 2:36:00 PM
RCRA	OBH25F009	019867	VALVE	4/12/2018 2:37:17 PM	0.6	Add		2	1	1	Passed	Jenai	4/12/2018 2:36:56 PM
RCRA	OBH25F009	019866	VALVE	4/12/2018 2:39:02 PM	1.8	Add		6	1	1	Passed	Jenai	4/12/2018 2:38:40 PM
RCRA	OBH25F009	019868	VALVE	4/12/2018 2:39:35 PM	0.6	Add		2	1	1	Passed	Jenai	4/12/2018 2:39:12 PM
RCRA	OBH25F009	019870	VALVE	4/12/2018 2:40:08 PM	0.6	Add		2	1	1	Passed	Jenai	4/12/2018 2:39:45 PM
RCRA	OBH25F009	019869	VALVE	4/12/2018 2:41:01 PM	0.9	Add		2	1	1	Passed	Jenai	4/12/2018 2:40:16 PM
RCRA	OBH25F009	019816	VALVE	4/12/2018 2:41:58 PM	1.0	Add		3	1	1	Passed	Jenai	4/12/2018 2:41:41 PM
RCRA	OBH25F009	007385	VALVE	4/12/2018 2:44:18 PM	2.3	Add		2	28	28	Passed	Jenai	4/12/2018 2:43:11 PM
RCRA	OBH25F009	019819	VALVE	4/12/2018 2:45:38 PM	1.3	Add		2	1	1	Passed	Jenai	4/12/2018 2:45:27 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F009	019818	VALVE	4/12/2018 2:46:13 PM	0.6	Add		2	1	1	Passed	Jenai	4/12/2018 2:45:54 PM
RCRA	OBH25F009	019820	VALVE	4/12/2018 2:47:27 PM	1.2	Add		3	1	1	Passed	Jenai	4/12/2018 2:47:11 PM
RCRA	OBH25F009	019659	VALVE	4/12/2018 2:48:13 PM	0.8	Add		0.25	15	15	Passed	Jenai	4/12/2018 2:48:01 PM
RCRA	OBH25F009	008533	VALVE	4/12/2018 2:50:02 PM	1.3	Add		3	1	1	Passed	Jenai	4/12/2018 2:49:44 PM
RCRA	OBH25F009	000595	VALVE	4/12/2018 2:54:13 PM	4.2	Add		2	1	1	Passed	Jenai	4/12/2018 2:53:56 PM
RCRA	OBH25F009	000614	VALVE	4/12/2018 2:54:59 PM	0.8	Add		3	1	1	Passed	Jenai	4/12/2018 2:54:33 PM
RCRA	OBH25F013	003833	VALVE	4/12/2018 3:01:20 PM	6.4	Add		2	6	6	Passed	Jenai	4/12/2018 3:01:02 PM
RCRA	OBH25F013	001562	VALVE	4/12/2018 3:01:48 PM	0.5	Add		0.5	5	5	Passed	Jenai	4/12/2018 3:01:32 PM
RCRA	OBH25F013	000317	VALVE	4/12/2018 3:02:30 PM	0.7	Add		2	4	4	Passed	Jenai	4/12/2018 3:02:13 PM
RCRA	OBH25F013	003856	VALVE	4/12/2018 3:02:56 PM	0.4	Add		0.5	4	4	Passed	Jenai	4/12/2018 3:02:41 PM
RCRA	OBH25F013	000302	VALVE	4/12/2018 3:03:26 PM	0.5	Add		0.5	5	5	Passed	Jenai	4/12/2018 3:03:12 PM
RCRA	OBH25F013	001560	VALVE	4/12/2018 3:03:53 PM	0.5	Add		0.5	5	5	Passed	Jenai	4/12/2018 3:03:38 PM
RCRA	OBH25F013	000314	VALVE	4/12/2018 3:04:24 PM	0.5	Add		0.5	4	4	Passed	Jenai	4/12/2018 3:04:09 PM
RCRA	OBH25F013	000307	VALVE	4/12/2018 3:04:46 PM	0.4	Add		0.5	4	4	Passed	Jenai	4/12/2018 3:04:32 PM
RCRA	OBH25F013	000306	VALVE	4/12/2018 3:05:08 PM	0.4	Add		0.5	4	4	Passed	Jenai	4/12/2018 3:04:54 PM
RCRA	OBH25F013	001558	VALVE	4/12/2018 3:05:31 PM	0.4	Add		0.5	3	3	Passed	Jenai	4/12/2018 3:05:17 PM
RCRA	OBH25F013	000305	VALVE	4/12/2018 3:05:58 PM	0.5	Add		0.5	3	3	Passed	Jenai	4/12/2018 3:05:44 PM
RCRA	OBH25F013	000304	VALVE	4/12/2018 3:06:19 PM	0.4	Add		0.5	4	4	Passed	Jenai	4/12/2018 3:06:04 PM
RCRA	OBH25F013	000303	VALVE	4/12/2018 3:07:05 PM	0.8	Add		0.5	4	4	Passed	Jenai	4/12/2018 3:06:27 PM
RCRA	OBH25F013	000308	VALVE	4/12/2018 3:07:52 PM	0.8	Add		0.5	7	7	Passed	Jenai	4/12/2018 3:07:30 PM
RCRA	OBH25F013	003889	VALVE	4/12/2018 3:08:55 PM	1.1	Add		0.5	7	7	Passed	Jenai	4/12/2018 3:08:35 PM
RCRA	OBH25F013	003884	VALVE	4/12/2018 3:09:33 PM	0.6	Add		0.75	8	8	Passed	Jenai	4/12/2018 3:09:05 PM
RCRA	OBH25F013	004242	VALVE	4/12/2018 3:10:09 PM	0.6	Add		0.75	6	6	Passed	Jenai	4/12/2018 3:09:53 PM
RCRA	OBH25F013	000309	VALVE	4/12/2018 3:10:55 PM	0.8	Add		0.5	5	5	Passed	Jenai	4/12/2018 3:10:39 PM
RCRA	OBH25F013	000342	VALVE	4/12/2018 3:11:58 PM	1.1	Add		0.5	8	8	Passed	Jenai	4/12/2018 3:11:43 PM
RCRA	OBH25F013	000343	VALVE	4/12/2018 3:12:31 PM	0.6	Add		0.75	8	8	Passed	Jenai	4/12/2018 3:12:16 PM
RCRA	OBH25F013	000327	VALVE	4/12/2018 3:14:12 PM	1.7	Add		0.75	5	5	Passed	Jenai	4/12/2018 3:13:56 PM
RCRA	OBH25F013	000349	VALVE	4/12/2018 3:15:09 PM	1.0	Add		0.75	6	6	Passed	Jenai	4/12/2018 3:14:42 PM
RCRA	OBH25F013	000311	VALVE	4/12/2018 3:16:13 PM	1.1	Add		0.75	8	8	Passed	Jenai	4/12/2018 3:15:44 PM
RCRA	OBH25F013	000336	VALVE	4/12/2018 3:17:02 PM	0.8	Add		0.75	19	19	Passed	Jenai	4/12/2018 3:16:26 PM
RCRA	OBH25F013	000348	VALVE	4/12/2018 3:18:26 PM	1.4	Add		0.5	12	12	Passed	Jenai	4/12/2018 3:18:11 PM
RCRA	OBH25F013	000346	VALVE	4/12/2018 3:18:50 PM	0.4	Add		0.75	9	9	Passed	Jenai	4/12/2018 3:18:34 PM
RCRA	OBH25F013	003897	VALVE	4/12/2018 3:19:33 PM	0.7	Add		0.75	10	10	Passed	Jenai	4/12/2018 3:19:06 PM
RCRA	OBH25F013	000341	VALVE	4/12/2018 3:20:53 PM	1.3	Add		0.5	7	7	Passed	Jenai	4/12/2018 3:20:38 PM
RCRA	OBH25F013	000326	VALVE	4/12/2018 3:24:39 PM	3.8	Add		0.75	5	5	Passed	Jenai	4/12/2018 3:24:06 PM
RCRA	OBH25F013	003881	VALVE	4/12/2018 3:25:01 PM	0.4	Add		0.75	4	4	Passed	Jenai	4/12/2018 3:24:46 PM
RCRA	OBH25F013	000321	VALVE	4/12/2018 3:25:27 PM	0.4	Add		2	4	4	Passed	Jenai	4/12/2018 3:25:07 PM
RCRA	OBH25F013	003650	VALVE	4/12/2018 3:26:22 PM	0.9	Add		0.5	3	3	Passed	Jenai	4/12/2018 3:26:03 PM
RCRA	OBH25F013	000328	VALVE	4/12/2018 3:27:03 PM	0.7	Add		0.75	4	4	Passed	Jenai	4/12/2018 3:26:46 PM
RCRA	OBH25F013	000340	VALVE	4/12/2018 3:27:33 PM	0.5	Add		0.5	7	7	Passed	Jenai	4/12/2018 3:27:17 PM
RCRA	OBH25F010	005208	VALVE	4/12/2018 3:34:00 PM	6.5	Add		1	1	1	Passed	Jenai	4/12/2018 3:33:42 PM
RCRA	OBH25F010	004910	VALVE	4/12/2018 3:34:52 PM	0.9	Add		3	1	1	Passed	Jenai	4/12/2018 3:34:23 PM
RCRA	OBH25F010	019822	VALVE	4/12/2018 3:35:26 PM	0.6	Add		0.5	0	0	Passed	Jenai	4/12/2018 3:35:09 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F010	019821	VALVE	4/12/2018 3:35:51 PM	0.4	Add		0.5	1	1	Passed	Jenai	4/12/2018 3:35:33 PM
RCRA	OBH25F010	002966	VALVE	4/12/2018 3:36:23 PM	0.5	Add		2	1	1	Passed	Jenai	4/12/2018 3:36:02 PM
RCRA	OBH25F004	005000	VALVE	4/12/2018 3:39:13 PM	2.8	Add		1.5	1	1	Passed	Jenai	4/12/2018 3:38:53 PM
RCRA	OBH25F004	008031	VALVE	4/12/2018 3:39:51 PM	0.6	Add		3	1	1	Passed	Jenai	4/12/2018 3:39:31 PM
RCRA	OBH25F004	005100	VALVE	4/12/2018 3:40:29 PM	0.6	Add		3	0	0	Passed	Jenai	4/12/2018 3:40:08 PM
RCRA	OBH25F004	019662	VALVE	4/12/2018 3:41:04 PM	0.6	Add		0.25	4	4	Passed	Jenai	4/12/2018 3:40:44 PM
RCRA	OBH25F004	019663	VALVE	4/12/2018 3:41:43 PM	0.7	Add		0.25	1	1	Passed	Jenai	4/12/2018 3:41:28 PM
RCRA	OBH25F009	007387	VALVE	4/12/2018 9:45:52 AM	17.1	Add		2	5	5	Passed	Jenai	4/12/2018 9:45:34 AM
RCRA	OBH25F009	007388	VALVE	4/12/2018 9:46:14 AM	0.4	Add		2	2	2	Passed	Jenai	4/12/2018 9:45:56 AM
RCRA	OBH25F009	007389	VALVE	4/12/2018 9:46:44 AM	0.5	Add		2	0	0	Passed	Jenai	4/12/2018 9:46:20 AM
RCRA	OBH25F009	000110	VALVE	4/12/2018 9:47:22 AM	0.6	Add		2	0	0	Passed	Jenai	4/12/2018 9:47:04 AM
RCRA	OBH25F009	000107	VALVE	4/12/2018 9:47:50 AM	0.5	Add		1	0	0	Passed	Jenai	4/12/2018 9:47:30 AM
RCRA	OBH25F009	000147	VALVE	4/12/2018 9:48:35 AM	0.8	Add		2	2	2	Passed	Jenai	4/12/2018 9:48:16 AM
RCRA	OBH25F009	000146	VALVE	4/12/2018 9:49:08 AM	0.6	Add		2	0	0	Passed	Jenai	4/12/2018 9:48:50 AM
RCRA	OBH25F009	000145	VALVE	4/12/2018 9:49:34 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 9:49:17 AM
RCRA	OBH25F009	008529	VALVE	4/12/2018 9:53:09 AM	3.6	Add		3	4	4	Passed	Jenai	4/12/2018 9:52:47 AM
RCRA	OBH25F009	000469	VALVE	4/12/2018 9:54:01 AM	0.9	Add		2	0	0	Passed	Jenai	4/12/2018 9:53:38 AM
RCRA	OBH25F009	000476	VALVE	4/12/2018 9:54:24 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 9:54:08 AM
RCRA	OBH25F009	000475	VALVE	4/12/2018 9:54:59 AM	0.6	Add		2	0	0	Passed	Jenai	4/12/2018 9:54:36 AM
RCRA	OBH25F009	000513	VALVE	4/12/2018 9:56:41 AM	1.7	Add		2	0	0	Passed	Jenai	4/12/2018 9:56:25 AM
RCRA	OBH25F009	000467	VALVE	4/12/2018 9:57:06 AM	0.4	Add		2	0	0	Passed	Jenai	4/12/2018 9:56:48 AM
RCRA	OBH25F009	008528	VALVE	4/12/2018 9:58:50 AM	1.7	Add		2	0	0	Passed	Jenai	4/12/2018 9:58:32 AM
RCRA	OBH25F009	001557	VALVE	4/12/2018 9:59:31 AM	0.7	Add		2	0	0	Passed	Jenai	4/12/2018 9:59:11 AM
RCRA	OBH25F007	000956	VALVE	4/17/2017 1:21:28 PM	135.3	Add		2	3	3	Passed	Joey	4/17/2017 1:21:11 PM
RCRA	OBH25F007	000955	VALVE	4/17/2017 1:21:55 PM	0.5	Add		2	3	3	Passed	Joey	4/17/2017 1:21:39 PM
RCRA	OBH25F007	000951	VALVE	4/17/2017 1:22:17 PM	0.4	Add		2	2	2	Passed	Joey	4/17/2017 1:22:01 PM
RCRA	OBH25F007	000148	VALVE	4/17/2017 1:22:50 PM	0.6	Add		2	3	3	Passed	Joey	4/17/2017 1:22:33 PM
RCRA	OBH25F007	000953	VALVE	4/17/2017 1:23:11 PM	0.4	Add		0.5	4	4	Passed	Joey	4/17/2017 1:22:56 PM
RCRA	OBH25F007	000962	VALVE	4/17/2017 1:23:43 PM	0.5	Add		0.5	2	2	Passed	Joey	4/17/2017 1:23:27 PM
RCRA	OBH25F007	000963	VALVE	4/17/2017 1:24:01 PM	0.3	Add		0.5	2	2	Passed	Joey	4/17/2017 1:23:47 PM
RCRA	OBH25F007	000964	VALVE	4/17/2017 1:24:20 PM	0.3	Add		0.5	2	2	Passed	Joey	4/17/2017 1:24:05 PM
RCRA	OBH25F007	000952	VALVE	4/17/2017 1:25:17 PM	1.0	Add		3	2	2	Passed	Joey	4/17/2017 1:24:58 PM
RCRA	OBH25F007	000849	VALVE	4/17/2017 1:26:02 PM	0.8	Add		3	5	5	Passed	Joey	4/17/2017 1:25:43 PM
RCRA	OBH25F007	000850	VALVE	4/17/2017 1:26:49 PM	0.8	Add		2	2	2	Passed	Joey	4/17/2017 1:26:31 PM
RCRA	OBH25F007	003648	VALVE	4/17/2017 1:28:10 PM	1.4	Add		3	2	2	Passed	Joey	4/17/2017 1:27:51 PM
RCRA	OBH25F007	003865	VALVE	4/17/2017 1:28:39 PM	0.5	Add		3	2	2	Passed	Joey	4/17/2017 1:28:19 PM
RCRA	OBH25F007	019823	VALVE	4/17/2017 1:29:45 PM	1.1	Add		0.5	4	4	Passed	Joey	4/17/2017 1:29:24 PM
RCRA	OBH25F007	000965	VALVE	4/17/2017 1:30:34 PM	0.8	Add		2	2	2	Passed	Joey	4/17/2017 1:30:16 PM
RCRA	OBH25F007	000966	VALVE	4/17/2017 1:30:55 PM	0.4	Add		2	2	2	Passed	Joey	4/17/2017 1:30:38 PM
RCRA	OBH25F004	000828	VALVE	4/17/2017 1:34:20 PM	3.4	Add		2	1	1	Passed	Joey	4/17/2017 1:34:04 PM
RCRA	OBH25F004	005130	VALVE	4/17/2017 1:35:11 PM	0.9	Add		4	1	1	Passed	Joey	4/17/2017 1:34:51 PM
RCRA	OBH25F004	001931	VALVE	4/17/2017 1:36:06 PM	0.9	Add		2	2	2	Passed	Joey	4/17/2017 1:35:48 PM
RCRA	OBH25F004	003953	VALVE	4/17/2017 1:38:36 PM	2.5	Add		3	1	1	Passed	Joey	4/17/2017 1:38:16 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F004	000832	VALVE	4/17/2017 1:39:12 PM	0.6	Add		3	1	1	Passed	Joey	4/17/2017 1:38:52 PM
RCRA	OBH25F004	000983	VALVE	4/17/2017 1:39:57 PM	0.8	Add		1	1	1	Passed	Joey	4/17/2017 1:39:41 PM
RCRA	OBH25F004	005099	VALVE	4/17/2017 1:40:42 PM	0.8	Add		0.75	2	2	Passed	Joey	4/17/2017 1:40:26 PM
RCRA	OBH25F004	000833	VALVE	4/17/2017 1:41:43 PM	1.0	Add		0.5	1	1	Passed	Joey	4/17/2017 1:41:30 PM
RCRA	OBH25F004	004703	VALVE	4/17/2017 1:42:27 PM	0.7	Add		1	2	2	Passed	Joey	4/17/2017 1:42:10 PM
RCRA	OBH25F004	000979	VALVE	4/17/2017 1:43:15 PM	0.8	Add		3	1	1	Passed	Joey	4/17/2017 1:42:56 PM
RCRA	OBH25F004	001932	VALVE	4/17/2017 1:43:54 PM	0.7	Add		3	1	1	Passed	Joey	4/17/2017 1:43:33 PM
RCRA	OBH25F004	000982	VALVE	4/17/2017 1:44:59 PM	1.1	Add		3	51	51	Passed	Joey	4/17/2017 1:44:39 PM
RCRA	OBH25F004	001837	VALVE	4/17/2017 1:45:39 PM	0.7	Add		1	2	2	Passed	Joey	4/17/2017 1:45:22 PM
RCRA	OBH25F004	000973	VALVE	4/17/2017 1:46:36 PM	1.0	Add		2	1	1	Passed	Joey	4/17/2017 1:46:18 PM
RCRA	OBH25F004	000978	VALVE	4/17/2017 1:47:14 PM	0.6	Add		0.75	1	1	Passed	Joey	4/17/2017 1:46:59 PM
RCRA	OBH25F004	001841	VALVE	4/17/2017 1:48:33 PM	1.3	Add		2	3	3	Passed	Joey	4/17/2017 1:48:16 PM
RCRA	OBH25F004	003875	VALVE	4/17/2017 1:51:05 PM	2.5	Add		3	54	54	Passed	Joey	4/17/2017 1:50:45 PM
RCRA	OBH25F004	000829	VALVE	4/17/2017 1:51:55 PM	0.8	Add		3	2	2	Passed	Joey	4/17/2017 1:51:36 PM
RCRA	OBH25F004	001839	VALVE	4/17/2017 1:52:49 PM	0.9	Add		1	1	1	Passed	Joey	4/17/2017 1:52:34 PM
RCRA	OBH25F004	000679	VALVE	4/17/2017 1:53:29 PM	0.7	Add		2	1	1	Passed	Joey	4/17/2017 1:53:12 PM
RCRA	OBH25F010	005909	VALVE	4/17/2017 1:58:42 PM	5.2	Add		3	2	2	Passed	Joey	4/17/2017 1:58:18 PM
RCRA	OBH25F009	019866	VALVE	4/17/2017 10:06:33 AM	8.8	Add		6	2	2	Passed	Joey	4/17/2017 10:06:09 AM
RCRA	OBH25F009	019867	VALVE	4/17/2017 10:06:57 AM	0.4	Add		2	1	1	Passed	Joey	4/17/2017 10:06:41 AM
RCRA	OBH25F009	019868	VALVE	4/17/2017 10:07:15 AM	0.3	Add		2	1	1	Passed	Joey	4/17/2017 10:07:02 AM
RCRA	OBH25F009	019869	VALVE	4/17/2017 10:08:51 AM	1.6	Add		2	10	10	Passed	Joey	4/17/2017 10:08:28 AM
RCRA	OBH25F009	019870	VALVE	4/17/2017 10:09:25 AM	0.6	Add		2	29	29	Passed	Joey	4/17/2017 10:08:56 AM
RCRA	OBH25F009	019816	VALVE	4/17/2017 10:15:23 AM	5.6	Add		3	1	1	Passed	Joey	4/17/2017 10:15:00 AM
RCRA	OBH25F009	019818	VALVE	4/17/2017 10:16:03 AM	0.7	Add		2	2	2	Passed	Joey	4/17/2017 10:15:36 AM
RCRA	OBH25F009	019819	VALVE	4/17/2017 10:16:26 AM	0.4	Add		2	1	1	Passed	Joey	4/17/2017 10:16:12 AM
RCRA	OBH25F009	019820	VALVE	4/17/2017 10:18:04 AM	1.6	Add		3	11	11	Passed	Joey	4/17/2017 10:17:40 AM
RCRA	OBH25F015	005332	VALVE	4/17/2017 10:21:52 AM	3.8	Add		2	2	2	Passed	Joey	4/17/2017 10:21:36 AM
RCRA	OBH25F015	002985	VALVE	4/17/2017 10:22:44 AM	0.9	Add		2	1	1	Passed	Joey	4/17/2017 10:22:28 AM
RCRA	OBH25F015	019669	VALVE	4/17/2017 10:24:45 AM	2.0	Add		1	1	1	Passed	Joey	4/17/2017 10:24:28 AM
RCRA	OBH25F015	005278	VALVE	4/17/2017 10:30:22 AM	5.6	Add		0.75	1	1	Passed	Joey	4/17/2017 10:30:07 AM
RCRA	OBH25F015	005069	VALVE	4/17/2017 10:30:54 AM	0.5	Add		1	6	6	Passed	Joey	4/17/2017 10:30:38 AM
RCRA	OBH25F015	000103	VALVE	4/17/2017 10:31:56 AM	1.0	Add		2	1	1	Passed	Joey	4/17/2017 10:31:39 AM
RCRA	OBH25F009	007391	VALVE	4/17/2017 10:35:58 AM	4.0	Add		3	1	1	Passed	Joey	4/17/2017 10:35:40 AM
RCRA	OBH25F009	007393	VALVE	4/17/2017 10:38:19 AM	2.4	Add		3	2	2	Passed	Joey	4/17/2017 10:38:00 AM
RCRA	OBH25F009	008526	VALVE	4/17/2017 10:45:54 AM	7.6	Add		3	19	19	Passed	Joey	4/17/2017 10:45:31 AM
RCRA	OBH25F010	005334	VALVE	4/17/2017 10:46:56 AM	1.0	Add		1	1	1	Passed	Joey	4/17/2017 10:46:39 AM
RCRA	OBH25F010	004572	VALVE	4/17/2017 10:47:55 AM	1.0	Add		2	1	1	Passed	Joey	4/17/2017 10:47:38 AM
RCRA	OBH25F010	005033	VALVE	4/17/2017 10:48:39 AM	0.7	Add		2	2	2	Passed	Joey	4/17/2017 10:48:21 AM
RCRA	OBH25F010	005210	VALVE	4/17/2017 10:54:21 AM	5.7	Add		2	1	1	Passed	Joey	4/17/2017 10:54:03 AM
RCRA	OBH25F010	005127	VALVE	4/17/2017 10:55:19 AM	1.0	Add		2	1	1	Passed	Joey	4/17/2017 10:54:59 AM
RCRA	OBH25F004	019664	VALVE	4/17/2017 11:05:00 AM	9.7	Add		0.75	1	1	Passed	Joey	4/17/2017 11:04:45 AM
RCRA	OBH25F004	019665	VALVE	4/17/2017 11:05:23 AM	0.4	Add		0.75	1	1	Passed	Joey	4/17/2017 11:05:07 AM
RCRA	OBH25F004	019666	VALVE	4/17/2017 11:05:51 AM	0.5	Add		0.75	1	1	Passed	Joey	4/17/2017 11:05:35 AM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F004	019667	VALVE	4/17/2017 11:06:11 AM	0.3	Add		0.75	1	1	Passed	Joey	4/17/2017 11:05:55 AM
RCRA	OBH25F010	003842	VALVE	4/17/2017 2:02:12 PM	3.5	Add		2	1	1	Passed	Joey	4/17/2017 2:01:55 PM
RCRA	OBH25F010	003837	VALVE	4/17/2017 2:02:36 PM	0.4	Add		1	1	1	Passed	Joey	4/17/2017 2:02:20 PM
RCRA	OBH25F010	003847	VALVE	4/17/2017 2:03:28 PM	0.9	Add		3	1	1	Passed	Joey	4/17/2017 2:03:09 PM
RCRA	OBH25F010	003858	VALVE	4/17/2017 2:04:03 PM	0.6	Add		3	1	1	Passed	Joey	4/17/2017 2:03:44 PM
RCRA	OBH25F010	003899	VALVE	4/17/2017 2:04:33 PM	0.5	Add		3	1	1	Passed	Joey	4/17/2017 2:04:14 PM
RCRA	OBH25F010	003860	VALVE	4/17/2017 2:04:58 PM	0.4	Add		0.5	1	1	Passed	Joey	4/17/2017 2:04:41 PM
RCRA	OBH25F010	003883	VALVE	4/17/2017 2:05:22 PM	0.4	Add		0.5	1	1	Passed	Joey	4/17/2017 2:05:08 PM
RCRA	OBH25F010	005364	VALVE	4/17/2017 2:06:08 PM	0.8	Add		3	1	1	Passed	Joey	4/17/2017 2:05:48 PM
RCRA	OBH25F010	000113	VALVE	4/17/2017 2:07:19 PM	1.2	Add		3	1	1	Passed	Joey	4/17/2017 2:06:59 PM
RCRA	OBH25F010	003845	VALVE	4/17/2017 2:09:28 PM	2.2	Add		4	1	1	Passed	Joey	4/17/2017 2:09:07 PM
RCRA	OBH25F010	000620	VALVE	4/17/2017 2:10:27 PM	1.0	Add		3	3	3	Passed	Joey	4/17/2017 2:10:08 PM
RCRA	OBH25F010	001620	VALVE	4/17/2017 2:11:31 PM	1.1	Add		1	1	1	Passed	Joey	4/17/2017 2:11:16 PM
RCRA	OBH25F010	000564	VALVE	4/17/2017 2:12:24 PM	0.9	Add		2	1	1	Passed	Joey	4/17/2017 2:12:08 PM
RCRA	OBH25F010	001603	VALVE	4/17/2017 2:12:59 PM	0.6	Add		2	2	2	Passed	Joey	4/17/2017 2:12:40 PM
RCRA	OBH25F010	002175	VALVE	4/17/2017 2:14:32 PM	1.6	Add		1	1	1	Passed	Joey	4/17/2017 2:14:16 PM
RCRA	OBH25F010	001870	VALVE	4/17/2017 2:15:54 PM	1.4	Add		2	1	1	Passed	Joey	4/17/2017 2:15:37 PM
RCRA	OBH25F009	000622	VALVE	4/17/2017 2:17:00 PM	1.1	Add		2	3	3	Passed	Joey	4/17/2017 2:16:44 PM
RCRA	OBH25F010	000659	VALVE	4/17/2017 2:17:27 PM	0.5	Add		0.5	2	2	Passed	Joey	4/17/2017 2:17:14 PM
RCRA	OBH25F010	004616	VALVE	4/17/2017 2:17:57 PM	0.5	Add		1	1	1	Passed	Joey	4/17/2017 2:17:41 PM
RCRA	OBH25F010	000652	VALVE	4/17/2017 2:19:04 PM	1.1	Add		2	1	1	Passed	Joey	4/17/2017 2:18:48 PM
RCRA	OBH25F010	000653	VALVE	4/17/2017 2:19:30 PM	0.4	Add		2	1	1	Passed	Joey	4/17/2017 2:19:14 PM
RCRA	OBH25F010	005132	VALVE	4/17/2017 2:21:05 PM	1.6	Add		3	1	1	Passed	Joey	4/17/2017 2:20:46 PM
RCRA	OBH25F010	004160	VALVE	4/17/2017 2:22:18 PM	1.2	Add		0.75	1	1	Passed	Joey	4/17/2017 2:22:03 PM
RCRA	OBH25F010	000710	VALVE	4/17/2017 2:22:43 PM	0.4	Add		0.75	1	1	Passed	Joey	4/17/2017 2:22:29 PM
RCRA	OBH25F010	006233	VALVE	4/17/2017 2:24:08 PM	1.4	Add		1	1	1	Passed	Joey	4/17/2017 2:23:52 PM
RCRA	OBH25F010	000776	VALVE	4/17/2017 2:24:39 PM	0.5	Add		0.75	2	2	Passed	Joey	4/17/2017 2:24:23 PM
RCRA	OBH25F010	000798	VALVE	4/17/2017 2:26:09 PM	1.5	Add		0.75	1	1	Passed	Joey	4/17/2017 2:25:52 PM
RCRA	OBH25F010	000823	VALVE	4/17/2017 2:26:40 PM	0.5	Add		1.5	147	147	Passed	Joey	4/17/2017 2:26:24 PM
RCRA	OBH25F010	000824	VALVE	4/17/2017 2:27:34 PM	0.9	Add		1.5	84	84	Passed	Joey	4/17/2017 2:27:18 PM
RCRA	OBH25F010	002506	VALVE	4/17/2017 2:28:22 PM	0.8	Add		1.5	3	3	Passed	Joey	4/17/2017 2:28:06 PM
RCRA	OBH25F010	000738	VALVE	4/17/2017 2:28:51 PM	0.5	Add		0.75	2	2	Passed	Joey	4/17/2017 2:28:37 PM
RCRA	OBH25F010	000728	VALVE	4/17/2017 2:30:47 PM	1.9	Add		0.75	1	1	Passed	Joey	4/17/2017 2:30:32 PM
RCRA	OBH25F010	000726	VALVE	4/17/2017 2:32:10 PM	1.4	Add		1	3	3	Passed	Joey	4/17/2017 2:31:55 PM
RCRA	OBH25F010	000727	VALVE	4/17/2017 2:32:33 PM	0.4	Add		1.5	2	2	Passed	Joey	4/17/2017 2:32:17 PM
RCRA	OBH25F010	000724	VALVE	4/17/2017 2:33:11 PM	0.6	Add		1.5	2	2	Passed	Joey	4/17/2017 2:32:55 PM
RCRA	OBH25F010	004245	VALVE	4/17/2017 2:34:23 PM	1.2	Add		0.75	1	1	Passed	Joey	4/17/2017 2:34:09 PM
RCRA	OBH25F010	008673	VALVE	4/17/2017 2:34:48 PM	0.4	Add		0.75	1	1	Passed	Joey	4/17/2017 2:34:33 PM
RCRA	OBH25F010	004238	VALVE	4/17/2017 2:36:33 PM	1.8	Add		0.75	1	1	Passed	Joey	4/17/2017 2:36:17 PM
RCRA	OBH25F010	000825	VALVE	4/17/2017 2:37:07 PM	0.6	Add		0.75	1	1	Passed	Joey	4/17/2017 2:36:51 PM
RCRA	OBH25F010	000118	VALVE	4/17/2017 2:38:20 PM	1.2	Add		2	2	2	Passed	Joey	4/17/2017 2:37:57 PM
RCRA	OBH25F010	000723	VALVE	4/17/2017 2:39:32 PM	1.2	Add		0.75	2	2	Passed	Joey	4/17/2017 2:39:17 PM
RCRA	OBH25F009	007387	VALVE	4/17/2017 2:41:26 PM	1.9	Add		2	1	1	Passed	Joey	4/17/2017 2:41:10 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F009	007388	VALVE	4/17/2017 2:41:53 PM	0.5	Add		2	1	1	Passed	Joey	4/17/2017 2:41:37 PM
RCRA	OBH25F009	007389	VALVE	4/17/2017 2:42:13 PM	0.3	Add		2	1	1	Passed	Joey	4/17/2017 2:41:57 PM
RCRA	OBH25F009	000110	VALVE	4/17/2017 2:42:55 PM	0.7	Add		2	1	1	Passed	Joey	4/17/2017 2:42:38 PM
RCRA	OBH25F009	000107	VALVE	4/17/2017 2:43:20 PM	0.4	Add		1	1	1	Passed	Joey	4/17/2017 2:43:01 PM
RCRA	OBH25F009	000147	VALVE	4/17/2017 2:44:21 PM	1.0	Add		2	2	2	Passed	Joey	4/17/2017 2:44:05 PM
RCRA	OBH25F009	000146	VALVE	4/17/2017 2:44:46 PM	0.4	Add		2	1	1	Passed	Joey	4/17/2017 2:44:30 PM
RCRA	OBH25F009	000145	VALVE	4/17/2017 2:45:07 PM	0.4	Add		2	2	2	Passed	Joey	4/17/2017 2:44:51 PM
RCRA	OBH25F009	000111	VALVE	4/17/2017 2:46:14 PM	1.1	Add		2	1	1	Passed	Joey	4/17/2017 2:45:59 PM
RCRA	OBH25F009	000112	VALVE	4/17/2017 2:46:35 PM	0.4	Add		2	1	1	Passed	Joey	4/17/2017 2:46:18 PM
RCRA	OBH25F009	008529	VALVE	4/17/2017 2:48:49 PM	2.2	Add		3	7	7	Passed	Joey	4/17/2017 2:48:30 PM
RCRA	OBH25F009	008527	VALVE	4/17/2017 2:49:39 PM	0.8	Add		3	2	2	Passed	Joey	4/17/2017 2:49:17 PM
RCRA	OBH25F009	000513	VALVE	4/17/2017 2:50:13 PM	0.6	Add		2	2	2	Passed	Joey	4/17/2017 2:49:57 PM
RCRA	OBH25F009	000467	VALVE	4/17/2017 2:51:04 PM	0.9	Add		2	2	2	Passed	Joey	4/17/2017 2:50:46 PM
RCRA	OBH25F009	000527	VALVE	4/17/2017 2:52:10 PM	1.1	Add		2	4	4	Passed	Joey	4/17/2017 2:51:51 PM
RCRA	OBH25F009	003895	VALVE	4/17/2017 2:52:55 PM	0.8	Add		2	3	3	Passed	Joey	4/17/2017 2:52:39 PM
RCRA	OBH25F009	000473	VALVE	4/17/2017 2:53:39 PM	0.7	Add		2	7	7	Passed	Joey	4/17/2017 2:53:16 PM
RCRA	OBH25F009	017854	VALVE	4/17/2017 2:54:41 PM	1.0	Add		2	8	8	Passed	Joey	4/17/2017 2:54:25 PM
RCRA	OBH25F009	000826	VALVE	4/17/2017 2:55:44 PM	1.1	Add		2	3	3	Passed	Joey	4/17/2017 2:55:28 PM
RCRA	OBH25F009	001847	VALVE	4/17/2017 2:56:21 PM	0.6	Add		0.75	6	6	Passed	Joey	4/17/2017 2:56:06 PM
RCRA	OBH25F009	001846	VALVE	4/17/2017 2:56:47 PM	0.4	Add		3	1	1	Passed	Joey	4/17/2017 2:56:28 PM
RCRA	OBH25F009	001845	VALVE	4/17/2017 2:57:18 PM	0.5	Add		3	2	2	Passed	Joey	4/17/2017 2:56:59 PM
RCRA	OBH25F009	001844	VALVE	4/17/2017 2:57:42 PM	0.4	Add		3	4	4	Passed	Joey	4/17/2017 2:57:23 PM
RCRA	OBH25F009	001557	VALVE	4/17/2017 2:59:10 PM	1.5	Add		2	1	1	Passed	Joey	4/17/2017 2:58:54 PM
RCRA	OBH25F009	008528	VALVE	4/17/2017 3:00:18 PM	1.1	Add		2	2	2	Passed	Joey	4/17/2017 3:00:01 PM
RCRA	OBH25F009	000472	VALVE	4/17/2017 3:01:19 PM	1.0	Add		2	2	2	Passed	Joey	4/17/2017 3:01:01 PM
RCRA	OBH25F009	000509	VALVE	4/17/2017 3:02:03 PM	0.7	Add		2	2	2	Passed	Joey	4/17/2017 3:01:47 PM
RCRA	OBH25F009	000605	VALVE	4/17/2017 3:04:08 PM	2.1	Add		3	1	1	Passed	Joey	4/17/2017 3:03:49 PM
RCRA	OBH25F009	000606	VALVE	4/17/2017 3:04:32 PM	0.4	Add		3	1	1	Passed	Joey	4/17/2017 3:04:12 PM
RCRA	OBH25F009	000475	VALVE	4/17/2017 3:05:43 PM	1.2	Add		2	2	2	Passed	Joey	4/17/2017 3:05:27 PM
RCRA	OBH25F009	000469	VALVE	4/17/2017 3:06:14 PM	0.5	Add		2	1	1	Passed	Joey	4/17/2017 3:05:58 PM
RCRA	OBH25F009	000476	VALVE	4/17/2017 3:06:39 PM	0.4	Add		2	1	1	Passed	Joey	4/17/2017 3:06:22 PM
RCRA	OBH25F009	003591	VALVE	4/17/2017 3:08:46 PM	2.1	Add		2	1	1	Passed	Joey	4/17/2017 3:08:30 PM
RCRA	OBH25F009	000602	VALVE	4/17/2017 3:09:14 PM	0.5	Add		2	2	2	Passed	Joey	4/17/2017 3:08:57 PM
RCRA	OBH25F009	000572	VALVE	4/17/2017 3:09:41 PM	0.5	Add		2	4	4	Passed	Joey	4/17/2017 3:09:24 PM
RCRA	OBH25F009	000565	VALVE	4/17/2017 3:10:04 PM	0.4	Add		2	3	3	Passed	Joey	4/17/2017 3:09:49 PM
RCRA	OBH25F009	004701	VALVE	4/17/2017 3:11:22 PM	1.3	Add		2	1	1	Passed	Joey	4/17/2017 3:11:05 PM
RCRA	OBH25F009	000553	VALVE	4/17/2017 3:12:02 PM	0.7	Add		2	1	1	Passed	Joey	4/17/2017 3:11:46 PM
RCRA	OBH25F009	000595	VALVE	4/17/2017 3:12:49 PM	0.8	Add		2	1	1	Passed	Joey	4/17/2017 3:12:32 PM
RCRA	OBH25F009	000594	VALVE	4/17/2017 3:14:26 PM	1.6	Add		2	1	1	Passed	Joey	4/17/2017 3:14:10 PM
RCRA	OBH25F009	000598	VALVE	4/17/2017 3:15:04 PM	0.6	Add		2	1	1	Passed	Joey	4/17/2017 3:14:46 PM
RCRA	OBH25F009	000607	VALVE	4/17/2017 3:16:52 PM	1.8	Add		3	3	3	Passed	Joey	4/17/2017 3:16:33 PM
RCRA	OBH25F009	004162	VALVE	4/17/2017 3:17:32 PM	0.7	Add		2	7	7	Passed	Joey	4/17/2017 3:17:15 PM
RCRA	OBH25F009	003854	VALVE	4/17/2017 3:18:12 PM	0.7	Add		3	2	2	Passed	Joey	4/17/2017 3:17:53 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F009	000610	VALVE	4/17/2017 3:18:51 PM	0.7	Add		3	1	1	Passed	Joey	4/17/2017 3:18:32 PM
RCRA	OBH25F009	000613	VALVE	4/17/2017 3:19:15 PM	0.4	Add		3	1	1	Passed	Joey	4/17/2017 3:18:56 PM
RCRA	OBH25F009	000614	VALVE	4/17/2017 3:19:48 PM	0.6	Add		3	1	1	Passed	Joey	4/17/2017 3:19:29 PM
RCRA	OBH25F009	000619	VALVE	4/17/2017 3:20:26 PM	0.6	Add		3	2	2	Passed	Joey	4/17/2017 3:20:07 PM
RCRA	OBH25F009	004158	VALVE	4/17/2017 3:21:15 PM	0.8	Add		2	2	2	Passed	Joey	4/17/2017 3:20:58 PM
RCRA	OBH25F009	001177	VALVE	4/17/2017 3:21:49 PM	0.6	Add		2	2	2	Passed	Joey	4/17/2017 3:21:33 PM
RCRA	OBH25F009	000150	VALVE	4/17/2017 3:23:19 PM	1.5	Add		2	2	2	Passed	Joey	4/17/2017 3:23:01 PM
RCRA	OBH25F004	005000	VALVE	4/17/2017 9:39:00 AM	15532.2	Add		1.5	1	1	Passed	Joey	4/17/2017 9:38:38 AM
RCRA	OBH25F004	005100	VALVE	4/17/2017 9:39:47 AM	0.8	Add		3	1	1	Passed	Joey	4/17/2017 9:39:27 AM
RCRA	OBH25F004	008031	VALVE	4/17/2017 9:41:03 AM	1.3	Add		3	6	6	Passed	Joey	4/17/2017 9:40:43 AM
RCRA	OBH25F004	019662	VALVE	4/17/2017 9:41:44 AM	0.7	Add		0.25	1	1	Passed	Joey	4/17/2017 9:41:31 AM
RCRA	OBH25F004	019663	VALVE	4/17/2017 9:42:03 AM	0.3	Add		0.25	1	1	Passed	Joey	4/17/2017 9:41:48 AM
RCRA	OBH25F010	002966	VALVE	4/17/2017 9:43:24 AM	1.4	Add		2	1	1	Passed	Joey	4/17/2017 9:43:06 AM
RCRA	OBH25F010	005208	VALVE	4/17/2017 9:44:22 AM	1.0	Add		1	3	3	Passed	Joey	4/17/2017 9:44:07 AM
RCRA	OBH25F010	004910	VALVE	4/17/2017 9:45:04 AM	0.7	Add		3	1	1	Passed	Joey	4/17/2017 9:44:45 AM
RCRA	OBH25F010	019821	VALVE	4/17/2017 9:46:13 AM	1.2	Add		0.5	1	1	Passed	Joey	4/17/2017 9:45:58 AM
RCRA	OBH25F010	019822	VALVE	4/17/2017 9:46:32 AM	0.3	Add		0.5	2	2	Passed	Joey	4/17/2017 9:46:19 AM
RCRA	OBH25F009	007385	VALVE	4/17/2017 9:54:21 AM	7.8	Add		2	2	2	Passed	Joey	4/17/2017 9:54:05 AM
RCRA	OBH25F009	007386	VALVE	4/17/2017 9:55:50 AM	1.5	Add		1	2	2	Passed	Joey	4/17/2017 9:55:35 AM
RCRA	OBH25F009	007390	VALVE	4/17/2017 9:57:48 AM	2.0	Add		3	12	12	Passed	Joey	4/17/2017 9:57:18 AM
RCRA	OBH25F009	008551	VALVE	4/18/2017 2:09:02 PM	1365.7	Add		2	2	2	Passed	Joey	4/18/2017 2:08:42 PM
RCRA	OBH25F009	008550	VALVE	4/18/2017 2:09:54 PM	0.9	Add		2	1	1	Passed	Joey	4/18/2017 2:09:36 PM
RCRA	OBH25F009	008532	VALVE	4/18/2017 2:11:03 PM	1.2	Add		3	2	2	Passed	Joey	4/18/2017 2:10:40 PM
RCRA	OBH25F009	008531	VALVE	4/18/2017 2:11:42 PM	0.7	Add		3	2	2	Passed	Joey	4/18/2017 2:11:18 PM
RCRA	OBH25F009	008530	VALVE	4/18/2017 2:16:44 PM	5.0	Add		2	1	1	Passed	Joey	4/18/2017 2:16:24 PM
RCRA	OBH25F009	008533	VALVE	4/18/2017 2:21:57 PM	5.2	Add		3	1	1	Passed	Joey	4/18/2017 2:21:37 PM
RCRA	OBH25F009	019659	VALVE	4/18/2017 2:27:51 PM	5.9	Add		0.25	0	0	Passed	Joey	4/18/2017 2:27:37 PM
RCRA	OBH25F015	000984	VALVE	4/18/2017 2:31:46 PM	3.9	Add		2	2	2	Passed	Joey	4/18/2017 2:31:25 PM
RCRA	OBH25F015	000985	VALVE	4/18/2017 2:32:40 PM	0.9	Add		2	1	1	Passed	Joey	4/18/2017 2:32:23 PM
RCRA	OBH25F015	000986	VALVE	4/18/2017 2:33:00 PM	0.3	Add		2	0	0	Passed	Joey	4/18/2017 2:32:43 PM
RCRA	OBH25F015	000988	VALVE	4/18/2017 2:33:32 PM	0.5	Add		2	3	3	Passed	Joey	4/18/2017 2:33:15 PM
RCRA	OBH25F015	001916	VALVE	4/18/2017 2:34:12 PM	0.7	Add		2	2	2	Passed	Joey	4/18/2017 2:33:55 PM
RCRA	OBH25F015	000989	VALVE	4/18/2017 2:34:56 PM	0.7	Add		0.5	1	1	Passed	Joey	4/18/2017 2:34:41 PM
RCRA	OBH25F015	000990	VALVE	4/18/2017 2:35:21 PM	0.4	Add		0.5	2	2	Passed	Joey	4/18/2017 2:35:02 PM
RCRA	OBH25F015	000996	VALVE	4/18/2017 2:35:52 PM	0.5	Add		2	2	2	Passed	Joey	4/18/2017 2:35:35 PM
RCRA	OBH25F015	000997	VALVE	4/18/2017 2:36:17 PM	0.4	Add		2	2	2	Passed	Joey	4/18/2017 2:36:01 PM
RCRA	OBH25F015	000998	VALVE	4/18/2017 2:36:51 PM	0.6	Add		0.75	2	2	Passed	Joey	4/18/2017 2:36:35 PM
RCRA	OBH25F015	000999	VALVE	4/18/2017 2:37:11 PM	0.3	Add		1	34	34	Passed	Joey	4/18/2017 2:36:55 PM
RCRA	OBH25F015	006502	VALVE	4/18/2017 2:38:07 PM	0.9	Add		2	1	1	Passed	Joey	4/18/2017 2:37:48 PM
RCRA	OBH25F015	008037	VALVE	4/18/2017 2:38:58 PM	0.9	Add		2	2	2	Passed	Joey	4/18/2017 2:38:40 PM
RCRA	OBH25F015	019668	VALVE	4/18/2017 2:39:27 PM	0.5	Add		1	1	1	Passed	Joey	4/18/2017 2:39:12 PM
RCRA	OBH25F015	003024	VALVE	4/18/2017 2:43:36 PM	4.2	Add		2	1	1	Passed	Joey	4/18/2017 2:43:17 PM
RCRA	OBH25F010	005127	VALVE	4/18/2018 1:39:40 PM	8518.0	Add		2	3	3	Passed	Joey	4/18/2018 1:39:04 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F010	005210	VALVE	4/18/2018 1:42:04 PM	2.4	Add		2	3	3	Passed	Joey	4/18/2018 1:41:27 PM
RCRA	OBH25F010	004572	VALVE	4/18/2018 1:43:58 PM	1.9	Add		2	3	3	Passed	Joey	4/18/2018 1:43:24 PM
RCRA	OBH25F010	005033	VALVE	4/18/2018 1:44:58 PM	1.0	Add		2	3	3	Passed	Joey	4/18/2018 1:44:22 PM
RCRA	OBH25F010	005334	VALVE	4/18/2018 1:45:55 PM	1.0	Add		1	4	4	Passed	Joey	4/18/2018 1:45:16 PM
RCRA	OBH25F010	000113	VALVE	4/18/2018 1:51:50 PM	5.9	Add		3	2	2	Passed	Joey	4/18/2018 1:51:14 PM
RCRA	OBH25F010	005909	VALVE	4/18/2018 1:53:33 PM	1.7	Add		3	2	2	Passed	Joey	4/18/2018 1:53:02 PM
RCRA	OBH25F010	005364	VALVE	4/18/2018 1:57:43 PM	4.2	Add		3	3	3	Passed	Joey	4/18/2018 1:57:14 PM
RCRA	OBH25F010	000825	VALVE	4/18/2018 1:59:49 PM	2.1	Add		0.75	3	3	Passed	Joey	4/18/2018 1:59:12 PM
RCRA	OBH25F010	004238	VALVE	4/18/2018 2:00:42 PM	0.9	Add		0.75	2	2	Passed	Joey	4/18/2018 2:00:11 PM
RCRA	OBH25F010	008673	VALVE	4/18/2018 2:01:42 PM	1.0	Add		0.75	3	3	Passed	Joey	4/18/2018 2:01:04 PM
RCRA	OBH25F004	000978	VALVE	4/18/2018 2:04:15 PM	2.6	Add		0.75	2	2	Passed	Joey	4/18/2018 2:03:39 PM
RCRA	OBH25F004	019664	VALVE	4/18/2018 2:05:40 PM	1.4	Add		0.75	2	2	Passed	Joey	4/18/2018 2:05:06 PM
RCRA	OBH25F004	019665	VALVE	4/18/2018 2:06:30 PM	0.8	Add		0.75	2	2	Passed	Joey	4/18/2018 2:05:46 PM
RCRA	OBH25F004	019666	VALVE	4/18/2018 2:07:19 PM	0.8	Add		0.75	2	2	Passed	Joey	4/18/2018 2:06:41 PM
RCRA	OBH25F004	019667	VALVE	4/18/2018 2:08:24 PM	1.1	Add		0.75	2	2	Passed	Joey	4/18/2018 2:07:44 PM
RCRA	OBH25F004	001841	VALVE	4/18/2018 2:10:05 PM	1.7	Add		2	2	2	Passed	Joey	4/18/2018 2:09:32 PM
RCRA	OBH25F015	003024	VALVE	4/18/2018 2:13:26 PM	3.4	Add		2	3	3	Passed	Joey	4/18/2018 2:12:51 PM
RCRA	OBH25F015	005069	VALVE	4/18/2018 2:14:00 PM	0.6	Add		1	3	3	Passed	Joey	4/18/2018 2:13:30 PM
RCRA	OBH25F015	005278	VALVE	4/18/2018 2:14:46 PM	0.8	Add		0.75	3	3	Passed	Joey	4/18/2018 2:14:08 PM
RCRA	OBH25F013	003833	VALVE	4/19/2017 1:54:50 PM	1345.9	Add		2	2	2	Passed	Joey	4/19/2017 1:54:34 PM
RCRA	OBH25F013	001562	VALVE	4/19/2017 1:55:35 PM	0.8	Add		0.5	2	2	Passed	Joey	4/19/2017 1:55:20 PM
RCRA	OBH25F013	000302	VALVE	4/19/2017 1:56:41 PM	1.1	Add		0.5	3	3	Passed	Joey	4/19/2017 1:56:27 PM
RCRA	OBH25F013	001560	VALVE	4/19/2017 1:57:04 PM	0.4	Add		0.5	3	3	Passed	Joey	4/19/2017 1:56:51 PM
RCRA	OBH25F013	000314	VALVE	4/19/2017 1:57:29 PM	0.4	Add		0.5	4	4	Passed	Joey	4/19/2017 1:57:14 PM
RCRA	OBH25F013	000307	VALVE	4/19/2017 1:57:55 PM	0.4	Add		0.5	7	7	Passed	Joey	4/19/2017 1:57:40 PM
RCRA	OBH25F013	000306	VALVE	4/19/2017 1:58:16 PM	0.4	Add		0.5	5	5	Passed	Joey	4/19/2017 1:58:01 PM
RCRA	OBH25F013	001558	VALVE	4/19/2017 1:58:44 PM	0.5	Add		0.5	3	3	Passed	Joey	4/19/2017 1:58:30 PM
RCRA	OBH25F013	000303	VALVE	4/19/2017 1:59:08 PM	0.4	Add		0.5	2	2	Passed	Joey	4/19/2017 1:58:55 PM
RCRA	OBH25F013	000304	VALVE	4/19/2017 1:59:26 PM	0.3	Add		0.5	2	2	Passed	Joey	4/19/2017 1:59:12 PM
RCRA	OBH25F013	000305	VALVE	4/19/2017 1:59:45 PM	0.3	Add		0.5	3	3	Passed	Joey	4/19/2017 1:59:30 PM
RCRA	OBH25F013	003856	VALVE	4/19/2017 2:01:59 PM	2.2	Add		0.5	2	2	Passed	Joey	4/19/2017 2:01:44 PM
RCRA	OBH25F013	000308	VALVE	4/19/2017 2:03:13 PM	1.2	Add		0.5	3	3	Passed	Joey	4/19/2017 2:02:59 PM
RCRA	OBH25F013	000309	VALVE	4/19/2017 2:03:29 PM	0.3	Add		0.5	2	2	Passed	Joey	4/19/2017 2:03:16 PM
RCRA	OBH25F013	003889	VALVE	4/19/2017 2:04:42 PM	1.2	Add		0.5	1	1	Passed	Joey	4/19/2017 2:04:22 PM
RCRA	OBH25F013	003884	VALVE	4/19/2017 2:05:37 PM	0.9	Add		0.75	2	2	Passed	Joey	4/19/2017 2:05:21 PM
RCRA	OBH25F013	000341	VALVE	4/19/2017 2:07:25 PM	1.8	Add		0.5	7	7	Passed	Joey	4/19/2017 2:07:11 PM
RCRA	OBH25F013	004242	VALVE	4/19/2017 2:08:46 PM	1.4	Add		0.75	3	3	Passed	Joey	4/19/2017 2:08:32 PM
RCRA	OBH25F013	000342	VALVE	4/19/2017 2:09:24 PM	0.6	Add		0.5	4	4	Passed	Joey	4/19/2017 2:09:00 PM
RCRA	OBH25F013	000343	VALVE	4/19/2017 2:10:05 PM	0.7	Add		0.75	3	3	Passed	Joey	4/19/2017 2:09:49 PM
RCRA	OBH25F013	000326	VALVE	4/19/2017 2:12:28 PM	2.4	Add		0.75	1	1	Passed	Joey	4/19/2017 2:12:13 PM
RCRA	OBH25F013	000327	VALVE	4/19/2017 2:12:48 PM	0.3	Add		0.75	1	1	Passed	Joey	4/19/2017 2:12:32 PM
RCRA	OBH25F013	000328	VALVE	4/19/2017 2:14:53 PM	2.1	Add		0.75	1	1	Passed	Joey	4/19/2017 2:14:38 PM
RCRA	OBH25F013	003881	VALVE	4/19/2017 2:15:18 PM	0.4	Add		0.75	1	1	Passed	Joey	4/19/2017 2:15:02 PM

UnitDescription	Drawing	ComponentTag	ComponentClass	InspectionDate	MinsAfterPrev	Document	Thumbnail	Size	Maximum	NetReading	Pass_Fail	Inspector	ScanStartTime
RCRA	OBH25F013	003897	VALVE	4/19/2017 2:18:32 PM	3.2	Add		0.75	3	3	Passed	Joey	4/19/2017 2:18:17 PM
RCRA	OBH25F013	000346	VALVE	4/19/2017 2:18:59 PM	0.5	Add		0.75	21	21	Passed	Joey	4/19/2017 2:18:44 PM
RCRA	OBH25F013	000348	VALVE	4/19/2017 2:20:16 PM	1.3	Add		0.5	20	20	Passed	Joey	4/19/2017 2:20:02 PM
RCRA	OBH25F013	000311	VALVE	4/19/2017 2:21:50 PM	1.6	Add		0.75	15	15	Passed	Joey	4/19/2017 2:21:35 PM
RCRA	OBH25F013	000336	VALVE	4/19/2017 2:23:11 PM	1.4	Add		0.75	3	3	Passed	Joey	4/19/2017 2:22:55 PM
RCRA	OBH25F013	003650	VALVE	4/19/2017 2:29:00 PM	5.8	Add		0.5	2	2	Passed	Joey	4/19/2017 2:28:44 PM
RCRA	OBH25F013	000340	VALVE	4/19/2017 2:29:49 PM	0.8	Add		0.5	5	5	Passed	Joey	4/19/2017 2:29:34 PM
RCRA	OBH25F013	000349	VALVE	4/19/2017 2:30:11 PM	0.4	Add		0.75	3	3	Passed	Joey	4/19/2017 2:29:56 PM
RCRA	OBH25F013	000321	VALVE	4/19/2017 2:33:45 PM	3.6	Add		2	1	1	Passed	Joey	4/19/2017 2:33:28 PM
RCRA	OBH25F013	000317	VALVE	4/19/2017 2:34:13 PM	0.5	Add		2	1	1	Passed	Joey	4/19/2017 2:33:55 PM
RCRA	OBH25F009	019301	VALVE	4/30/2018 3:29:46 PM	15936.0	Add		2	4	4	Passed	Joey	4/30/2018 3:29:05 PM
RCRA	OBH25F009	019302	VALVE	4/30/2018 3:30:24 PM	0.6	Add		2	4	4	Passed	Joey	4/30/2018 3:29:56 PM
RCRA	OBH25F009	007390	VALVE	4/30/2018 3:38:52 PM	8.5	Add		3	4	4	Passed	Joey	4/30/2018 3:38:18 PM
RCRA	OBH25F009	007393	VALVE	4/30/2018 3:41:32 PM	2.7	Add		3	4	4	Passed	Joey	4/30/2018 3:40:51 PM
RCRA	OBH25F009	008526	VALVE	4/30/2018 3:43:09 PM	1.6	Add		3	4	4	Passed	Joey	4/30/2018 3:42:19 PM
RCRA	OBH25F009	007391	VALVE	4/30/2018 3:45:31 PM	2.4	Add		3	4	4	Passed	Joey	4/30/2018 3:44:54 PM
RCRA	OBH25F009	000111	VALVE	4/30/2018 3:52:04 PM	6.6	Add		2	4	4	Passed	Joey	4/30/2018 3:51:29 PM
RCRA	OBH25F009	000112	VALVE	4/30/2018 3:52:47 PM	0.7	Add		2	3	3	Passed	Joey	4/30/2018 3:52:14 PM
RCRA	OBH25F009	000574	VALVE	4/30/2018 3:54:47 PM	2.0	Add		1	4	4	Passed	Joey	4/30/2018 3:54:12 PM
RCRA	OBH25F009	001606	VALVE	4/30/2018 3:56:29 PM	1.7	Add		2	3	3	Passed	Joey	4/30/2018 3:55:56 PM
RCRA	OBH25F009	000827	VALVE	4/30/2018 3:57:30 PM	1.0	Add		2	4	4	Passed	Joey	4/30/2018 3:57:03 PM
RCRA	OBH25F010	005634	VALVE	4/30/2018 3:59:54 PM	2.4	Add		0.75	4	4	Passed	Joey	4/30/2018 3:59:20 PM
RCRA	OBH25F015	019303	VALVE	4/30/2018 4:01:37 PM	1.7	Add		1	4	4	Passed	Joey	4/30/2018 4:00:54 PM
RCRA	OBH25F007	019304	VALVE	4/30/2018 4:05:12 PM	3.6	Add		2	4	4	Passed	Joey	4/30/2018 4:04:41 PM

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
17	0	0		False	False	P8332== MV on line to Recirculation	T8332		0.4	6.3
18	0	0		False	False	P8332== MV on line to Waste	T8332		0.3	6.3
19	0	0		False	False	P8332== Sample Valve on line to Waste	T8332		0.3	6.3
16	0	0		False	False	T8332= MV on line to PSV	T8332		0.1	2.4
20	0	0		False	False	P8332== MV off line to Grade	T8332		0.5	9.4
56	0	0		False	False	P8332== MV off line to Grade on line to PI	T8332		0.2	9.4
30	0	0		False	False	P8332== MV on line to Grade	T8332		0.3	9.4
16	0	0		False	False	P8332== MV on line to Load/Unload	T8332		0.4	6.3
26	0	0		False	False	P8332== MV on line from 702	T8332		0.2	6.3
14	0	0		False	False	T8332= MV of manifold above P8332	T8332		0.4	6.3
21	0	0		False	False	P8332== MV off line to Load/ Unload	T8332		0.3	6.3
38	0	0		False	False	P8332== MV on line into Hazardous Waste line	T8332		0.2	9.4
33	0	0		False	False	P8332== MV off line into Hazardous Waste line	T8332		0.3	9.4
33	0	0		False	False	P8332== MV on line into Hazardous Waste line	T8332		0.3	9.4
20	0	0		False	False	P8332== MV on line to Load/ Unload	T8332		0.3	6.3
17	0	0		False	False	F8332= MV on fliter pot loop line	T8332		0.4	6.3
20	0	0		False	False	F8332= MV on line to PSV	T8332		0.3	6.3
14	0	0		False	False	F8332= MV out the bottom of F8332	T8332		0.4	6.3
17	0	0		False	False	F8332= MV on line out the bottom of F8332	T8332		0.4	6.3
19	0	0		False	False	F8332= MV on line to Hazardous Waste	T8332		0.3	6.3
18	0	0		False	False	F8332= MV on line to PI	T8332		0.3	6.3
25	0	0		False	False	F8332= MV on fliter pot loop line	T8332		0.3	6.3
20	0	0		False	False	F8332= MV on line after PSV	T8332		0.3	6.3
18	0	0		False	False	T8332 TOP== MV on line headed from T8345	T8332		0.3	6.3
29	0	0		False	False	P8332== MV off line into Hazardous Waste line	T8332		0.3	9.4
19	0	0		False	False	T8332 TOP== MV off line headed from T8345	T8332		0.5	9.4
21	0	0		False	False	T8332 TOP== MV after PSV	T8332		0.4	9.4
18	0	0		False	False	T8332 TOP== MV on line to Waste	T8332		0.3	6.3
20	0	0		False	False	T8332 TOP== MV after PSV	T8332		0.5	9.4
12	0	0		False	False	T8332= MV on manifold above P8332	T8332		0.5	6.3
14	0	0		False	False	T8331 SIDE==VLV off PMP INTAKE to PI	T8331		0.1	1.6
15	0	0		False	False	T8331 SIDE==VLV off PMP INTAKE to PI	T8331		0.1	1.6
23	0	0		False	False	T8331 SIDE==VLV on PMP INTAKE	T8331		0.4	9.4
21	0	0		False	False	T8331 SIDE==Sample VLV off PMP INTAKE	T8331		0.4	9.4
20	0	0		False	False	T8331 SIDE==VLV off PMP DISC	T8331		0.2	3.1
22	0	0		False	False	T8331 SIDE==VLV on PMP DISC	T8331		0.4	9.4
19	0	0		False	False	T8331 SIDE==VLV off PMP DISC	T8331		0.3	6.3
46	0	0		False	False	T8331 SIDE==VLV on Tank DISC	T8331		0.3	12.6
28	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.3	9.4
22	0	0		False	False	T8331 SIDE==VLV off Tank DISC	T8331		0.1	3.1
17	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.4	6.3
18	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.3	6.3
18	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.3	6.3

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.2	3.1
14	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.1	1.6
34	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.2	6.3
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.4	6.3
39	0	0		False	False	T8331 SIDE==MV off Side Line to Filter	T8331		0.2	6.3
51	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.1	3.1
23	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.1	2.4
23	0	0		False	False	T8331 SIDE==MV off Line from Filter	T8331		0.1	2.4
18	0	0		False	False	T8331 SIDE==MV off Line from Filter	T8331		0.3	6.3
17	0	0		False	False	T8331 SIDE==MV off Line from Filter to PSV	T8331		0.1	2.4
17	0	0		False	False	T8331 SIDE==MV off Line after Blower	T8331		0.2	3.1
34	0	0		False	False	T8331 SIDE==MV onLine after Blower	T8331		0.1	4.7
17	0	0		False	False	T8331 SIDE==MV off Line after Blower	T8331		0.2	3.1
23	0	0		False	False	T8331 SIDE==MV onLine after Blower	T8331		0.2	4.7
125	0	0		False	False	T8331 SIDE==MV off Line from Filter to PSV	T8331		0.0	2.4
22	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.2	4.7
25	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.1	2.4
16	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.1	2.4
20	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.1	2.4
20	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.1	2.4
60	0	0		False	False	T8331 SIDE==MV on Line after PMP	T8331		0.1	4.7
51	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.2	9.4
16	0	0		False	False	T8331 SIDE==MV on Line after PMP	T8331		0.3	4.7
22	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.6	12.6
29	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.2	6.3
24	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.3	6.3
19	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.5	9.4
27	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.1	3.1
29	0	0		False	False	T8333 BOT==Sample VLV off PMP DISC Line	T8333		0.3	9.4
28	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.3	9.4
14	0	0		False	False	T8333 BOT==MV on PMP DISC Line to PI	T8333		0.1	1.6
24	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.1	3.1
57	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.1	3.1
20	0	0		False	False	T8333 BOT==MV on PMP DISC Line	T8333		0.5	9.4
17	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.1	2.4
24	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.1	3.1
18	0	0		False	False	T8333 BOT==OV on Tank DISC Line	T8333		0.3	6.3
20	0	0		False	False	T8333 BOT==MV on PMP DISC Line	T8333		0.5	9.4
20	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.3	6.3
19	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.5	9.4
28	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.3	9.4
45	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.2	9.4
17	0	0		False	False	MV off line to PI bleed	Boiler Trailer Unload		0.1	1.6

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
15	0	0		False	False	MV off line to PI off of pump loop line	Boiler Trailer Unload		0.1	1.6
14	0	0		False	False	MV off line to PI off of pump loop line	Boiler Trailer Unload		0.1	1.6
13	0	0		False	False	MV under PI	Boiler Trailer Unload		0.1	1.6
20	0	0		False	False	MV on pump loop line	Boiler Trailer Unload		0.5	9.4
15	0	0		False	False	MV on pump loop line	Boiler Trailer Unload		0.1	1.6
18	0	0		False	False	MV on line to Waste Unload/ Load	Boiler Trailer Unload		0.3	6.3
30	0	0		False	False	MV on pump loop line	Boiler Trailer Unload		0.3	9.4
32	0	0		False	False	MV on line to Supply	Boiler Trailer Unload		0.2	6.3
21	0	0		False	False	MV on line after flex hose	Boiler Trailer Unload		0.4	9.4
25	0	0		False	False	MV off line after flex hose	Boiler Trailer Unload		0.4	9.4
16	0	0		False	False	MV on line to Waste Unload/ Load	Boiler Trailer Unload		0.4	6.3
18	0	0		False	False	MV on line to PI off of line to Waste Unload/ Lo	Boiler Trailer Unload		0.3	6.3
18	0	0		False	False	MV on line to PSV off of line to Waste UnL/L	Boiler Trailer Unload		0.3	6.3
20	0	0		False	False	OV on top of trailer load	Boiler Trailer Unload		0.3	6.3
18	0	0		False	False	MV on top of trailer load	Boiler Trailer Unload		0.3	6.3
16	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
25	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
18	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
17	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
38	0	0		False	False	T8345 BOT==MV off PMP INTAKE Line	T8345		0.2	6.3
18	0	0		False	False	T8345 BOT==MV off PMP DISC Line to PI	T8345		0.1	1.6
17	0	0		False	False	T8345 BOT==SAMPLE VLV off PMP DISC Line	T8345		0.1	1.6
16	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
15	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.2	2.4
18	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.2	3.1
25	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
20	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
21	0	0		False	False	T8345 BOT==OV on Tank DISC Line	T8345		0.3	6.3
16	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
17	0	0		False	False	T8345 TOP==MV on Line to T8332	T8345		0.4	6.3
73	0	0		False	False	T8345 TOP==MV on PSV Line	T8345		0.1	6.3
46	0	0		False	False	T8345 BOT==MV on N2 bleed	T8345		0.1	3.1
17	0	0		False	False	T8345 BOT==MV on N2	T8345		0.2	3.1
40	0	0		False	False	T8332 TOP== MV on NZ line into the top of T8332	T8332		0.1	3.1
44	0	0		False	False	P8332== MV on loop line	T8332		0.2	9.4
21	0	0		False	False	T8332 TOP== MV from CV	T8332		0.3	6.3
22	0	0		False	False	T8332 TOP== MV from CV	T8332		0.9	18.8
23	0	0		False	False	T8332 TOP== MV other tanks	T8332		0.3	6.3
23	0	0		False	False	T8332 TOP== MV other tanks S of plat	T8332		0.3	6.3
45	0	0		False	False	T8332 TOP== MV other tanks	T8332		0.1	6.3
17	0	0		False	False	T8332 TOP== MV under CV	T8332		0.6	9.4
67	0	0		False	False	T8332 TOP== MV on line to T8331	T8332		0.1	6.3
11	0	0		False	False	T8332 TOP== MV east of catwalk bld	T8332		0.6	6.3

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
19	0	0		False	False	T8332 TOP== MV east of catwalk	T8332		0.3	6.3
16	0	0		False	False	T8332 TOP== MV under CV	T8332		0.6	9.4
12	0	0		False	False	T8332 TOP== MV on NZ line into the top of T8332	T8332		0.1	0.8
18	0	0		False	False	T8332 TOP== MV on line to T8331	T8332		0.5	9.4
17	0	0		False	False	F8332= MV on line to Hazardous Waste	T8332		0.4	6.3
26	0	0		False	False	T8332 TOP== MV off line to Waste	T8332		0.4	9.4
18	0	0		False	False	Boiler #4 SIDE==MV off Pot Line	B8394		0.3	6.3
16	0	0		False	False	Boiler #4 SIDE==MV bleed of waste fuel inlet before pots	B8394		0.1	1.6
17	0	0		False	False	Boiler #4 SIDE==MV off Pot Line	B8394		0.4	6.3
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==drain MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==drain MV off Pots	B8394		0.1	1.6
38	0	0		False	False	Boiler #4 SIDE==drain MV off Pots	B8394		0.0	1.6
22	0	0		False	False	Boiler #4 SIDE==MV off Relief Line	B8394		0.1	1.6
20	0	0		False	False	Boiler #4 SIDE==MV off Relief Line	B8394		0.1	1.6
28	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
16	0	0		False	False	Boiler #4 SIDE==MV on Relief Line	B8394		0.1	2.4
16	0	0		False	False	Boiler #4 SIDE==MV off Relief Line	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV on return to waste tanks	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV on Relief Line	B8394		0.2	2.4
16	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
27	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
29	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
36	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
15	0	0		False	False	Boiler #4 SIDE==MV off line from FV to waste return, bleed	B8394		0.1	1.6
16	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
27	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
15	0	0		False	False	Boiler #4 SIDE==MV off line from FV to waste return	B8394		0.1	1.6
33	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
20	0	0		False	False	Boiler #4 SIDE==MV off Pot Line	B8394		0.3	6.3
19	0	0		False	False	Boiler #4 SIDE==PCV after pots on way to boiler	B8394		0.1	1.6
17	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
16	0	0		False	False	Boiler #4 SIDE==MV off Pot Line to PI	B8394		0.1	1.6
18	0	0		False	False	T8331 TOP==MV on NZ Line	T8331		0.2	3.1
29	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.3	9.4
17	0	0		False	False	T8331 TOP==MV on LSH	T8331		0.1	1.6

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
18	0	0		False	False	T8331 TOP==MV on LSH	T8331		0.1	1.6
21	0	0		False	False	T8331 TOP==MV on FA Line	T8331		0.3	6.3
20	0	0		False	False	T8333 TOP==MV on NZ Line	T8333		0.2	4.7
20	0	0		False	False	T8333 TOP==MV on Drain Line	T8333		0.5	9.4
21	0	0		False	False	T8333 TOP==MV on FA Line	T8333		0.4	9.4
20	0	0		False	False	T8333 TOP==MV on LSV line	T8333		0.0	0.8
15	0	0		False	False	T8333 TOP==MV on LSV line	T8333		0.1	0.8
18	0	0		False	False	T8332 SIDE== MV into the side of T8335	T8332		0.3	6.3
18	0	0		False	False	T8332 SIDE== MV into the side of T8335	T8332		0.3	6.3
24	0	0		False	False	T8332 BOT== MV on line into the bottom of T8335	T8332		0.3	6.3
18	0	0		False	False	T8332 BOT== MV on line into the side of T8335	T8332		0.3	6.3
20	0	0		False	False	T8332= MV out the bottom of T8332 bleed	T8332		0.2	3.1
19	0	0		False	False	D8365 BOT= MV on line to P8332	T8332		0.3	6.3
18	0	0		False	False	D8365 BOT= MV on loop on side of D8365	T8332		0.3	6.3
17	0	0		False	False	D8365 BOT= MV off of loop line	T8332		0.4	6.3
22	0	0		False	False	P8332== MV off of line from D8365 to P8332	T8332		0.4	9.4
23	0	0		False	False	F8332= MV on line into sample pot	T8332		0.3	6.3
16	0	0		False	False	F8332= MV off line into sample pot(quick con)	T8332		0.4	6.3
23	0	0		False	False	F8332= MV out the top ot the sample pot	T8332		0.3	6.3
16	0	0		False	False	P8332== MV off line from SZ	T8332		0.4	6.3
18	0	0		False	False	P8332== MV off line from SZ	T8332		0.3	6.3
18	0	0		False	False	P8332== MV on line to Load/ Unload	T8332		0.3	6.3
20	0	0		False	False	P8332== MV off line to Load/ Unload	T8332		0.3	6.3
17	0	0		False	False	MV on line to PSV off of line to Waste UnL/L	Boiler Trailer Unload		0.4	6.3
16	0	0		False	False	MV on line to PI off of line to Waste Unload/ Lo	Boiler Trailer Unload		0.4	6.3
16	0	0		False	False	MV on line to Waste Unload/ Load	Boiler Trailer Unload		0.4	6.3
17	0	0		False	False	MV on line to Waste Unload/ Load	Boiler Trailer Unload		0.4	6.3
15	0	0		False	False	MV on pump loop line	Boiler Trailer Unload		0.1	1.6
16	0	0		False	False	MV off line to PI off of pump loop line	Boiler Trailer Unload		0.1	1.6
14	0	0		False	False	MV off line to PI off of pump loop line	Boiler Trailer Unload		0.1	1.6
15	0	0		False	False	MV off line to PI bleed	Boiler Trailer Unload		0.1	1.6
19	0	0		False	False	MV on pump loop line	Boiler Trailer Unload		0.5	9.4
19	0	0		False	False	MV on pump loop line	Boiler Trailer Unload		0.5	9.4
18	0	0		False	False	MV on line to Supply	Boiler Trailer Unload		0.3	6.3
19	0	0		False	False	MV on line after flex hose	Boiler Trailer Unload		0.5	9.4
20	0	0		False	False	MV off line after flex hose	Boiler Trailer Unload		0.5	9.4
21	0	0		False	False	MV under PI	Boiler Trailer Unload		0.1	1.6
18	0	0		False	False	OV on top of trailer load	Boiler Trailer Unload		0.3	6.3
17	0	0		False	False	MV on top of trailer load	Boiler Trailer Unload		0.4	6.3
16	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.4	6.3
20	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.6	12.6
18	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.3	6.3
20	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.5	9.4

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
20	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.5	9.4
16	0	0		False	False	T8333 BOT==MV off TANK DISC Line	T8333		0.2	3.1
16	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.1	2.4
13	0	0		False	False	T8333 BOT==MV on PMP DISC Line to PI	T8333		0.1	1.6
17	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.2	3.1
19	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.5	9.4
21	0	0		False	False	T8333 BOT==Sample VLV off PMP DISC Line	T8333		0.4	9.4
20	0	0		False	False	T8333 BOT==MV on PMP DISC Line	T8333		0.5	9.4
17	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.2	3.1
18	0	0		False	False	T8333 BOT==OV on Tank DISC Line	T8333		0.3	6.3
15	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.2	2.4
17	0	0		False	False	T8333 BOT==MV on Tank DISC Line	T8333		0.4	6.3
20	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.5	9.4
19	0	0		False	False	T8333 BOT==MV on TANK DISC Line	T8333		0.5	9.4
15	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.2	3.1
17	0	0		False	False	T8333 BOT==MV off PMP DISC Line	T8333		0.4	6.3
24	0	0		False	False	T8331 SIDE==VLV on PMP DISC	T8331		0.4	9.4
24	0	0		False	False	T8332 TOP== MV from CV	T8332		0.8	18.8
16	0	0		False	False	T8332 TOP== MV from CV	T8332		0.4	6.3
13	0	0		False	False	T8332 TOP== MV other tanks	T8332		0.5	6.3
23	0	0		False	False	T8332 TOP== MV other tanks	T8332		0.3	6.3
29	0	0		False	False	T8332 TOP== MV other tanks S of plat	T8332		0.2	6.3
23	0	0		False	False	T8332 TOP== MV under CV	T8332		0.4	9.4
27	0	0		False	False	T8332 TOP== MV east of catwalk	T8332		0.2	6.3
14	0	0		False	False	T8332 TOP== MV east of catwalk bld	T8332		0.4	6.3
24	0	0		False	False	T8332 TOP== MV under CV	T8332		0.4	9.4
16	0	0		False	False	T8345 TOP==MV on Line to T8332	T8345		0.4	6.3
16	0	0		False	False	T8345 TOP==MV on PSV Line	T8345		0.4	6.3
17	0	0		False	False	T8345 BOT==MV on N2 bleed	T8345		0.2	3.1
15	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.2	2.4
16	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.2	3.1
17	0	0		False	False	T8345 BOT==OV on Tank DISC Line	T8345		0.4	6.3
18	0	0		False	False	T8332 TOP== MV off line into the top of T8332	T8332		0.5	9.4
19	0	0		False	False	T8332 TOP== OV on line into the top of T8332	T8332		0.5	9.4
23	0	0		False	False	T8332 TOP== MV off line into the top of T8332	T8332		0.4	9.4
17	0	0		False	False	T8331 TOP==MV on FU Relief Line	T8331		0.2	3.1
17	0	0		False	False	T8331 TOP==LCV on FU Line	T8331		0.4	6.3
18	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.3	6.3
18	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.3	6.3
20	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.3	6.3
15	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.2	2.4
16	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
16	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
16	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
17	0	0		False	False	T8331 SIDE==VLV off PMP DISC	T8331		0.4	6.3
16	0	0		False	False	T8331 SIDE==VLV off PMP DISC	T8331		0.2	3.1
19	0	0		False	False	T8331 SIDE==VLV on PMP DISC	T8331		0.5	9.4
19	0	0		False	False	T8331 SIDE==VLV on PMP INTAKE	T8331		0.5	9.4
19	0	0		False	False	T8331 SIDE==Sample VLV off PMP INTAKE	T8331		0.5	9.4
17	0	0		False	False	T8331 SIDE==VLV off PMP INTAKE to PI	T8331		0.1	1.6
14	0	0		False	False	T8331 SIDE==VLV off PMP INTAKE to PI	T8331		0.1	1.6
20	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.5	9.4
20	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.5	9.4
21	0	0		False	False	T8331 SIDE==VLV on Tank DISC	T8331		0.6	12.6
19	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.5	9.4
15	0	0		False	False	T8331 SIDE==VLV off Tank DISC	T8331		0.2	3.1
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.4	6.3
19	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.3	6.3
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.2	3.1
17	0	0		False	False	T8331 SIDE==MV off Side Line to Filter	T8331		0.4	6.3
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.4	6.3
13	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.1	1.6
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.2	3.1
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.4	6.3
16	0	0		False	False	T8331 SIDE==MV off Side Line	T8331		0.4	6.3
19	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.5	9.4
15	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.2	2.4
14	0	0		False	False	T8331 SIDE==MV off Line from Filter	T8331		0.2	2.4
16	0	0		False	False	T8331 SIDE==MV off Line after Blower	T8331		0.2	3.1
16	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.1	2.4
17	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.1	2.4
16	0	0		False	False	T8331 SIDE==MV on Line after PMP	T8331		0.3	4.7
16	0	0		False	False	T8331 SIDE==MV on Line after PMP	T8331		0.3	4.7
16	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.3	4.7
14	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.2	2.4
15	0	0		False	False	T8331 SIDE==MV off Line after PMP	T8331		0.2	2.4
15	0	0		False	False	T8331 SIDE==MV off Line after Blower	T8331		0.2	3.1
16	0	0		False	False	T8331 SIDE==MV onLine after Blower	T8331		0.3	4.7
16	0	0		False	False	T8331 SIDE==MV onLine after Blower	T8331		0.3	4.7
14	0	0		False	False	T8331 SIDE==MV off Line from Filter to PSV	T8331		0.2	2.4
15	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.2	2.4
16	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.1	2.4
16	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.1	2.4
23	0	0		False	False	T8331 SIDE==MV off Line from Filter	T8331		0.3	6.3
15	0	0		False	False	T8331 SIDE==MV off Line from Filter to PSV	T8331		0.2	2.4
16	0	0		False	False	T8332 SIDE== MV into the side of T8335	T8332		0.4	6.3

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
16	0	0		False	False	T8332 SIDE== MV into the side of T8335	T8332		0.4	6.3
16	0	0		False	False	T8332 BOT== MV on line into the bottom of T8335	T8332		0.4	6.3
17	0	0		False	False	T8332 BOT== MV on line into the side of T8335	T8332		0.4	6.3
19	0	0		False	False	T8332= MV out the bottom of T8332 bleed	T8332		0.2	3.1
16	0	0		False	False	D8365 BOT= MV on line to P8332	T8332		0.4	6.3
16	0	0		False	False	D8365 BOT= MV on loop on side of D8365	T8332		0.4	6.3
16	0	0		False	False	D8365 BOT= MV off of loop line	T8332		0.4	6.3
15	0	0		False	False	D8365 TOP== MV on the end of the loop line	T8332		0.4	6.3
17	0	0		False	False	D8365 TOP== MV on line back into D8365 from loop	T8332		0.4	6.3
19	0	0		False	False	P8332== MV off of line from D8365 to P8332	T8332		0.5	9.4
22	0	0		False	False	P8332== MV on loop line	T8332		0.4	9.4
16	0	0		False	False	P8332== MV off line from SZ	T8332		0.4	6.3
18	0	0		False	False	P8332== MV off line from SZ	T8332		0.3	6.3
19	0	0		False	False	P8332== MV on line to Recirculation	T8332		0.3	6.3
16	0	0		False	False	P8332== MV on line to Waste	T8332		0.4	6.3
23	0	0		False	False	P8332== Sample Valve on line to Waste	T8332		0.3	6.3
16	0	0		False	False	P8332== MV on line from 702	T8332		0.4	6.3
16	0	0		False	False	P8332== MV on line to Load/Unload	T8332		0.4	6.3
15	0	0		False	False	T8332= MV on line to PSV	T8332		0.2	2.4
19	0	0		False	False	P8332== MV off line to Grade on line to PI	T8332		0.5	9.4
19	0	0		False	False	P8332== MV on line to Grade	T8332		0.5	9.4
19	0	0		False	False	P8332== MV off line to Grade	T8332		0.5	9.4
16	0	0		False	False	P8332== MV off line to Load/ Unload	T8332		0.4	6.3
17	0	0		False	False	P8332== MV on line to Load/ Unload	T8332		0.4	6.3
18	0	0		False	False	P8332== MV off line to Load/ Unload	T8332		0.3	6.3
16	0	0		False	False	T8332= MV of manifold above P8332	T8332		0.4	6.3
19	0	0		False	False	P8332== MV on line into Hazardous Waste line	T8332		0.5	9.4
20	0	0		False	False	P8332== MV off line into Hazardous Waste line	T8332		0.5	9.4
16	0	0		False	False	F8332= MV out the top ot the sample pot	T8332		0.4	6.3
16	0	0		False	False	F8332= MV on line into sample pot	T8332		0.4	6.3
17	0	0		False	False	F8332= MV off line into sample pot(quick con)	T8332		0.4	6.3
16	0	0		False	False	F8332= MV on line to PSV	T8332		0.4	6.3
17	0	0		False	False	F8332= MV on fliter pot loop line	T8332		0.4	6.3
17	0	0		False	False	F8332= MV on line out the bottom of F8332	T8332		0.4	6.3
15	0	0		False	False	F8332= MV out the bottom of F8332	T8332		0.4	6.3
17	0	0		False	False	F8332= MV on line to Hazardous Waste	T8332		0.4	6.3
16	0	0		False	False	F8332= MV on line to PI	T8332		0.4	6.3
17	0	0		False	False	F8332= MV on line to Hazardous Waste	T8332		0.4	6.3
16	0	0		False	False	F8332= MV on fliter pot loop line	T8332		0.4	6.3
18	0	0		False	False	F8332= MV on line after PSV	T8332		0.3	6.3
19	0	0		False	False	P8332== MV on line into Hazardous Waste line	T8332		0.5	9.4
17	0	0		False	False	T8332 TOP== MV on line headed from T8345	T8332		0.4	6.3
19	0	0		False	False	P8332== MV off line into Hazardous Waste line	T8332		0.5	9.4

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
19	0	0		False	False	T8332 TOP== MV off line headed from T8345	T8332		0.5	9.4
19	0	0		False	False	T8332 TOP== MV after PSV	T8332		0.5	9.4
19	0	0		False	False	T8332 TOP== MV off line to Waste	T8332		0.5	9.4
19	0	0		False	False	T8332 TOP== MV after PSV	T8332		0.5	9.4
17	0	0		False	False	T8332 TOP== MV on line to Waste	T8332		0.4	6.3
16	0	0		False	False	T8332= MV on manifold above P8332	T8332		0.4	6.3
18	0	0		False	False	P8332== MV on line to Load/ Unload	T8332		0.3	6.3
22	0	0		False	False	T8333 TOP==MV on NZ Line	T8333		0.2	4.7
20	0	0		False	False	T8333 TOP==MV on FA Line	T8333		0.5	9.4
20	0	0		False	False	T8333 TOP==MV on Drain Line	T8333		0.5	9.4
13	0	0		False	False	T8333 TOP==MV on LSV line	T8333		0.1	0.8
15	0	0		False	False	T8333 TOP==MV on LSV line	T8333		0.1	0.8
18	0	0		False	False	T8331 TOP==MV on FA Line	T8331		0.3	6.3
15	0	0		False	False	T8331 TOP==MV on NZ Line	T8331		0.2	3.1
19	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.5	9.4
15	0	0		False	False	T8331 TOP==MV on LSH	T8331		0.1	1.6
13	0	0		False	False	T8331 TOP==MV on LSH	T8331		0.1	1.6
16	0	0		False	False	T8332 TOP== MV on line to T8331	T8332		0.4	6.3
15	0	0		False	False	T8332 TOP== MV on NZ line into the top of T8332	T8332		0.2	3.1
30	0	0		False	False	T8332 TOP== MV on line into the top of T8332	T8332		0.3	9.4
20	0	0		False	False	T8332 TOP== MV on line from P9331A to tank	T8332		0.3	6.3
18	0	0		False	False	T8332 TOP== MV on line from Boiler to tank	T8332		0.3	6.3
23	0	0		False	False	T8332 TOP== MV on line to Waste	T8332		0.4	9.4
24	0	0		False	False	T8332 TOP== MV on line from P9331A	T8332		0.4	9.4
20	0	0		False	False	T8332 TOP== MV on line from P9331A	T8332		0.3	6.3
20	0	0		False	False	T8332 TOP== MV on line to T8331	T8332		0.5	9.4
14	0	0		False	False	T8332 TOP== MV on NZ line into the top of T8332	T8332		0.1	0.8
21	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
17	0	0		False	False	T8345 BOT==MV off PMP INTAKE Line	T8345		0.4	6.3
17	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
17	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
17	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
15	0	0		False	False	T8345 BOT==MV off PMP DISC Line to PI	T8345		0.1	1.6
19	0	0		False	False	T8345 BOT==SAMPLE VLV off PMP DISC Line	T8345		0.1	1.6
17	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
16	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.4	6.3
16	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.1	2.4
16	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.2	3.1
19	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
18	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
15	0	0		False	False	T8345 BOT==MV on N2	T8345		0.2	3.1
19	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.3	6.3
36	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.2	6.3

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
37	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.2	6.3
34	0	0		False	False	T8331 TOP==LCV on FU Line	T8331		0.2	6.3
36	0	0		False	False	T8331 TOP==MV on FU Line	T8331		0.2	6.3
39	0	0		False	False	T8331 TOP==MV on FU Relief Line	T8331		0.1	3.1
36	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.3	9.4
31	0	0		False	False	T8331 SIDE==VLV on PMP DISC	T8331		0.3	9.4
29	0	0		False	False	T8331 SIDE==MV off Side	T8331		0.3	9.4
37	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.1	2.4
31	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.1	2.4
38	0	0		False	False	T8331 SIDE==MV off Line from Filter after PSV	T8331		0.1	2.4
36	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
34	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
44	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
38	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
40	0	0		False	False	T8333 BOT==MV off Tank DISC Line	T8333		0.1	2.4
33	0	0		False	False	T8333 BOT==MV on Tank DISC Line	T8333		0.2	6.3
35	0	0		False	False	T8345 BOT==MV on Tank DISC Line	T8345		0.2	6.3
30	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.1	3.1
38	0	0		False	False	T8345 BOT==MV off Tank DISC Line	T8345		0.1	2.4
16	0	0		False	False	Boiler #4 SIDE==MV off Pot Line	B8394		0.4	6.3
15	0	0		False	False	Boiler #4 SIDE==MV bleed of waste fuel inlet before pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
13	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
13	0	0		False	False	Boiler #4 SIDE==drain MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==drain MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==drain MV off Pots	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pots	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV off Relief Line	B8394		0.1	1.6
13	0	0		False	False	Boiler #4 SIDE==MV off Relief Line	B8394		0.1	1.6
20	0	0		False	False	Boiler #4 SIDE==MV off Relief Line	B8394		0.1	1.6
16	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
14	0	0		False	False	Boiler #4 SIDE==MV off line from FV to waste return	B8394		0.1	1.6
14	0	0		False	False	Boiler #4 SIDE==MV on Relief Line	B8394		0.2	2.4
24	0	0		False	False	Boiler #4 SIDE==MV on return to waste tanks	B8394		0.1	1.6
16	0	0		False	False	Boiler #4 SIDE==MV on Relief Line	B8394		0.1	2.4
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
16	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
16	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4

ScanSeconds	Longitude	Latitude	Altitude	SatellitesFixed	BarcodeScanned	LocationDescription	Property	FeetFromPrev	ScanSpeed	Circumference
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
14	0	0		False	False	Boiler #4 SIDE==MV off line from FV to waste return, bleed	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
16	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.1	2.4
16	0	0		False	False	Boiler #4 SIDE==PCV after pots on way to boiler	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV off Pot Line to PI	B8394		0.1	1.6
15	0	0		False	False	Boiler #4 SIDE==MV on Purge PMP Line	B8394		0.2	2.4
17	0	0		False	False	Boiler #4 SIDE==MV off Pot Line	B8394		0.4	6.3
18	0	0		False	False	Boiler #4 SIDE==MV off Pot Line	B8394		0.3	6.3
41	0	0	0	False	False	T8332= TOP Below PSV North of tank	T8332		0.2	6.3
28	0	0	0	False	False	T8332= TOP After PSV North of tank	T8332		0.2	6.3
34	0	0	0	False	False	T8332 TOP== MV on line into the top of T8332	T8332		0.3	9.4
41	0	0	0	False	False	T8332 TOP== OV on line into the top of T8332	T8332		0.2	9.4
50	0	0	0	False	False	T8332 TOP== MV off line into the top of T8332	T8332		0.2	9.4
37	0	0	0	False	False	T8332 TOP== MV off line into the top of T8332	T8332		0.3	9.4
35	0	0	0	False	False	D8365 TOP== MV on the end of the loop line	T8332		0.2	6.3
33	0	0	0	False	False	D8365 TOP== MV on line back into D8365 from loop	T8332		0.2	6.3
35	0	0	0	False	False	T8332= After PSV	T8332		0.1	3.1
33	0	0	0	False	False	F8332= MV off line into sample pot(quick con)	T8332		0.2	6.3
27	0	0	0	False	False	P8332== MV on line to Load/Unload	T8332		0.2	6.3
34	0	0	0	False	False	T8331 TOP==MV on FU Relief Line	T8331		0.1	2.4
43	0	0	0	False	False	T8345 BOT==Bleed on pump inlet	T8345		0.1	3.1
31	0	0	0	False	False	MV under PI	Boiler Trailer Unload		0.2	6.3

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SECTION O
SUBPART CC AIR EMISSION STANDARDS
[40 CFR 264.1080-.1090; SC R.61-79.264.1080-.1090]

O.1 Applicability (40 CFR 264.1080)

SI Group has four aboveground waste storage, blend, and feed tanks (T-100M-5, T-30M-61, T-30M-66, and T10M-32) and < 90-day tanks and containers (including tank trucks/trailers) that are subject to these regulations because the concentration of volatile organics (VO) in the waste in these tanks and containers can exceed 500 parts per million by weight (ppmw). SI Group takes a conservative approach and estimates that the VO concentration of the waste in each of the tanks and containers exceeds 500 ppm. The four tanks are equipped with fixed roofs and vent to a closed system which is controlled by a flare (Stack ID E-8332). Less <90-day tanks and containers comply with large quantity generator standards in 40 CFR 262 and 40 CFR 265; <90-day storage activities are described in Section B of this Application.

The four waste storage tanks have losses during the filling of the tanks and breathing losses due to temperature changes during storage of the waste.

O.2 Standards: General (40 CFR 264.1082)

O.2.a Applicability (40 CFR 264.1082(a)

SI Group has four aboveground waste storage, blend, and feed tanks (T-100M-5, T-30M-61, T-30M-66, and T10M-32) subject to these regulations due to the fact that the concentration of VO in the waste can exceed 500 ppmw.

O.2.b Control of Air Pollutant Emissions (40 CFR 264.1082(b))

The waste gases from the four waste storage tanks are vented into a closed-vent system which routes gases and vapors to a flare (E-8832) in accordance with 40 CFR 270.27(a)(5) and 40 CFR 264.1087(b).

O.2.c Exemptions (40 CFR 264.1082(c))

O.2.c.1 (40 CFR 264.1082(c)(1))

This exemption is not applicable because the concentration of VO in the waste in the four waste storage tanks can exceed 500 ppmw.

O.2.c.2 (40 CFR 264.1082(c)(2))

This exemption is not applicable.

O.2.c.3 (40 CFR 264.1082(c)(3))

This exemption is not applicable.

O.2.c.4 (40 CFR 264.1082(c)(4))

This exemption is not applicable.

O.2.c.5 (40 CFR 264.1082(c)(5))

This exemption is not applicable.

O.2.d (40 CFR 264.1082(d))

This section is not applicable because SI Group is not requesting any applicable exemptions.

O.3 Waste Determination Procedures (40 CFR 264.1083)

This section is not applicable because SI Group is not requesting exemptions from Subpart CC requirements.

O.4 Standards: Tanks (40 CFR 264.1084)

O.4.a (40 CFR 264.1084(a))

The provisions of this section apply to the control of air pollutant emissions from tanks for which 40 CFR 264.1082(b) of this subpart references the use of this section for such air emission control. SI Group has four aboveground waste storage, blend, and feed tanks that are subject to these regulations.

O.4.b (40 CFR 264.1084(b)(1))

SI Group complies with the requirements of 40 CFR 264.1084(b)(2) (Level 2 Controls); therefore, the Level 1 control requirements are not applicable.

O.4.b.1 (40 CFR 264.1084(b)(2))

SI Group uses Level 2 controls for the storage tanks.

O.4.c (40 CFR 264.1084(c))

This section is not applicable because the facility uses Level 2 controls.

O.4.d (40 CFR 264.1084(d)(1) through (3))

SI Group uses Level 2 controls for the storage tanks, which are equipped with fixed roofs. The waste gases from the four waste storage tanks are vented into a closed-vent system which routes

gases and vapors to a flare. Please see Section D of this permit application for descriptions of the tanks. Also refer to the 2003 Permit Application that contained Professional Engineer certification.

O.4.d.1 (40 CFR 264.1084(d)(4))

The facility does not use a pressure tank; therefore, this section is not applicable.

O.4.d.2 (40 CFR 264.1084(d)(5))

This section is not applicable to the facility.

O.4.e (40 CFR 264.1084(e))

This section is not applicable to the facility because it applies to tanks with fixed roofs with an internal floating roof and the facility does not have this configuration.

O.4.f (40 CFR 264.1084(f))

This section is not applicable to the facility because it applies to tanks with external floating roofs and the facility does not have this configuration.

O.4.g (40 CFR 264.1084(g))

This section is applicable to the facility. The tanks are equipped with fixed roofs and the waste gases from the four waste storage tanks are vented into a closed-vent system which routes gases and vapors to a flare. The closed vent system is designed so that it meets the design requirements in 40 CFR 270.27(a) and 40 CFR 264.1087(c)(1)(iii)) which lists a flare as an allowable control device.

Annual monitoring and inspection is conducted as required as part of the Leak Detection and Repair Program, discussed in Section N of this application.

O.4.g.1 (40 CFR 264.1084(g)(1))

The tanks are covered by a fixed roof and vented directly through a closed-vent system to a control device; the fixed roof and associated closure devices are designed to form a barrier over the entire surface area of the liquid in the tanks.

The closed vent system is designed and installed to meet the requirements as outlined in 40 CFR 264.1033(d). A copy of the manufacturer's specifications is in Appendix O-1.

O.4.g.2 (40 CFR 264.1084(g)(2))

The closed vent system is designed and installed to meet the design requirements as outlined in 40 CFR 264.1033(d).

O.4.g.3 (40 CFR 264.1084(g)(3))

In addition to daily tank inspections, the four storage tanks are inspected annually by the maintenance department for signs of visible cracks, holes, or gaps in the roof sections or between the roof and tank wall; broken/cracked or otherwise damaged seals and/or gaskets; broken/missing hatches/access covers, caps, or other closure devices for compliance the RCRA Organic Emissions Standards for tanks. The inspection records are maintained in the Maintenance Connect Software. Detailed information regarding the tank inspections is in Section F.2.1.4 and Appendices F-1 and F-3 of this application.

The initial leak detection monitoring of the closed vent was completed and is maintained in the LeakDAS database. Annual inspections of the closed vent system are conducted including use of Method 21 No Detectable Emissions Protocol. An emission in excess of 500 ppmw is addressed by initiating repairs within 5 days of detection. Repairs are completed within 15 days of detection. The LDAR technician performs annual visual inspections of the closed vent system joints, seams, or other connections that are permanently or semi-permanently sealed. The documentation of the inspections is also maintained in the LeakDas database. Additional information regarding LDAR inspections is in Section N of this application.

O.4.h (40 CFR 264.1084(h))

This section is not applicable because the facility does not use pressure tanks to control air pollutant emissions.

O.4.i (40 CFR 264.1084(i))

This section is not applicable because the facility does not use an enclosure vented through a closed-vent system to an enclosed combustion control device to control air pollutant emissions.

O.4.j (40 CFR 264.1084(j)(1))

Hazardous waste is transferred to the tanks in hard-piping or other closed systems to prevent exposure of the hazardous waste to the atmosphere. Figure D.9-1 in this application shows the piping diagrams for the storage tanks.

O.4.k (40 CFR 264.1084(k))

Required inspections, monitoring, and associated corrections of any leaks are completed as part of the LDAR Program, discussed in Section N of this application. Site-specific procedures state that a first attempt to repair the leak must occur no later than 5 calendar days after detection but must be completed no later than 15 days after detection.

Site-specific procedures state that a first attempt to repair a defect found during an inspection must occur no later than 5 calendar days after detection and must be completed no later than 45 calendar days after detection, except as provided in paragraph K(2) of the regulation.

O.4.l (40 CFR 264.1084(l))

This is covered as part of the LDAR Program, discussed in Section N of this application.

O.5 Standards: Surface Impoundments (40 CFR 264.1085)

This section is not applicable because there are no surface impoundments at the facility that require control of air pollutant emissions.

O.6 Standards: Containers (40 CFR 264.1086)

Facility-owned containers (trailers) used to transfer wastes to the four waste storage tanks are monitored using vapor pressure tightness tests. Plantwide procedure OB62308 (in Appendix N-1) describes how the facility monitors waste containers for air pollution emissions.

O.7 Closed Vent Systems (40 CFR 264.1087)

O.7.a Closed Vent System Control (40 CFR 264.1087(a) and (b))

The waste gases from the four waste storage tanks are vented into a closed-vent system which routes gases and vapors to a flare (E-8832) in accordance with 40 CFR 270.27(a)(5) and 40 CFR 264.1087(b). The closed vent system is designed so that it meets the design requirements in 40 CFR 270.27(a) and 40 CFR 264.1087(c)(1)(iii) which lists a flare as an allowable control device.

In accordance with 40 CFR 264.1087(c)(1)(i), the flare must be designed and operated to reduce the total organic content by at least 95 percent by weight. The flare must be designed and operated in accordance with the requirements of 40 CFR 264.1033(d). Additionally, the facility's Title V permit lists multiple requirements for the flare.

The unit has bypass valves which are car sealed in the closed position and can only be opened manually. The valves are inspected monthly to ensure they are kept in the closed position. See inspection form in F-2 "Automatic Waste Feed Cutoff Log."

O.7.b Closed Vent System Control Device (40 CFR 264.1087(c)(1))

As stated above, the facility utilizes a flare to control the emissions from the four waste storage tanks.

O.7.b.1 Standards: Closed-Vent Systems and Control Devices (40 CFR 264.1033(d))

O.7.b.1(a) Visible Emissions (40 CFR 264.1033(d)(1))

The flare is designed and operated with no visible emissions as determined by Method 22 in 40 CFR 60, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours. The facility has conducted a Method 22 reading and documentation is maintained onsite.

O.7.b.1(b) Flame Present (40 CFR 264.1033(d)(2))

The flare is equipped with a temperature probe monitor that alarms if the temperature falls to below 700 degrees F. The continuous recordings are recorded on a circular log chart every 84 seconds. Instantaneous readings are also taken every 6 hours and recorded on the Boiler Log sheet and logged in the PI manual logger.

O.7.b.1(c) Net Heating Value (40 CFR 264.1033(d)(3) and (e)(2))

The average heat value of the vent gases is calculated on an annual basis based on the average waste compositions. The net heating value of gas being combusted for non-assisted flares must be 200 British Thermal Units per standard cubic foot or greater. The 2016 and 2017 calculations indicate the net heating value is greater than 200 British Thermal Units per standard cubic foot. Copies of the 2016 and 2017 calculations are included in Appendix O-2.

O.7.b.1(d) Exit Gas Velocity (40 CFR 264.1033(d)(4))

The exit gas velocity for the flare is calculated as 3.33 feet per second, which is less than the 60 feet per second requirements. The exit gas velocity calculation is in Appendix O-3.

O.7.b.1(e) Flow Monitoring (40 CFR 264.1033(f)(1))

The flow meter records the vent stream flow on an hourly basis. The alarm and data prints out on a circular chart.

O.7.b.2 Design and Operating Requirements (40 CFR 264.1087(c)(2))

Logs of maintenance downtime are kept to verify it does not exceed 240 hours per year. The maintenance department records planned anticipated future maintenance for the next 6 months for the flare/closed vent system. These documents are kept in the maintenance planning records.

O.7.b.3 Carbon Absorption System Operating Requirements (40 CFR 264.1087(c)(3))

This is section is not applicable because SI does not use a carbon absorption system to comply with the requirements of this regulation.

O.7.b.4 Other Control Device Operating Requirements (40 CFR 264.1087(c)(4))

This is section is not applicable because SI uses a flare to comply with the requirements of this regulation.

O.7.b.5 Design and Operating Requirements (40 CFR 264.1087(c)(5)(i)(A) and (c)(5)(ii) through (c)(5)(v))

SI has had numerous performance tests conducted on the flare. Records of test results are maintained by SI Group, and can be provided if necessary.

O.8 Inspection and Monitoring Requirements (40 CFR 264.1088)

The Boiler No. 4 General Inspection Plan meets the requirements of 40 CFR 264.1088. A copy of the plan is included in Appendix F-3 of this Application.

O.9 Recordkeeping Requirements (40 CFR 264.1089)

SI group will keep records of the stack test results, hazardous waste determinations, calculations, daily flare inspections, and opacity readings for a period of 3 years. Records will be kept in the Environmental File Room.

O.10 Reporting Requirements (40 CFR 264.1090)

SI group must provide reports to the Regional Administrator for each occurrence when the hazardous waste stored in the tank is not in compliance with the conditions listed in 40 CFR 264.1084(b). The written report must be submitted within 15 calendar days of the time SI Group became aware of the occurrence. The report must include the following information:

- The facility's United States Environmental Protection Agency ID number
- Facility name and address
- Description of the noncompliance, including:

- the cause
- the dates of noncompliance
- the actions taken to correct the issue and prevent recurrences

- Signed and dated by authorized representative

A semi-annual written report must be submitted to the Regional Administrator when either the following occurred:

- The flare operated out of compliance of the applicable operating values in 40 CFR 264.1035(c)(4) continuously for 24 hours or longer

- The flare operated with visible emissions for 5 minutes or longer in a 2-hour period

The report must describe each occurrence during the previous 6-month period

If the flare operated in compliance with all applicable regulations during the semi-annual period, a report is not required to be submitted.

This report has to describe each occurrence during the semiannual period.

O.11 Emissions Monitoring Plan Reporting Requirements (40 CFR 270.27(a)(6))

The SI Group uses the Boiler No. 4 General Inspection Plan and Leak Detection and Repair Program to meet the requirements of this regulation. A copy of the Boiler No. 4 General Inspection Plan is included in Appendix F-3 and a copy of the Leak Detection and Repair Program is in Appendix N-1.

Appendix O-1
Manufacturing Specifications

FAX TRANSMITTAL FORM

JOHN ZINK COMPANY

A Division of Koch Engineering Company, Inc.
P.O. Box 21220
Tulsa, OK 74121-1220

DELIVER TO:	Stacy Balzegar	**DATE:**	July 9, 1997
COMPANY:	Albemarle Corporation		
FAX NUMBER:	(803) 539-5130		
TOTAL PAGES:	1		
SENDER'S NAME:	John Bellovich	**MSG. NO.:**	JZ-AC-03
YOUR REFERENCE:	Flare	**OUR REFERENCE:**	FS-2711 rev 1.
FAX COPIES TO:			
OFFICE COPIES TO:			

IF MISSENT, PLEASE TELEPHONE 918 234-5302. THIS MESSAGE IS BEING SENT FROM RAPICOM 918 234-1986.

Dear Mr. Balzegar:

Per our phone conversation, you had mentioned that for permitting purposes, your company needs a 95% destruction efficiency on VOCs. If a flare is properly designed and operated, the destruction efficiencies are around 98%. For your particular application, if the LHV of your waste gas is, at a minimum, 300 Btu/SCF and the flow rate does not exceed the 250 #/hr, the destruction efficiency will be 95% or greater.

Contact me if you have any questions.

Sincerely,

John Bellovich
Flare Applications

FAX TRANSMITTAL FORM

JOHN ZINK COMPANY

A Division of Koch Engineering Company, Inc.
P.O. Box 21220
Tulsa, OK 74121-1220

DELIVER TO:	Stacy Balzegar	**DATE:**	April 30, 1997
COMPANY:	Albemarle Corporation		
FAX NUMBER:	(803) 539-5130		
TOTAL PAGES:	13		
SENDER'S NAME:	John Bellovich Ext. 5816	**MSG. NO.:**	JZ-AC-02
YOUR REFERENCE:	Flare	**OUR REFERENCE:**	FS-2711 rev 1.
FAX COPIES TO:			
OFFICE COPIES TO:			

IF MISSENT, PLEASE TELEPHONE 918 234-5802. THIS MESSAGE IS BEING SENT FROM RAPICOM 918 234-1986.

Thank you for considering the John Zink Company. Based upon the information contained in your inquiry, we are pleased to offer the following equipment:

DESIGN CRITERIA

1.	Flow Rate:	250 #/hr.
2.	Molecular Weight:	32
3.	Temperature:	104 °F
4.	Pressure Available:	5" wc
5.	Composition:	0-200 #/hr Nitrogen 0-50 #/hr Organic Vapors (50% toluene, 30% hexane, misc. VOCs)

EQUIPMENT DESCRIPTION

Item I, Elevated Integrated Flare System

One (1) Self Supported Flare Stack, to provide for an overall system height of 30' when connected to the flare tip (Item II). A 3" flanged connection is provided on the stack inlet. A data sheet is attached.

The riser will be in 1 section (plus flare tip) suitable for shipment and match marked for field welding. The following items are included:

One (1) John Zink Model EEF-U-3 Flare Tip (Item II)

One (1) John Zink Model (AR-3) Purge Reduction Device (Item III)

One (1) 12 diameter (approx.) waste gas riser

One (1) lot of 1" pilot gas and 1" ignition piping from flare tip to near grade.

One (1) lot of 1" conduit and thermocouple wire from flare tip to near grade.

One (1) Automatic/Explosionproof Pilot Ignition Panel (FFG, Item IV). With 4-20 mA output.

All piping is provided to 10' above grade.

Riser Material: A-36 type carbon steel or equal.

Paint: SSP-SP-6 sandblast with one shop coat of inorganic zinc primer.

The structural design is in accordance with AISC for 125 MPH winds per ASCE 7-88.

Welding per AWS.

UTILITIES REQUIRED

1.	Pilot Gas:	50 SCFH of Natural Gas at 10 PSIG per pilot
2.	Ignition Gas:	150 SCFH of Natural Gas at 15 PSIG during ignition (intermittent)
3.	Ignition Air:	1500 SCFH of air at 15 PSIG during ignition (intermittent)
4.	Ignition Power:	110 Volt, 60 Cycle, 1 phase (intermittent)
5.	Continuous purge gas:	10 SCFH (with AR-3 Purge Reduction device, Item III)

Note: Purge gas can be any gas that will not go to dew point in ambient conditions and does not contain oxygen

SPECIFICATION SUMMARY

The following specifications apply to this equipment.

1. Welding - AWS
2. Weld Examination & Testing - AWS
3. Structural Mechanical Design - AISC
4. Piping per John Zink Standards A63, B62 except as noted.
5. Wind Loads - ASCE 7-88, 125 MPH
6. Earthquake Load - ASCE 7-88, Zone 2

If customer specifications call for submittal of calculations for review John Zink Company does not agree to submit such calculations unless specifically agreed to elsewhere in this proposal.

All dimensions, material thickness, etc. in this proposal are preliminary and subject to modification, in compliance with specifications, after final engineering.

Unless specifically defined in this proposal or the inquiry package, all nozzles on vessels, stacks, etc. will not be designed to accept loads from piping, or other external forces.

The following items are specifically not included in this proposal:

1. Foundation Design
2. Installation
3. Startup
4. Utilities
5. Auxiliary Piping

PRICING - BASE BID

1. Items I - IV, Elevated Flare System

Total **$13,900.00**

Note: All prices are F.O.B. Point of Manufacture, (unless otherwise specified Tulsa or Skiatook, Oklahoma for U.S. fabrication)

This bid is void after thirty (30) days.

WEIGHTS AND CUBAGES

Item No.	Estimated Shipping Weight (pounds)	Volume (cubic feet)
I - IV	1600	350

TERMS AND CONDITIONS OF SALE

1. **Terms:** This proposal and the price quoted is based upon John Zink Company's Standard Terms and Conditions of Sale.

2. **Payment:** Payment due 100% at time of shipment or certification that good are ready for shipment.

3. Price includes five (5) prints or one (1) sepia of approval drawings, five (5) prints or one (1) sepia of final drawings and five (5) copies of the Operation Manual, unless otherwise specified. Additional copies of the above items will be furnished at $2.00 per print and $4.00 per sepia. The price for additional Operating Manuals will be based on the complexity of the specific equipment.

   Changes required by the Buyer or its agents after the initial drawing review may result in delays and additional engineering or drafting costs. Such costs, together with increases in fabrication costs that will result from these changes, will be presented to you and must be approved before work commences.

   Refer to Attachment A to this proposal for additional pricing information.

4. Our scope of supply is limited to the equipment and services described in this proposal.

   Our statements concerning equipment design and sizing, materials of construction and manufacturer of individual items of equipment have been made solely to prepare this proposal for your evaluation. Our offer is also based on locating equipment and connections at lowest cost. Any client-preferred locations or conditions not included with the bid specification may affect price. In the event of an order, after detailed engineering, we reserve the right to size and select materials and equipment other than that itemized in order to produce an equipment best designed to meet the customer's specified requirements. We would, of course, advise you of such changes in a timely manner.

5. Unless otherwise stated, any utility piping and conduit of 2" nominal diameter or smaller will be shipped loose in random lengths with mill finish.

DELIVERY

1. Drawings will be submitted for approval 4-6 weeks after receipt of order and all required process and mechanical specifications and information.

2. Shipment can be made 6-8 weeks after receipt of final approved drawings. Any changes made during the drawing approval process and after approval is received, may result in a price change and extension of the shipment schedule.

3. Firm delivery schedule will be established upon receipt of purchase order and is dependent upon shop loading.

CLARIFICATION TO TERMS AND CONDITIONS

1. John Zink Company is submitting this price and technical proposal only with the understanding and condition, that any resulting order shall be based upon mutually agreed upon terms and conditions negotiated in good faith before the order is issued.

2. John Zink Company will not be liable for any lost profits, special, indirect, incidental or consequential damages whether arising under warranty, contract, negligence, strict liability, indemnification, or any other cause or combination of causes whatsoever. This limitation shall apply notwithstanding any failure of essential purpose of any limited remedy. Zink's liability is limited to the price allocable to the equipment determined defective, and in no event will Zink's cumulative liability be in excess of the total contract price, whether arising under warranty, contract, negligence, strict liability, indemnification, or any other cause or combination of causes whatsoever. Buyer's remedies are specifically limited to the repair or replacement of the equipment and are exclusive of all other remedies. Should these remedies be found inadequate or to have failed of their essential purpose for any reason whatsoever, Buyer agrees that return of the full sales order price to it by Zink shall prevent the remedies from failing of their essential purpose and shall be considered by Buyer as a fair and adequate remedy.

QUALIFICATIONS

The Clean Air People

John Zink offers technologically advanced equipment and systems for the clean and efficient combustion of fossil fuels and for the removal of contaminates from process effluents entering the atmosphere. These are typical applications of Zink technologies:

- Carbon adsorption systems for the recovery of organic vapors dilute in air.
- Flares systems for the destruction of combustible waste gases released from petroleum refining or chemical production processes, or from loading operations.
- Thermal oxidation systems for conversion of liquid and gaseous chemical wastes, normally incorporating heat recovery boilers and/or vent gas scrubbing components.
- Low-emission fossil fuel burners which provide heat in industrial furnaces, heaters, or boilers.
- High-efficiency gas cleaning systems (wet scrubbers) for removal of acid gases and/or particulate matter from exhaust streams.
- Regenerative and catalytic oxidizers for the conversion of airborne organic waste gases to harmless compounds.

Zink's technologies are either directly aimed at air quality control, or are distinguished by their superior environmental performance. That is the reason for the tag line, *The Clean Air People*.

Technical Depth

John Zink has over 300 engineers and technical experts with specialized academic training and extensive practical experience in the areas of fuel handling, combustion processes, environmental controls, mechanical and structural design, process control and safety.

The Company developed along with modern process industries, building a successful record of solving customer problems using practical applications of both science and empirical knowledge.

Systems are designed using protocols and modeling derived from both commercially available computer programs and those developed in-house.

Industrial Strength

John Zink's customer base consists of the most sophisticated and technologically advanced industrial sectors: petrochemical manufacturing; petroleum production, transportation and refining; petroleum distribution; and other capital intensive process segments such as pulp & paper, food processing, and coating operations. Because these industries have been among the first to face demands for environmental control measures and have been regulated most extensively with respect to air and water quality impacts, Zink's solutions are state-of-the-art.

Global Reach

There is an active Zink presence in virtually every industrially developed region of the world. The Company has corporate entities in the USA, Canada, Europe, the UK and Japan, and permanent sales and service representation in Latin America, the Middle East, the Pacific Rim. Zink's Eastern Hemisphere manufacturing plant is in Luxembourg.

There are few nations on earth without Zink equipment installed in operating process plants or production facilities.

Historical Weight

In continuous operation since its founding in 1929, Zink has a huge base of successfully operating systems in the field. Building on fuel-handling and combustion knowledge from the Company's first product – a waste gas burner for use in the oil patch, John Zink invented the modern smokeless flare system and the thermal oxidizer for chemical waste disposal. These innovations were responses to customers who brought their difficult technical problems to Zink, working in partnerships long before that concept became a cornerstone of quality management techniques.

Technological Leadership

John Zink maintains a unique and very valuable resource, the International Research and Development Center. Using the several test furnaces, boiler systems, flare firing areas and massive utility supplies, Zink can simulate industrial-scale field conditions for the demonstration of established equipment and the development of next-generation technologies.

At Zink's Luxembourg plant, there is also a regional test facility at which similar activities are conducted.

Training Resource

For decades, the Company has offered the internationally renowned John Zink Burner School. Engineers and operators from process plants around the world attend intensive training sessions in the art and science of combustion and air quality control. In recent years, the success of the Burner School has spawned additional special-interest sessions known as Flare School and Vapor Control School.

It is also common for John Zink technical specialists to conduct seminars in regions with a high level of ongoing process activity. The purpose of such programs is to update customers on advances in technologies which will be useful in their own facilities.

Manufacturing Excellence

Among the advantages Zink maintains in the industry is extensive capability in specialized manufacturing. In Oklahoma, the Company owns over one-half-million square feet of fabrication facilities, with staff to execute critical machining of system components, code welding of process vessels, assembly of complete skids, and building of custom-designed control panels. In Luxembourg, Zink's modern plant has similar capabilities close to Eastern Hemisphere customers' sites.

KOCH INDUSTRIES

Since 1989, John Zink has been a division of Koch Engineering Company, Inc., which is in turn a subsidiary of Koch Industries, Inc. (Wichita, Kansas).

Koch Engineering has a history even longer than Zink's as a supplier of systems to the petroleum and chemical process industries, and to a widening array of other sectors. Koch Engineering specializes in mass transfer equipment, flow conditioning devices an acid-proof construction materials. Other entities within the Koch Chemical Technology Group manufacture heat exchangers, water treatment systems and specialized protective coatings. Because of their broad-based operations in hydrocarbon development, transportation, processing and distribution, the knowledge within Koch has become an important advantage to John Zink.

One of our sister companies, Koch Field Services, provides in-field equipment erection and repair services. Since our incorporation into Koch Industries, Koch Field Services has provided flare stack field assembly and erection, flare tip removal and repair, flare foundation design and supply, flare structure field analysis, and other services. If you are interested in John Zink/Koch providing any of the above, please contact the undersigned.

In addition to the above services, being part of Koch allows John Zink additional commercial flexibility.

In lieu of monetary payment for the quoted equipment or services, John Zink, via our parent company Koch Industries, would be willing to accept various commercially traded commodities as payment. These commodities, for example, could be:

- Crude Oil
- Refined Petroleum Products
- Coke
- Cattle
- Steel
- Castings
- Etc.

Please contact the undersigned if you are interested in this as an alternate form of payment.

We thank you for this opportunity to quote John Zink equipment. If you have any questions or require additional information, please contact ô in our ô office at ô.

Regards,

JOHN ZINK COMPANY

John Bellovich

John Bellovich
Flare Applications

EEF-U-3
UTILITY FLARE TIP

MANUFACTURING SPECIFICATIONS	
WELDING	WQS AND WPR PER ASME SECTION IX
PAINT	CARBON STEEL: SSPC-SP6 SURFACE PREPARATION 2 COATS HIGH TEMP. ALUMINUM, 1-2 MILS DFT
	STAINLESS STEEL: NONE REQUIRED

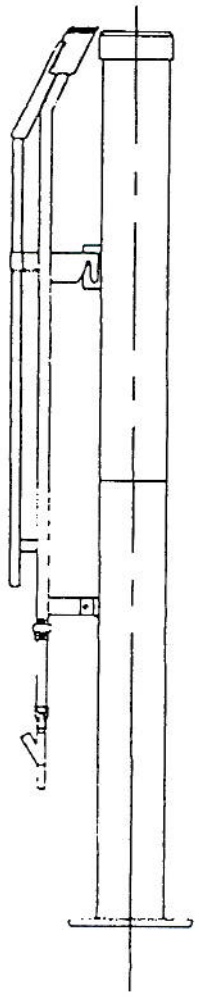
NOZZLE INFORMATION			
DESCRIPTION	SIZE	QUANTITY	TYPE
WASTE GAS INLET	3"	1	ANSI 150 LB RFWN FLANGE
PILOT GAS INLET	3/4"	1	PLAIN
IGNITION LINE INLET	1"	1	PLAIN

CONSTRUCTION MATERIAL	
SECTION	MATERIAL
LOWER RISER	A106B CS SCH. 40 PIPE
UPPER RISER	304 SS SCH. 10S PIPE
RETENTION RING	304 SS
INLET FLANGE	A105 CS

DESIGN INFORMATION	
OVERALL LENGTH	10'-1"
WEIGHT	145 LB
PILOT QUANTITY	1

UTILITY CONSUMPTION	
PURGE RATE[a]	100 SCFH
	10 SCFH WITH AR-3
	5 SCFH WITH MS-3
[a] ANY GAS (AMBIENT STATE) THAT DOES NOT REACH DEW POINT, SELF-IGNITE, OR CONTAIN OXYGEN	

NOTE: SCHEMATIC MAY NOT DEPICT ACTUAL DESIGN.



EEF-AR-3
AIRRESTOR PURGE REDUCTION DEVICE

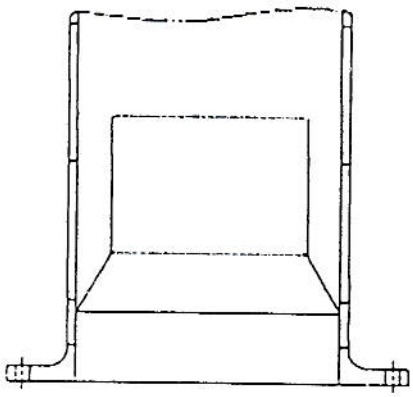
MANUFACTURING SPECIFICATIONS	
WELDING	WQS AND WPR PER ASME SECTION IX
PAINT	NONE REQUIRED

CONSTRUCTION MATERIAL	
SECTION	MATERIAL
AIRRESTOR	304 SS

DESIGN INFORMATION	
INLET SIZE	3"
WEIGHT	2 LB

UTILITY CONSUMPTION	
PURGE RATE[1]	10 SCFH
[1] ANY GAS (AMBIENT STATE) THAT DOES NOT REACH DEW POINT, SELF-IGNITE, OR CONTAIN OXYGEN	

NOTE: SCHEMATIC MAY NOT DEPICT ACTUAL DESIGN.



AUTOMATIC FFG-NEMA 7
EXPLOSIONPROOF FLAME FRONT GENERATOR IGNITION

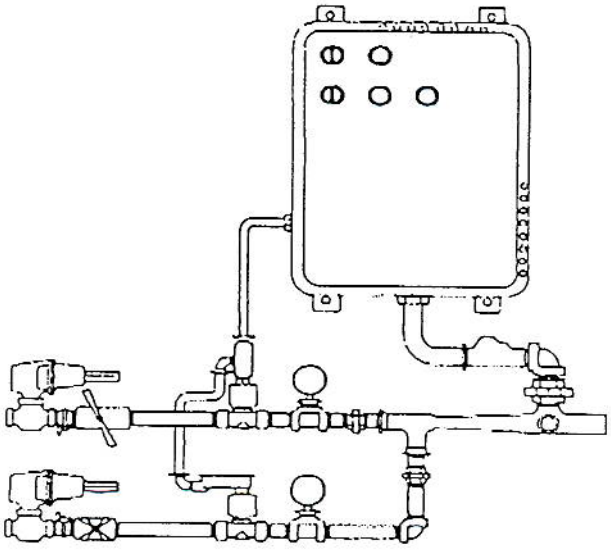
MANUFACTURING SPECIFICATIONS	
WELDING	WQS AND WPR PER ASME SECTION IX
PAINT SPECIFICATION	SP-1 HANDCLEAN SURFACE PREPARATION
	ZINC CHROMATE EPOXY PRIMER, POLYURETHANE ENAMEL FINISH COAT

CONNECTION INFORMATION			
DESCRIPTION	SIZE	QUANTITY	TYPE
TRANSFORMER	3/4"	1	NPTF
IGNITION GAS INLET	1/2"	1	NPTF
AIR INLET	3/4"	1	NPTF
IGNITION LINE	1"	1 PER PILOT	NPTF
THERMOCOUPLE	3/4"	1	NPTF

EQUIPMENT SPECIFICATIONS			
TYPE	MODEL	DESCRIPTION	SIZE
PRESSURE REGULATOR	FISHER 627	200 PSIG MAXIMUM	3/4"
SOLENOID	ASCO	ALUMINUM	1/2"
TEMPERATURE SWITCH	ACTIONPAK	TYPE K CALIBRATED	N/A
IGNITION LINE VALVE[1]	ATKOMATIC	SOLENOID	1"
CONTROL HOUSING	HOFFMAN	NEMA 7	N/A
PRESSURE GAUGE	ASHCROFT	0 - 30 PSIG	1/4" NPT
GAS VALVE	RP&C	NEEDLE, CS	1/2"
AIR VALVE	RP&C	NEEDLE, CS	3/4"
4-20 mA OUTPUT MODULE	YOKAGOWA	TEMP TRANSMITTER	N/A

[1] ONLY REQUIRED WITH TWO OR MORE PILOTS.

UTILITY CONSUMPTION	
TYPE	DESCRIPTION
NATURAL GAS	150 SCFH, 15.0 PSIG
AIR	1,500 SCFH, 15.0 PSIG
ELECTRICITY	3 A (120 V, SINGLE PHASE, 60 HZ)



GENERAL INFORMATION & EQUIPMENT ESCRIPTION

: John Zink EEF Series Flare is a waste vapor combustor custom designed to operate under conditions stated in John Zink Quotation, FS-2711 rev. 1.

ype of Supply

e Tip	:	EEF-U-3 with one (1) pilot
t Style	:	EEP-210 burning Natural Gas
ition Device	:	Auto Manual Flame Front Generator (FFG)
ge Reduction Device	:	AR-3
ge Rate	:	10 SCFH

flare tip is mounted on a self supported riser to provide an overall height of 30 feet.

sign Basis

		Design
1.	Flow Rate (LB/HR)	250
2.	Molecular Weight	32
3.	Gas Temperature (° F)	104
4.	Inlet Pressure ("W.C.)	5"
5.	Composition	**Lbs/Hr.**
	Hexane	15
	Nitrogen	200
	Toluene	25
	VOC's	10

WARNING

☠ Do not operate this equipment outside the design limits or make any modifications, adjustments, or changes affecting the design criteria without John Zink's prior written consent. Injury to persons and damage to equipment may result.

I. GENERAL INFORMATION & EQUIPMENT DESCRIPTION

The John Zink EEF Series Flare is a waste vapor combustor custom designed to operate under the conditions stated in John Zink Quotation, FS-2711 rev. 1.

Scope of Supply

Flare Tip	:	EEF-U-3 with one (1) pilot
Pilot Style	:	EEP-210 burning Natural Gas
Ignition Device	:	Auto Manual Flame Front Generator (FFG)
Purge Reduction Device	:	AR-3
Purge Rate	:	10 SCFH

The flare tip is mounted on a self supported riser to provide an overall height of 30 feet.

Design Basis

		Design
1.	Flow Rate (LB/HR)	250
2.	Molecular Weight	32
3.	Gas Temperature (° F)	104
4.	Inlet Pressure ("W.C.)	5"
5.	Composition	**Lbs/Hr.**
	Hexane	15
	Nitrogen	200
	Toluene	25
	VOC's	10

WARNING

☠ Do not operate this equipment outside the design limits or make any modifications, adjustments, or changes affecting the design criteria without John Zink's prior written consent. Injury to persons and damage to equipment may result.

Reference OB62333

Boiler No. 4 Flare Requirements

Background: Non-assisted flare

Startup date: December 5, 1997 Construction Permit: 1860-0004-CY

Flare provides VOC emissions control for T-10M-32, T-30M-61, T-30M-66, and T-100M-5

RCRA Requirements – Subpart AA and CC (Air Emission Controls for Tanks) (some of these requirements are in the TV permit)		
Citation	**Requirements**	**Compliance Method**
Visible Emissions (264.1033(d)(1) and (e)(1))	No visible emissions via Method 22 (in 40 CFR Part 60) except for no more than 5 minutes during any 2 consecutive hours.	No requirement to conduct visible emission monitoring; however if emissions are noted – contact Env. Department. Daily VE conducted during daylight hours (per Method 22). Method 22 does not require certification. Training on Method 22 will be conducted internally.
Flame Presence (264.1033(d)(2) and (f)(2)(iii))	Flare must be operated with flame present at all times as monitored by the pilot flame monitor.	Temperature probe monitor; temp alarms at < 700°F. Continuous recording on circular chart; readings also taken every 6 hours on Boiler Log sheet; logged in PI manual logger as well.
Net Heating Value (264.1033(d)(3) and (e)(2))	200 BTU/scf or greater is non assisted. Calculate net heating value using formula in section (e)(2).	The average heat value of the vent gases is calculated yearly based on average waste composition. Refer to yearly calculations.
Exit Velocity (264.1033(d)(4))	Designed and operated with an exit velocity of < 60 ft/sec.	Calculated exit velocity is 3.33 ft/sec. Refer to calculation sheet.
Flow monitoring (264.1033(f)(1))	Monitor and record flow hourly.	Flow meter installed; alarm and data prints on circular chart. In PI/ RT reports for alarms.
Closed Vent System (264.1033(k))	The closed vent system must operate with no detectable emissions (demonstrated annually using Method 21 No Detectable Emission protocol) . Leaks must be repaired within 15 days with first attempt within 5 days.	All welded except flange joints which are bolted. Sniff if repair or replace component, to ensure no leaks. Then goes back to visual.

RCRA Requirements – Subpart AA and CC (Air Emission Controls for Tanks) (some of these requirements are in the TV permit)		
Citation	**Requirements**	**Compliance Method**
Operations (264.1033(m))	Closed vent system and flare must be operated at all times when emissions are vented to system.	Monitor downtime for bypass. There is a knockout (empty pot) pot prior to the flare for condensables/condensate collection.
Bypass Valve (264.1087(b)(3)(iii))	Bypass valve must be locked or car sealed. Position of bypass valve and car seal must be visually inspected once per month to ensure the bypass is maintained in the closed position.	Recorded on AWFCO boiler recordkeeping form; recorded monthly at a minimum. AWFCO completed forms filed in Env. File Room.
Flare Downtime for routine maintenance (264.1087(c)(2)(i))	Flare can be down for no more than 240 hours/year for planned routing maintenance.	Flare downtime recorded in Boiler Operator Database spreadsheet (column DZ).
Recordkeeping (264.1035(c))	1. Record flare flow hourly 2. Continuously record presence of flare flame. 3. Record periods of time the flare is not ignited. 4. Record monthly visual check of bypass valve. 5. Record time of any visible emissions 6. Record date and start/stop time flare is down for routine maintenance. Note type/purpose of maintenance. (264.1089(e)(1)(v)(B). 7. Record planned anticipated future maintenance for next 6 months for flare/closed vent system. In which the flare will not be operational. (264.1089(e)(1)(v)(A)). 8. Documentation of heating value and exit velocity (264.1033(e)).	Circular chart for continuous readings; manual readings every 6 hours on Boiler Log sheet; PI Manual Logger. Circular chart maintained in Env. File Room. Flare downtime noted on circular chart. Monthly AWFCO form; maintained in Env. File Room Noted on Boiler Log sheet as applicable Boiler Operator Database (spreadsheet) Maintenance Planning Records Env. Procedure EN-PP-382

RCRA Requirements – Subpart AA and CC (Air Emission Controls for Tanks) (some of these requirements are in the TV permit)		
Citation	**Requirements**	**Compliance Method**
Reporting (264.1036(a) and 264.1090(c))	Semiannual report to DHEC for times: (1) flare had visible emissions for 5 minutes or longer within a two hour period or (2) any consecutive 24 hour period for which there was no pilot flame for the flare or (3) Vent gas flow > 50 lbs/hr for more than 24 consecutive hours	Reports will be submitted as appropriate to DHEC.

Appendix O-2
Net Heating Values

	Chemical Name	Database Component ID
1	2,6-DITERTIARYBUTYLPHENOL	1380
2	2-TERT-BUTYLPHENOL	1276
3	ISOBUTYLBENZENE	748
4	n-BUTYLBENZENE	70
5	TOLUENE	183
6	HEXANE	231
7	METHANOL	965
8	CYCLOHEXANE	246
9	DODECANE	316
10	CUMENE	1357
11	2,6-DIISOPROPYLANILINE	606
12	1,6-HEXANEDIOL	916
13	1,2-HEXANEDIOL	144
14	METHYL ACRYLATE	1331
15	EXXAL 8	1701
16	ISOPROPYL ALCOHOL	966
17	MCP DIMER	620
18	DIMETHYL CARBITOL	296
19	XYLENE-M	165
20	1H-PYRROLE	216
21	TRIETHYLAMINE	380
22	TETRAHYDROFURAN	217
23	DIETHYL KETONE	1330
24	2,6-DIISOPROPYL PHENOL	583
25	DIETHYL ETHER	859
26	AMMONIA	1144
27	ANILINE	904
28	2-ISOPROPYLANILINE	950
29	ETHANOL	947
30	METHYLENE CHLORIDE	1061
31	1,4-DIOXANE	404
32	1,4-DIETHYLBENZENE	75
33	ACETONE	967
34	1,2-PROPYLENE OXIDE	1090
35	METHYL ETHYL KETONE	1215
36	ISOHEXANE	147
37	NITROGEN	1161
38	WATER	1164
39	CARBON DIOXIDE	420
40	NITRIC OXIDE	41
41	NITROGEN DIOXIDE	42
42	4-ISOBUTYLACETOPHENONE	675
43	HME	1690
44	PME	1550
45	EXXAL 8	1701
46		
47		
48		
49		
50		

2,6

Instructions:

Click on a cell under "Chemical Name" and press "Import Component" button.
Click "Import" to select component in list.

Max # components in subdatabase = 50

User Units			
T (input)	C	NBP	C
		RadGyr	ft
AcFactor	unitless	SolParam	(cal/cc)^0.5
CASNo	unitless	VolSLM	cuft/lbmol
Zc	unitless	Tmin	C
DipoleMom	Debye units	Tmax	C
LFL	volume %	TripleP	psia
MolWt	unitless	TripleT	C
RefIndex	unitless	vdWarea	sqft/lbmol
UFL	volume %	vdWvol	cuft/lbmol
		DensL	g/cc
Tautoig	C	DensS	g/cc
Pc	psia	CpL	BTU/lb-F
Tc	C	CpS	BTU/lb-F
Vc	cuft/lbmol	CpV	BTU/lb-F
dHformIG	BTU/lb	dHvap	BTU/lb
FlashT	C	SurfTens	dyne/cm
dGform	BTU/lb	ThCondL	BTU/ft-hr-F
dHcomb	BTU/lb	ThCondV	BTU/ft-hr-F
dHmelt	BTU/lb	VapP	psia
SIG	BTU/lbmol-R	ViscL	cP
MeltT	C	ViscV	cP

diisopropyl aniline

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

LL 07/28/17

Tank ID	T-30M-66	
Description	Burn Tank - Average of what burned in Cy16	
Tank contents temperature	40	°C
Tank pressure	0	psig
Sum of composition	97.12	wt%
Vapor net heating value, Q_{net}	**325.4**	**BTU/scf**

Volatile Components

PropXL - only for combustible liquids at 25 °C

	Liquid Comp. wt%	Note	Mol wt mw	Vapor Pressure P^{sat} psia	Activity Coeff. g	Liq State Heat of Combust. at 25 °C Q_{comb}^{liq} BTU/lb	1/mw	Heat of Vaporiz. Q_{vap} BTU/lb	IG State Heat of Combust. at 25 °C Q_{comb}^{IG} BTU/lb
ISOBUTYLBENZENE	9.32		134.221	0.09361	1	17809	0	154	17963
n-BUTYLBENZENE	8.78		134.221	0.05303	1	17809	0	161	17970
4-ISOBUTYLACETOPHENONE	0.58		176.26	0.00173	1	16451	0	136	16587
METHANOL	6.61		32.0422	5.13625	1	8560	0	510	9070
TOLUENE	0.13		92.1405	1.14144	1	17404	0	179	17583
HEXANE	4.14		86.1772	5.43151	1	19257	0	157	19414
					1	8000			
					1				
					1				

Manual - for non-PropXL components and non-combustible components

Fuel Oil	11.81		200	0.2	1	18000	0.005	100	18100
Super High Flash Naphtha	5.04	SHFN is a blend, used properties for solvent naphtha however	114	0.798	1	19093	0.00877193	125	19218
heptane	1.42		100.21	0.773	1	19163	0.009979044	149	19312
4 methyl 1 pentene	1.145		84.15	8.48	1	19283	0.011883541	145	19428
4 methyl 2 pentene	0.84		84.16	7.715	1	19283	0.011882129	145	19428

Nonvolatile Components

Ethanox 330/330 heel	18.901		775.2				0.00128999		
702	12.375		424				0.002358491		
process oil	0.366		180				0.005555556		
ibuprofen (including meta, para)	14.465		206.29				0.004847545		
HME	0.61		236.314				0.004231658		
PME	0.60		220.314				0.004538976		

97.115

Notes:

1 use dodecane to represent kerosene

2 component X is proprietary, but with known properties provided by the vendor

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

BTB 7/28/15

This calculation is intended to determine the net combustion heat contained in the vent stream from a tank that contains a mixture of components, one or more of which are combustible. Two main provisions of the calculation include (1) determination of the vapor composition given the liquid composition based upon the modified Raoult's Law equation, and (2) determination of the net combustion heat for each of the components.

The data entered for the calculation are in three categories. In the first section, volatile components featured in PropXL, the Corporate physical properties database for SI Group, can be selected, which allows for automatic determination of the properties used in the calculation. In the second section, volatile components not contained in PropXL may be entered manually, including their identity and properties. In the third section, non-volatile components can be entered along with their molecular weights.

Vapor Composition

$$y_i \cdot P = x_i \cdot g_i \cdot P_i^{sat}$$

y_i = concentration of component i in the vapor, mol fr
P = pressure in tank
x_i = concentration of component i in the liquid, mol fr
g_i = activity coefficient of component i in the liquid, which accounts for solution non-ideality (often a default value of unity is used)
P_i^{sat} = vapor pressure of component i at the tank temperature

Combustion

The appropriate basis for the combustion calculation is for each component in its ideal gas state, liberating vapor-phase products. That means water is produced as steam and its latent heat is not recovered, which provides the combustion calculation on a net heating basis. Typical net heat of combustion data are for the component in its normally-occurring state at standard conditions. For the volatile components in the tank, that basis is as liquid. To modify the heat of combustion to the reference state for an ideal gas, which is applicable to this calculation for the vent stream, the value is adjusted by the heat of vaporization:

$$Q_{comb}^{IG} = Q_{comb}^{liq} + Q_{vap}$$

Q_{comb}^{IG} = heat of combustion for the ideal gas state at 25 °C
Q_{comb}^{liq} = heat of combustion for the liquid state at 25 °C
Q_{vap} = heat of vaporization at 25 °C

Using the basis of 1 scf (expressed with standard conditions of 20 °C), the combustion heat for each combustible component is determined as follows:

$$n = P \cdot V/(R \cdot T)$$

n = moles in 1 scf, lbmol
V = 1 scf
R = ideal gas constant, 10.73 cuft-psia/lbmol-R
T = standard temperature, 68+459.67 R

$$Q_i = y_i \cdot n \cdot mw_i \cdot Q_{comb}^{IG}$$

Q_i = net combustion heat of component i in the vent stream
mw_i = molecular weight of component i

Finally, the total net heating value of the vent stream is determined by the sum:

$$Q_{net} = S\ Q_i$$

Current Streams								
Waste ID	**Waste Desciption**	**Waste Status**	**Area**	**Constituent**	**wt %**	**Mid point**	**Appendix VIII Hazardous Constituent?**	**Amount burned in CY16**
2	330/330 C Still Bottoms	D001	3	Fuel oil	0-50	25	N	2,494,211
				alklyated phenols	0-50	40	N	
				isobutyl benzene	25	16	N	
				normal butyl benzene	25	16		
							N	
				heptane		3		
3	IBB Still Bottoms	D001	**2**	isobutyl benzene	0-100	50	N	128,574
				normal butyl benzene	0-100	50	N	
5	Organic separated from Concentrated Aqueous Waste	D001, F005	Env. Ops (Pollution Control)	process oil	80-95	87.5		1940
				isooctyl alcohol	0-2	1.5		
				2,6 DTBP	0-5	2.5		
				PME	0-1	0.5		
				TTBP	0-1	0.5		
				OTBP	0-1	0.5		
				IBAP	0-1	0.5		
				water	0.5	0.5		
7	Toluene from vessel and tank cleaning	D001, F005	2 and 3	toluene	0-10	5		134,348
				4 -methyl 1 pentene	30-65	45		
				4 - methyl 2 pentene	25-40	33		
				hexene	0-10	5		
16	**Used lubricating, hydraulic and cutting oil**	**D001**	**Maintenance**	various oils	90-100	100	N	4809
23	methanol/hexane washout	D001, F003	3	methanol	0-80	45	N	13463
				hexane	0-80	45	N	
				IBAP	0-10	5	N	
				HME	0-10	5	N	
				mis compounds			N	
85	702/703 still bottoms with super high flash naphtha	D001	1	naphtha	0-50	28.5	N	932,882.00
				702	0-50	70	N	
				703	0-50	0	N	
				cumene	0-75	0.75	N	
				total xylenes	0-75	0.75	N	

Current Streams								
Waste ID	**Waste Desciption**	**Waste Status**	**Area**	**Constituent**	**wt %**	**Mid point**	**Appendix VIII Hazardous Constituent?**	**Amount burned in CY16**
90	DIPA Columns Bottoms	Non hazardous	2	diisopropylaniline	< 85	50	N	29820
				heavy compounds	< 75	50	N	
99	Oil from Alkyla Aluminum Cylinder Cleaning	Non hazardous	2	process oil	90-100	90	N	17258
				water	0-10	5	N	
				alkyl organics	0-5	5	N	
104	Heavy Organics from DR-3 Production (DR3 heel)	D001	3	ibuprofen	??	60	N	954403
				hexane	0-20	20	N	
				para DR3	36	10	N	
				meta DR3	15	10	N	
123	Organic from DR-3 Aqueous Waste	D001	3	isobutylbenzene	0-50	20	N	142924
				IBAP	0-50	21	N	
				PME	0-50	22	N	
				HME	0-50	22	N	
				Hexane	0-25	15	N	
125	DIP Misc	Non hazardous	3	water	0-5	2.5	N	45014
				phenol	10-15	7.5	Y	
				propoxylbenzene	0-5	2.5	N	
				2 isopropylphenol	25-40	32.5	N	
				3 ethyl 4 methylphenol	10-15	12.5	N	
				propofol	30-35	33.5	N	
				2,4,6 triisopropylphenol	0-3	1.5	N	
127	DTBP Miscellaneous Organics	D001	2	2,6 ditertiarybutyl phenol	10-50	20.00	N	21000
				irganaox	0-60	20	N	
				methyl acrylate	0-20	10	N	
				process oil	10-90	10	N	
				exxall 8 alcohol	10-90	40	N	
148	Recovered Process Oil-NcendX	D001, F005	2	hydrolyzed oil	90-100	100	N	0

Current Streams								
Waste ID	**Waste Desciption**	**Waste Status**	**Area**	**Constituent**	**wt %**	**Mid point**	**Appendix VIII Hazardous Constituent?**	**Amount burned in CY16**
149	AN-701 Lights	D001		OTBP	10-20	15	N	8203
				2,6 DTBP	40-55	47.5	N	
				2,4 DTBP	0-5	2.5	N	
				TTBP	10-20	15	N	
				702	0-5	2.5	N	
				phenol	10-May	7.5	N	
				water	<0.5%	0.5	N	
175	Waste Methanol	D001		water	0-10	0.99	N	0
				ammonia	100-500 ppm		N	
				hexane	0-100 ppm	0.01	N	
				methanol	90-99	99	N	
162	DIPA waste solvents	D001		anilne	15	15	Y	0
				OIPA	7	7	N	
				PIPA	1	1	N	
				DIPA	17	17	N	
				super high flash naphtha	60	57	N	
				cumene	3	3	N	
389	4716 Methanol	D001	2	methanol		98.00	N	349570
				water		0.5	N	
				exxall 8 alcohol		1	N	
				methyl acrylate		0.5	N	

Constituent	Percent
702 Total	12.375
703 Total	0.000
2 isopropylphenol Total	0.277
2,4 DTBP Total	0.004
2,4,6 triisopropylphenol Total	0.013
2,6 ditertiarybutyl phenol Total	0.154
3 ethyl 4 methylphenol Total	0.107
330 organics Total	18.901
4 - methyl 2 pentene Total	0.840
4 -methyl 1 pentene Total	1.145
alkyl organics Total	0.016
ammonia Total	0.000
anilne Total	0.000
cumene Total	0.133
diisopropylaniline Total	0.282
Fuel oil Total	11.813
heavy compounds Total	0.282
heptane Total	1.42
hexane Total	4.137
hexene Total	0.127
HME Total	0.608
hydrolyzed oil Total	0.000
IBAP Total	0.582
ibuprofen Total	14.465
irganaox Total	0.080
isobutyl benzene Total	9.320
isooctyl alcohol Total	0.226
methanol Total	6.605
methyl acrylate Total	0.073
mis compounds Total	0.000
normal butyl benzene Total	8.778
OIPA Total	0.000
OTBP Total	0.023
phenol Total	0.076
PIPA Total	0.000
PME Total	0.596
process oil Total	0.366
propofol Total	0.286
propoxylbenzene Total	0.021
super high flash naphtha Total	5.037
toluene Total	0.127
total xylenes Total	0.001
TTBP Total	0.023
various oils Total	0.091
water Total	0.072
Grand Total	99.482

Constituent	Percent Component to Total Burned
330 organics Total	18.901
ibuprofen Total	14.465
702 Total	12.375
Fuel oil Total	11.813
isobutyl benzene Total	9.320
normal butyl benzene Total	8.778
methanol Total	6.605
super high flash naphtha Total	5.037
hexane Total	4.137
heptane Total	1.42
4 -methyl 1 pentene Total	1.145
4 - methyl 2 pentene Total	0.840
HME Total	0.608
PME Total	0.596
IBAP Total	0.582

	Chemical Name	Database Component ID
1	2,6-DITERTIARYBUTYLPHENOL	1380
2	2-TERT-BUTYLPHENOL	1276
3	ISOBUTYLBENZENE	748
4	n-BUTYLBENZENE	70
5	TOLUENE	183
6	HEXANE	231
7	METHANOL	965
8	CYCLOHEXANE	246
9	DODECANE	316
10	CUMENE	1357
11	2,6-DIISOPROPYLANILINE	606
12	1,6-HEXANEDIOL	916
13	1,2-HEXANEDIOL	144
14	METHYL ACRYLATE	1331
15	EXXAL 8	1701
16	ISOPROPYL ALCOHOL	966
17	MCP DIMER	620
18	DIMETHYL CARBITOL	296
19	XYLENE-M	165
20	1H-PYRROLE	216
21	TRIETHYLAMINE	380
22	TETRAHYDROFURAN	217
23	DIETHYL KETONE	1330
24	2,6-DIISOPROPYL PHENOL	583
25	DIETHYL ETHER	859
26	AMMONIA	1144
27	ANILINE	904
28	2-ISOPROPYLANILINE	950
29	ETHANOL	947
30	METHYLENE CHLORIDE	1061
31	1,4-DIOXANE	404
32	1,4-DIETHYLBENZENE	75
33	ACETONE	967
34	1,2-PROPYLENE OXIDE	1090
35	METHYL ETHYL KETONE	1215
36	ISOHEXANE	147
37	NITROGEN	1161
38	WATER	1164
39	CARBON DIOXIDE	420
40	NITRIC OXIDE	41
41	NITROGEN DIOXIDE	42
42	4-ISOBUTYLACETOPHENONE	675
43	HME	1690
44	PME	1550
45	EXXAL 8	1701
46	1-OCTANOL	292
47		
48		
49		
50		

2,6

Instructions:

Click on a cell under "Chemical Name" and press "Import Component" button.
Click "Import" to select component in list.

Max # components in subdatabase = 50

User Units			
T (input)	C	NBP	C
		RadGyr	ft
AcFactor	unitless	SolParam	(cal/cc)^0.5
CASNo	unitless	VolSLM	cuft/lbmol
Zc	unitless	Tmin	C
DipoleMom	Debye units	Tmax	C
LFL	volume %	TripleP	psia
MolWt	unitless	TripleT	C
RefIndex	unitless	vdWarea	sqft/lbmol
UFL	volume %	vdWvol	cuft/lbmol
		DensL	g/cc
Tautoig	C	DensS	g/cc
Pc	psia	CpL	BTU/lb-F
Tc	C	CpS	BTU/lb-F
Vc	cuft/lbmol	CpV	BTU/lb-F
dHformIG	BTU/lb	dHvap	BTU/lb
FlashT	C	SurfTens	dyne/cm
dGform	BTU/lb	ThCondL	BTU/ft-hr-F
dHcomb	BTU/lb	ThCondV	BTU/ft-hr-F
dHmelt	BTU/lb	VapP	psia
SIG	BTU/lbmol-R	ViscL	cP
MeltT	C	ViscV	cP

diisopropyl aniline

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

LL 01/23/2018

Tank ID	T-30M-66	
Description	Burn Tank - Average of what burned in Cy17	
Tank contents temperature	40	°C
Tank pressure	0	psig
Sum of composition	97.04	wt%
Vapor net heating value, Q_{net}	**328.8**	**BTU/scf**

Volatile Components

PropXL - only for combustible liquids at 25 °C

	Liquid Comp.	Note	Mol wt mw	Vapor Pressure P^{sat}	Activity Coeff. g	Liq State Heat of Combust. at 25 °C Q_{comb}^{liq}	1/mw	Heat of Vaporiz. Q_{vap}	IG State Heat of Combust. at 25 °C Q_{comb}^{IG}
	wt%			psia		BTU/lb		BTU/lb	BTU/lb
ISOBUTYLBENZENE	8.48		134.221	0.093606	1	17809	0	154	17963
n-BUTYLBENZENE	8.02		134.221	0.053029	1	17809	0	161	17970
4-ISOBUTYLACETOPHENONE	0.58		176.26	0.00173	1	16451	0	136	16587
METHANOL	3.06		32.0422	5.136252	1	8560	0	510	9070
TOLUENE	3.75		92.1405	1.141441	1	17404	0	179	17583
HEXANE	4.22		86.1772	5.431509	1	19257	0	157	19414
1-octanol	0.79		130.23	0.006147	1	8000	0	233	8233
					1				
					1				

Manual - for non-PropXL components and non-combustible components

Fuel Oil	12.46		200	0.2	1	18000	0.005	100	18100
Super High Flash Naphtha	4.17	SHFN is a blend, used properties for solvent naphtha however	114	0.798	1	19093	0.00877193	125	19218
heptane	1.5		100.21	0.773	1	19163	0.009979044	149	19312
4 methyl 1 pentene	0.962		84.15	8.48	1	19283	0.011883541	145	19428
4 methyl 2 pentene	0.705		84.16	7.715	1	19283	0.011882129	145	19428

Nonvolatile Components

Ethanox 330/330 heel	19.939		775.2	0.00128999
702	11.344		424	0.002358491
process oil	0.959		180	0.005555556
ibuprofen (including meta, para)	15.089		206.29	0.004847545
HME	0.51		236.314	0.004231658
PME	0.51		220.314	0.004538976

97.04

Notes:

1 use dodecane to represent kerosene

2 component X is proprietary, but with known properties provided by the vendor

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

BTB 7/28/15

This calculation is intended to determine the net combustion heat contained in the vent stream from a tank that contains a mixture of components, one or more of which are combustible. Two main provisions of the calculation include (1) determination of the vapor composition given the liquid composition based upon the modified Raoult's Law equation, and (2) determination of the net combustion heat for each of the components.

The data entered for the calculation are in three categories. In the first section, volatile components featured in PropXL, the Corporate physical properties database for SI Group, can be selected, which allows for automatic determination of the properties used in the calculation. In the second section, volatile components not contained in PropXL may be entered manually, including their identity and properties. In the third section, non-volatile components can be entered along with their molecular weights.

Vapor Composition

$$y_i \cdot P = x_i \cdot g_i \cdot P_i^{sat}$$

y_i = concentration of component i in the vapor, mol fr
P = pressure in tank
x_i = concentration of component i in the liquid, mol fr
g_i = activity coefficient of component i in the liquid, which accounts for solution non-ideality (often a default value of unity is used)
P_i^{sat} = vapor pressure of component i at the tank temperature

Combustion

The appropriate basis for the combustion calculation is for each component in its ideal gas state, liberating vapor-phase products. That means water is produced as steam and its latent heat is not recovered, which provides the combustion calculation on a net heating basis. Typical net heat of combustion data are for the component in its normally-occurring state at standard conditions. For the volatile components in the tank, that basis is as liquid. To modify the heat of combustion to the reference state for an ideal gas, which is applicable to this calculation for the vent stream, the value is adjusted by the heat of vaporization:

$$Q_{comb}^{IG} = Q_{comb}^{liq} + Q_{vap}$$

Q_{comb}^{IG} = heat of combustion for the ideal gas state at 25 °C
Q_{comb}^{liq} = heat of combustion for the liquid state at 25 °C
Q_{vap} = heat of vaporization at 25 °C

Using the basis of 1 scf (expressed with standard conditions of 20 °C), the combustion heat for each combustible component is determined as follows:

$$n = P \cdot V/(R \cdot T)$$

n = moles in 1 scf, lbmol
V = 1 scf
R = ideal gas constant, 10.73 cuft-psia/lbmol-R
T = standard temperature, 68+459.67 R

$$Q_i = y_i \cdot n \cdot mw_i \cdot Q_{comb}^{IG}$$

Q_i = net combustion heat of component i in the vent stream
mw_i = molecular weight of component i

Finally, the total net heating value of the vent stream is determined by the sum:

$$Q_{net} = S\ Q_i$$

Current Streams								
Waste ID	**Waste Desciption**	**Waste Status**	**Area**	**Constituent**	**wt %**	**Mid point**	**Appendix VIII Hazardous Constituent?**	**Amount burned in CY17**
2	330/330 C Still Bottoms	D001	3	Fuel oil	0-50	25	N	2,670,510
				alklyated phenols	0-50	40	N	
				isobutyl benzene	25	16	N	
				normal butyl benzene	25	16		
							N	
				heptane		3		
3	IBB Still Bottoms	D001	**2**	isobutyl benzene	0-100	50	N	-
				normal butyl benzene	0-100	50	N	
5	Organic separated from Concentrated Aqueous Waste	D001, F005	Env. Ops (Pollution Control)	process oil	80-95	87.5		0
				isooctyl alcohol	0-2	1.5		
				2,6 DTBP	0-5	2.5		
				PME	0-1	0.5		
				TTBP	0-1	0.5		
				OTBP	0-1	0.5		
				IBAP	0-1	0.5		
				water	0.5	0.5		
7	Toluene from vessel and tank cleaning	D001, F005	2 and 3	toluene	0-10	5		114,479
				4 -methyl 1 pentene	30-65	45		
				4 - methyl 2 pentene	25-40	33		
				hexene	0-10	5		
16	**Used lubricating, hydraulic and cutting oil**	**D001**	**Maintenance**	various oils	90-100	100	N	
23	methanol/hexane washout	D001, F003	3	methanol	0-80	45	N	
				hexane	0-80	45	N	
				IBAP	0-10	5	N	
				HME	0-10	5	N	
				mis compounds			N	

Current Streams								
Waste ID	**Waste Desciption**	**Waste Status**	**Area**	**Constituent**	**wt %**	**Mid point**	**Appendix VIII Hazardous Constituent?**	**Amount burned in CY17**
85	702/703 still bottoms with super high flash naphtha	D001	1	naphtha	0-50	28.5	N	868,173.00
				702	0-50	70	N	
				703	0-50	0	N	
				cumene	0-75	0.75	N	
				total xylenes	0-75	0.75	N	
90	DIPA Columns Bottoms	Non hazardous	2	diisopropylaniline	< 85	50	N	30317
				heavy compounds	< 75	50	N	
99	Oil from Alkyla Aluminum Cylinder Cleaning	Non hazardous	2	process oil	90-100	90	N	45797
				water	0-10	5	N	
				alkyl organics	0-5	5	N	
104	Heavy Organics from DR-3 Production (DR3 heel)	D001	3	ibuprofen	??	60	N	1,010,456
				hexane	0-20	20	N	
				para DR3	36	10	N	
				meta DR3	15	10	N	
123	Organic from DR-3 Aqueous Waste	D001	3	isobutylbenzene	0-50	20	N	123284
				IBAP	0-50	21	N	
				PME	0-50	22	N	
				HME	0-50	22	N	
				Hexane	0-25	15	N	
125	DIP Misc	Non hazardous	3	water	0-5	2.5	N	
				phenol	10-15	7.5	Y	
				propoxylbenzene	0-5	2.5	N	
				2 isopropylphenol	25-40	32.5	N	
				3 ethyl 4 methylphenol	10-15	12.5	N	
				propofol	30-35	33.5	N	
				2,4,6 triisopropylphenol	0-3	1.5	N	

Current Streams								
Waste ID	**Waste Desciption**	**Waste Status**	**Area**	**Constituent**	**wt %**	**Mid point**	**Appendix VIII Hazardous Constituent?**	**Amount burned in CY17**
127	DTBP Miscellaneous Organics	D001	2	2,6 ditertiarybutyl phenol	10-50	20.00	N	101850
				irganaox	0-60	20	N	
				methyl acrylate	0-20	10	N	
				process oil	10-90	10	N	
				exxall 8 alcohol	10-90	40	N	
148	Recovered Process Oil-NcendX	D001, F005	2	hydrolyzed oil	90-100	100	N	0
149	AN-701 Lights	D001		OTBP	10-20	15	N	0
				2,6 DTBP	40-55	47.5	N	
				2,4 DTBP	0-5	2.5	N	
				TTBP	10-20	15	N	
				702	0-5	2.5	N	
				phenol	10-May	7.5	N	
				water	<0.5%	0.5	N	
175	Waste Methanol	D001		water	0-10	0.99	N	0
				ammonia	100-500 ppm		N	
				hexane	0-100 ppm	0.01	N	
				methanol	90-99	99	N	
162	DIPA waste solvents	D001		anilne	15	15	Y	0
				OIPA	7	7	N	
				PIPA	1	1	N	
				DIPA	17	17	N	
				super high flash naphtha	60	57	N	
				cumene	3	3	N	
389	4716 Methanol	D001	2	methanol		98.00	N	167003
				water		0.5	N	
				exxall 8 alcohol		1	N	
				methyl acrylate		0.5	N	

Constituent	Percent Component to Total Burned
702 Total	11.344
703 Total	0.000
2 isopropylphenol Total	0.000
2,4 DTBP Total	0.000
2,4,6 triisopropylphenol Total	0.000
2,6 DTBP Total	0.380
3 ethyl 4 methylphenol Total	0.000
4 - methyl 2 pentene Total	0.705
4 -methyl 1 pentene Total	0.962
330 heel Total	19.939
alkyl organics Total	0.043
ammonia Total	0.000
anilne Total	0.000
cumene Total	0.122
diisopropylaniline Total	0.283
DIPA Total	0.000
Fuel oil Total	12.462
heavy compounds Total	0.283
heptane Total	1.50
hexane Total	4.223
hexene Total	0.107
HME Total	0.506
hydrolyzed oil Total	0.000
IBAP Total	0.483
ibuprofen Total	15.089
irganaox Total	0.380
isobutyl benzene Total	8.478
isooctyl alcohol	0.000
exxall 8 alcohol	0.760
exxall 8 alcohol	0.031
isooctyl alcohol Total	0.792
methanol Total	3.057
methyl acrylate Total	0.248
mis compounds Total	0.000
normal butyl benzene Total	8.018
OIPA Total	0.000
OTBP Total	0.000
phenol Total	0.000
PIPA Total	0.000
PME Total	0.506
process oil Total	0.959
propofol Total	0.000
propoxylbenzene Total	0.000
super high flash naphtha Total	4.619
toluene Total	3.747
total xylenes Total	0.001
TTBP Total	0.000
various oils Total	0.000
water Total	0.058
Grand Total	99.289

CY17

Constituent	Percent Component to Total Burned
330 heel Total	19.939
ibuprofen Total	15.089
Fuel oil Total	12.462
702 Total	11.344
isobutyl benzene Total	8.478
normal butyl benzene Total	8.018
hexane Total	4.223
super high flash naphtha Total	4.169
toluene Total	3.747
methanol Total	3.057
heptane Total	1.50
4 -methyl 1 pentene Total	0.962
process oil Total	0.959
isooctyl alcohol Total	0.792
4 - methyl 2 pentene Total	0.705
HME Total	0.506
PME Total	0.506
IBAP Total	0.483
2,6 DTBP Total	0.380
irganaox Total	0.380
diisopropylaniline Total	0.283
heavy compounds Total	0.283

	Chemical Name	Database Component ID
1	2,6-DITERTIARYBUTYLPHENOL	1380
2	2-TERT-BUTYLPHENOL	1276
3	ISOBUTYLBENZENE	748
4	n-BUTYLBENZENE	70
5	TOLUENE	183
6	HEXANE	231
7	METHANOL	965
8	CYCLOHEXANE	246
9	DODECANE	316
10	CUMENE	1357
11	2,6-DIISOPROPYLANILINE	606
12	1,6-HEXANEDIOL	916
13	1,2-HEXANEDIOL	144
14	METHYL ACRYLATE	1331
15	EXXAL 8	1701
16	ISOPROPYL ALCOHOL	966
17	MCP DIMER	620
18	DIMETHYL CARBITOL	296
19	XYLENE-M	165
20	1H-PYRROLE	216
21	TRIETHYLAMINE	380
22	TETRAHYDROFURAN	217
23	DIETHYL KETONE	1330
24	2,6-DIISOPROPYL PHENOL	583
25	DIETHYL ETHER	859
26	AMMONIA	1144
27	ANILINE	904
28	2-ISOPROPYLANILINE	950
29	ETHANOL	947
30	METHYLENE CHLORIDE	1061
31	1,4-DIOXANE	404
32	1,4-DIETHYLBENZENE	75
33	ACETONE	967
34	1,2-PROPYLENE OXIDE	1090
35	METHYL ETHYL KETONE	1215
36	ISOHEXANE	147
37	NITROGEN	1161
38	WATER	1164
39	CARBON DIOXIDE	420
40	NITRIC OXIDE	41
41	NITROGEN DIOXIDE	42
42	4-ISOBUTYLACETOPHENONE	675
43	HME	1690
44	PME	1550
45	EXXAL 8	1701
46		
47		
48		
49		
50		

Instructions:
Click on a cell under "Chemical Name" and press "Import Component" button. Click "Import" to select component in list.

Max # components in subdatabase = 50

User Units			
T (input)	C	NBP	C
		RadGyr	ft
AcFactor	unitless	SolParam	(cal/cc)^0.5
CASNo	unitless	VolSLM	cuft/lbmol
Zc	unitless	Tmin	C
DipoleMom	Debye units	Tmax	C
LFL	volume %	TripleP	psia
MolWt	unitless	TripleT	C
RefIndex	unitless	vdWarea	sqft/lbmol
UFL	volume %	vdWvol	cuft/lbmol
		DensL	g/cc
Tautoig	C	DensS	g/cc
Pc	psia	CpL	BTU/lb-F
Tc	C	CpS	BTU/lb-F
Vc	cuft/lbmol	CpV	BTU/lb-F
dHformIG	BTU/lb	dHvap	BTU/lb
FlashT	C	SurfTens	dyne/cm
dGform	BTU/lb	ThCondL	BTU/ft-hr-F
dHcomb	BTU/lb	ThCondV	BTU/ft-hr-F
dHmelt	BTU/lb	VapP	psia
SIG	BTU/lbmol-R	ViscL	cP
MeltT	C	ViscV	cP

2,6 diisopropyl aniline

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

LLUNA 01/22/2020 CY19 Reference OB62333

Tank ID	T-30M-66		
Description	Burn Tank - Average of what burned in Cy19		
Tank contents temperature	40	°C	
Tank pressure	0	psig	
Sum of composition	99.18	wt%	
Vapor net heating value, Q_{net}	**379.3**	**BTU/scf**	

Volatile Components

PropXL - only for combustible liquids at 25 °C

	Liquid Comp. wt%	Note	Mol wt mw	Vapor Pressure P^{sat} psia	Activity Coeff. γ	Liq State Heat of Combust. at 25 °C Q_{comb}^{liq} BTU/lb	1/mw	Heat of Vaporiz. Q_{vap} BTU/lb	IG State Heat of Combust. at 25 °C Q_{comb}^{IG} BTU/lb
ISOBUTYLBENZENE	11.13		134.221	0.093606	1	17809	0	154	17963
n-BUTYLBENZENE	10.35		134.221	0.053029	1	17809	0	161	17970
4-ISOBUTYLACETOPHENONE	0.83		176.26	0.00173	1	16451	0	136	16587
METHANOL	9.24		32.0422	5.136252	1	8560	0	510	9070
TOLUENE	1.37		92.1405	1.141441	1	17404	0	179	17583
HEXANE	5.24		86.1772	5.431509	1	19257	0	157	19414
CUMENE	0.29		120.194	0.212074	1	17706	0	161	9000

Manual - for non-PropXL components and non-combustible components

Fuel Oil	11.50		200	0.2	1	18000	0.005	100	18100
Super High Flash Naphtha	1.36	SHFN is a blend, used properties for solvent naphtha however	114	0.798	1	19093	0.00877193	125	19218
heptane	1.38		100.21	0.773	1	19163	0.009979044	149	19312
4 methyl 1 pentene	2.4		84.15	8.48	1	19283	0.011883541	145	19428
4 methyl 2 pentene	1.32		84.16	7.715	1	19283	0.011882129	145	19428

Nonvolatile Components

Ethanox 330/330 heel	18.4		775.2				0.00128999		
702	1.22		424				0.002358491		
process oil	3.4		180				0.005555556		
ibuprofen (including meta, para)	18.02		206.29				0.004847545		
HME	0.87		236.314				0.004231658		
PME	0.86		220.314				0.004538976		

99.18

Notes

1 use dodecane to represent kerosene

2 component X is proprietary, but with known properties provided by the vendor

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

BTB 7/28/15

This calculation is intended to determine the net combustion heat contained in the vent stream from a tank that contains a mixture of components, one or more of which are combustible. Two main provisions of the calculation include (1) determination of the vapor composition given the liquid composition based upon the modified Raoult's Law equation, and (2) determination of the net combustion heat for each of the components.

The data entered for the calculation are in three categories. In the first section, volatile components featured in PropXL, the Corporate physical properties database for SI Group, can be selected, which allows for automatic determination of the properties used in the calculation. In the second section, volatile components not contained in PropXL may be entered manually, including their identity and properties. In the third section, non-volatile components can be entered along with their molecular weights.

Vapor Composition

$$y_i \cdot P = x_i \cdot \gamma_i \cdot P_i^{sat}$$

y_i = concentration of component i in the vapor, mol fr
P = pressure in tank
x_i = concentration of component i in the liquid, mol fr
γ_i = activity coefficient of component i in the liquid, which accounts for solution non-ideality (often a default value of unity is used)
P_i^{sat} = vapor pressure of component i at the tank temperature

Combustion

The appropriate basis for the combustion calculation is for each component in its ideal gas state, liberating vapor-phase products. That means water is produced as steam and its latent heat is not recovered, which provides the combustion calculation on a net heating basis. Typical net heat of combustion data are for the component in its normally-occurring state at standard conditions. For the volatile components in the tank, that basis is as liquid. To modify the heat of combustion to the reference state for an ideal gas, which is applicable to this calculation for the vent stream, the value is adjusted by the heat of vaporization:

$$Q_{comb}^{IG} = Q_{comb}^{liq} + Q_{vap}$$

Q_{comb}^{IG} = heat of combustion for the ideal gas state at 25 °C
Q_{comb}^{liq} = heat of combustion for the liquid state at 25 °C
Q_{vap} = heat of vaporization at 25 °C

Using the basis of 1 scf (expressed with standard conditions of 20 °C), the combustion heat for each combustible component is determined as follows:

$$n = P \cdot V/(R \cdot T)$$

n = moles in 1 scf, lbmol
V = 1 scf
R = ideal gas constant, 10.73 cuft-psia/lbmol-R
T = standard temperature, 68+459.67 R

$$Q_i = y_i \cdot n \cdot mw_i \cdot Q_{comb}^{IG}$$

Q_i = net combustion heat of component i in the vent stream
mw_i = molecular weight of component i

Finally, the total net heating value of the vent stream is determined by the sum:

$$Q_{net} = \Sigma Q_i$$

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
2	330/330 C Still Bottoms	D001	3	Fuel oil	0-50	25	N	2,643,363
				alklyated phenols	0-50	40	N	
				isobutyl benzene	25	16	N	
				normal butyl benzene	25	16		
				heptane		3	N	
3	IBB Still Bottoms	D001	**2**	isobutyl benzene	0-100	50	N	341,760
				normal butyl benzene	0-100	50	N	
5	Organic separated from Concentrated Aqueous Waste	D001, F005	Env. Ops (Pollution Control)	naphtha	0-70	70	N	0
				2,6 di tert butyl phenol	0-10	10	N	
				other alkylated phenols (non volatiles)		10	N	
				toluene (assume 10)	10	10		
7	Toluene from vessel and tank cleaning	D001, F005	2 and 3	toluene	0-70	3.7		233,600
				4 -methyl 1 pentene	0-30	51.9		
				4 - methyl 2 pentene	0-10	32.6		
				non volatiles		11.8		
16	**Used lubricating, hydraulic and cutting oil**	**D001**	**Maintenance**	various oils	90-100	100	N	0

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
23	methanol/hexane washout	D001, F003	3	methanol	0-80	45	N	14,112
				hexane	0-80	45	N	
				IBAP	0-10	5	N	
				HME	0-10	5	N	
				mis compounds			N	
85	702/703 still bottoms with super high flash naphtha	D001	1	naphtha	0-50	35	N	223,784
				702	0-50	32	N	
				703	0-50	15	N	
				cumene	0-75	7.5	N	
				formaldehyde	0.5	0.5	N	
				1,2,4 timethylbenzene	0-5	2.5	N	
				total xylenes	0-75	7.5	N	
90	DIPA Columns Bottoms	Non hazardous	2	diisopropylaniline	< 85	50	N	0
				heavy compounds	< 75	50	N	
99	Oil from Alkyla Aluminum Cylinder Cleaning	Non hazardous	2	process oil	90-100	90	N	78,283
				water	0-10	5	N	
				alkyl organics	0-5	5	N	
104	Heavy Organics from DR-3 Production (DR3 heel)	D001	3	ibuprofen	??	60	N	1,293,704
				hexane	0-20	20	N	
				para DR3	36	10	N	
				meta DR3	15	10	N	
123	Organic from DR-3 Aqueous Waste	D001	3	isobutylbenzene	0-50	20	N	224,812
				IBAP	0-50	21	N	
				PME	0-50	22	N	
				HME	0-50	22	N	
				Hexane	0-25	15	N	

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
127	E4716 Organics	D001	2	2,6 ditertiarybutyl phenol	10-50	20.00	N	0
				irganaox	0-60	20	N	
				methyl acrylate	0-20	10	N	
				process oil	10-90	10	N	
				exxall 8 alcohol	10-90	40	N	
125	DIP Misc. Organics			water	0-5	2.5	N	79,772
				phenol	10-15	12.5	Y	
				propoxylbenzene	0-5	2.5		
				2-isopropylphenol	35-40	37		
				3 ethyl 5 methylphenol	10-15	11		
				propofol	30-35	33		
				2,4,6 triisopropylphenol	0-3	1.5		
148	Recovered Process Oil-NcendX	D001, F005	2	hydrolyzed oil	90-100	100	N	0
149	AN 701 Lights			OTBP	10-20	17	N	0
				2,6 DTBP	40-55	50	N	
				2,4 DTBP	0-5	3	N	
				ttbp	10-20	17	N	
				702	0-5	4	N	
				phenol	5-10	8	Y	
				water	<0.5	1	N	

Current Streams

Waste ID	Waste Desciption	Waste Status	Area	Constituent	wt %	Mid point	Appendix VIII Hazardous Constituent?	Amount burned in CY19
175	Waste Methanol	D001		water	0-10	0.99	N	0
				ammonia	100-500 ppm		N	
				hexane	0-100 ppm	0.01	N	
				methanol	90-99	99	N	
162	DIPA waste solvents	D001		anilne	15	15	Y	0
				OIPA	7	7	N	
				PIPA	1	1	N	
				DIPA	17	17	N	
				super high flash naphtha	60	57	N	
				cumene	3	3	N	
389	4716 Methanol	D001	2	methanol		98.00	N	535,198
				water		0.5	N	
				exxall 8 alcohol		1	N	
				methyl acrylate		0.5	N	
687	T-15M-60 Recycle Toluene	D001	North	toluene	75-98	94.5	Y	74,523
				hexane	0-5	2.5		
				isobutylbenzene	<1	1		
				n-butyl benzene	<1	1		
				methanol	<0.05	0.05		
				methyl acrylate	<1	0.95		
709	Fuel Oil (off spec)	D001,	North	fuel oil	90-100	95		0
				water	0-10	5		

Constituent	percent component to total burned
702	1.363844921
703	0.584504966
1,2,4 timethylbenzene	0.097417494
2,4,6 triisopropylphenol	0.020835775
2-isopropylphenol	0.51394911
3 ethyl 5 methylphenol	0.152795681
4 - methyl 2 pentene	1.326045276
4 -methyl 1 pentene	2.11109662
alklyated phenols	18.41131092
alkyl organics	0.068156202
cumene	0.292252483
formaldehyde	0.019483499
Fuel oil	11.50706932
heptane	1.380848319
hexane	0.110578067
hexane	0.587190016
hexane	4.505394564
hexane	0.0324413
HME	0.012286452
HME	0.861212023
IBAP	0.012286452
IBAP	0.822066022
ibuprofen	13.51618369
ibuprofen	2.252697282
ibuprofen	2.252697282
isobutylbenzene	2.975494484
isobutylbenzene	7.364524368
isobutylbenzene	0.782920021
isobutylbenzene	0.01297652
isooctyl alcohol	0.093192808
methanol	0.110578067
methanol	9.132895147
methanol	0.000648826
methyl acrylate	0.046596404
methyl acrylate	0.01297652
naphtha	1.363844921
non volatiles	0.479979578
normal butyl benzene	2.975494484
normal butyl benzene	7.364524368
normal butyl benzene	0.01297652
phenol	0.173631456
PME	0.861212023
process oil	1.226811629
propofol	0.458387044
propoxylbenzene	0.034726291
toluene	0.150502071
toluene	1.226281149
xylenes	0.002922525
water	0.034726291
water	0.068156202
water	0.046596404

Constituent	percent component to total burned
702 Total	1.363844921
703 Total	0.584504966
1,2,4 timethylbenzene Total	0.097417494
2,4,6 triisopropylphenol Total	0.020835775
2-isopropylphenol Total	0.51394911
3 ethyl 5 methylphenol Total	0.152795681
4 - methyl 2 pentene Total	1.326045276
4 -methyl 1 pentene Total	2.11109662
alklyated phenols Total	18.41131092
alkyl organics Total	0.068156202
cumene Total	0.292252483
formaldehyde Total	0.019483499
Fuel oil Total	11.50706932
heptane Total	1.380848319
hexane Total	5.235603947
HME Total	0.873498475
IBAP Total	0.834352474
ibuprofen Total	18.02157826
isobutylbenzene Total	11.13591539
isooctyl alcohol Total	0.093192808
methanol Total	9.24412204
methyl acrylate Total	0.059572924
naphtha Total	1.363844921
non volatiles Total	0.479979578
normal butyl benzene Total	10.35299537
phenol Total	0.173631456
PME Total	0.861212023
process oil Total	1.226811629
propofol Total	0.458387044
propoxylbenzene Total	0.034726291
toluene Total	1.37678322
xylenes Total	0.002922525
water Total	0.149478897
Grand Total	99.82821986

Constituent	percent component to total burned
alklyated phenols Total	18.41131092
ibuprofen Total	18.02157826
Fuel oil Total	11.50706932
isobutylbenzene Total	11.13591539
normal butyl benzene Total	10.35299537
methanol Total	9.24412204
hexane Total	5.235603947
4 -methyl 1 pentene Total	2.11109662
heptane Total	1.380848319
toluene Total	1.37678322
702 Total	1.363844921
naphtha Total	1.363844921
4 - methyl 2 pentene Total	1.326045276
process oil Total	1.226811629
HME Total	0.873498475
PME Total	0.861212023
IBAP Total	0.834352474
703 Total	0.584504966
2-isopropylphenol Total	0.51394911
non volatiles Total	0.479979578
propofol Total	0.458387044
cumene Total	0.292252483
phenol Total	0.173631456
3 ethyl 5 methylphenol Total	0.152795681
water Total	0.149478897
1,2,4 timethylbenzene Total	0.097417494
isooctyl alcohol Total	0.093192808
alkyl organics Total	0.068156202
methyl acrylate Total	0.059572924
propoxylbenzene Total	0.034726291
2,4,6 triisopropylphenol Total	0.020835775
formaldehyde Total	0.019483499
xylenes Total	0.002922525

Appendix O-3
Flare Velocity

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

BTB 7/28/15

Tank ID	T-30M-66		
Description	Burn Tank - Average of what burned in Cy14		
Tank contents temperature		40	°C
Tank pressure		0	psig
Sum of composition		100	wt%
Vapor net heating value, Q_{net}		**222.6**	**BTU/scf**

	Liquid Comp.	Note	Mol wt mw	Vapor Pressure P^{sat} psia	Activity Coeff. g	Liq State Heat of Combust. at 25 °C Q_{comb}^{liq} BTU/lb	1/mw	Heat of Vaporiz. Q_{vap} BTU/lb	IG State Heat of Combust. at 25 °C Q_{comb}^{IG} BTU/lb
Volatile Components	wt%								
PropXL - only for combustible liquids at 25 °C									
ISOBUTYLBENZENE	18.26		134.221	0.093606	1	17809	0	154	17963
n-BUTYLBENZENE	5.79		134.221	0.053029	1	17809	0	161	17970
CUMENE	1.05		120.194	0.212074	1	17706	0	161	17867
METHANOL	2.6		32.0422	5.136252	1	8560	0	510	9070
TOLUENE	4.31		92.1405	1.141441	1	17404	0	179	17583
HEXANE	3.15		86.1772	5.431509	1	19257	0	157	19414
CYCLOHEXANE	0.81		84.1613	3.606415	1	18696	0	169	18865
ANILINE	0.16		93.1283	0.029994	1	14957	0	258	15215
DODECANE	0.13		170.338	0.008408	1	18955	0	152	19107
Manual - for non-PropXL components and non-combustible components									
Fuel Oil	17.11		200	0.2	1	18000	0.005	100	18100
Super High Flash Naphtha	3.42	SHFN is a blend, used properties for solvent naphtha however	114	0.798	1	19093	0.008772	125	19218
2,4,6 triisipropylphenol	4.2	Assumed same properties as 2,6 DIP	220	0.002464	1	100	0.004545	149	249
2,6 diisopropyl phenol	0.4		178.27	0.002	1	100	0.005609	149	249
heptane	2.5		100.21	0.773	1	19163	0.009979	137	19300
2 4 diisopropyl phenol	2.9	Assumed same properties as 2,6 DIP	220	0.002464	1	100	0.004545	149	249
2,6 diisopropyl aniline	0.51		177.29	0.00185	1	14000	0.00564	146	14146
					1				
Nonvolatile Components									
Ethanox 330/330 heel	14		775.2				0.00129		
702	9.3		424				0.002358		
703	1.4		424				0.002358		
ibuprofen (including meta, para)	8		206.29				0.004848		

Notes:

1 use dodecane to represent kerosene

2 component X is proprietary, but with known properties provided by the vendor

Exit Velocity Calculation
Flare E-8332 for Boiler #4 Waste Tank Venting

Flare pipe exit diameter	3.5	inches
thus the area is	0.267	sq ft
Maximum estimated pump in rate	400	gpm
convert gallons to cu ft	53.48	CFM
convert minutes to seconds	0.89	cu ft per second
Therefore velocity = Flow / Area	**3.33**	feet per second

	Chemical Name	Database Component ID
1	2,6-DITERTIARYBUTYLPHENOL	1380
2	2-TERT-BUTYLPHENOL	1276
3	ISOBUTYLBENZENE	748
4	n-BUTYLBENZENE	70
5	TOLUENE	183
6	HEXANE	231
7	METHANOL	965
8	CYCLOHEXANE	246
9	DODECANE	316
10	CUMENE	1357
11	2,6-DIISOPROPYLANILINE	606
12	1,6-HEXANEDIOL	916
13	1,2-HEXANEDIOL	144
14	METHYL ACRYLATE	1331
15	EXXAL 8	1701
16	ISOPROPYL ALCOHOL	966
17	MCP DIMER	620
18	DIMETHYL CARBITOL	296
19	XYLENE-M	165
20	1H-PYRROLE	216
21	TRIETHYLAMINE	380
22	TETRAHYDROFURAN	217
23	DIETHYL KETONE	1330
24	2,6-DIISOPROPYL PHENOL	583
25	DIETHYL ETHER	859
26	AMMONIA	1144
27	ANILINE	904
28	2-ISOPROPYLANILINE	950
29	ETHANOL	947
30	METHYLENE CHLORIDE	1061
31	1,4-DIOXANE	404
32	1,4-DIETHYLBENZENE	75
33	ACETONE	967
34	1,2-PROPYLENE OXIDE	1090
35	METHYL ETHYL KETONE	1215
36	ISOHEXANE	147
37	NITROGEN	1161
38	WATER	1164
39	CARBON DIOXIDE	420
40	NITRIC OXIDE	41
41	NITROGEN DIOXIDE	42
42		
43		
44		
45		
46		
47		
48		
49		
50		

2,6

Instructions:

Click on a cell under "Chemical Name" and press "Import Component" button.
Click "Import" to select component in list.

Max # components in subdatabase = 50

User Units			
T (input)	C	NBP	C
		RadGyr	ft
AcFactor	unitless	SolParam	(cal/cc)^0.5
CASNo	unitless	VolSLM	cuft/lbmol
Zc	unitless	Tmin	C
DipoleMom	Debye units	Tmax	C
LFL	volume %	TripleP	psia
MolWt	unitless	TripleT	C
RefIndex	unitless	vdWarea	sqft/lbmol
UFL	volume %	vdWvol	cuft/lbmol
		DensL	g/cc
Tautoig	C	DensS	g/cc
Pc	psia	CpL	BTU/lb-F
Tc	C	CpS	BTU/lb-F
Vc	cuft/lbmol	CpV	BTU/lb-F
dHformIG	BTU/lb	dHvap	BTU/lb
FlashT	C	SurfTens	dyne/cm
dGform	BTU/lb	ThCondL	BTU/ft-hr-F
dHcomb	BTU/lb	ThCondV	BTU/ft-hr-F
dHmelt	BTU/lb	VapP	psia
SIG	BTU/lbmol-R	ViscL	cP
MeltT	C	ViscV	cP

diisopropyl aniline

Net Heating Value Calculator for Vent from Tank with Volatile Fuels

BTB 7/28/15

This calculation is intended to determine the net combustion heat contained in the vent stream from a tank that contains a mixture of components, one or more of which are combustible. Two main provisions of the calculation include (1) determination of the vapor composition given the liquid composition based upon the modified Raoult's Law equation, and (2) determination of the net combustion heat for each of the components.

The data entered for the calculation are in three categories. In the first section, volatile components featured in PropXL, the Corporate physical properties database for SI Group, can be selected, which allows for automatic determination of the properties used in the calculation. In the second section, volatile components not contained in PropXL may be entered manually, including their identity and properties. In the third section, non-volatile components can be entered along with their molecular weights.

Vapor Composition

$$y_i \cdot P = x_i \cdot g_i \cdot P_i^{sat}$$

y_i = concentration of component i in the vapor, mol fr
P = pressure in tank
x_i = concentration of component i in the liquid, mol fr
g_i = activity coefficient of component i in the liquid, which accounts for solution non-ideality (often a default value of unity is used)
P_i^{sat} = vapor pressure of component i at the tank temperature

Combustion

The appropriate basis for the combustion calculation is for each component in its ideal gas state, liberating vapor-phase products. That means water is produced as steam and its latent heat is not recovered, which provides the combustion calculation on a net heating basis. Typical net heat of combustion data are for the component in its normally-occurring state at standard conditions. For the volatile components in the tank, that basis is as liquid. To modify the heat of combustion to the reference state for an ideal gas, which is applicable to this calculation for the vent stream, the value is adjusted by the heat of vaporization:

$$Q_{comb}^{IG} = Q_{comb}^{liq} + Q_{vap}$$

Q_{comb}^{IG} = heat of combustion for the ideal gas state at 25 °C
Q_{comb}^{liq} = heat of combustion for the liquid state at 25 °C
Q_{vap} = heat of vaporization at 25 °C

Using the basis of 1 scf (expressed with standard conditions of 20 °C), the combustion heat for each combustible component is determined as follows:

$$n = P \cdot V/(R \cdot T)$$

n = moles in 1 scf, lbmol
V = 1 scf
R = ideal gas constant, 10.73 cuft-psia/lbmol-R
T = standard temperature, 68+459.67 R

$$Q_i = y_i \cdot n \cdot mw_i \cdot Q_{comb}^{IG}$$

Q_i = net combustion heat of component i in the vent stream
mw_i = molecular weight of component i

Finally, the total net heating value of the vent stream is determined by the sum:

$$Q_{net} = S\, Q_i$$