Integrated Contingency Plan

Superior Region (#866) Response Zone

Version Core 4.2/Annex 4.4
2017/2018
Superior-ICP-##

ENBRIDGE

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Version: Core 4.2 | Annex 4.4
2017/2018

ENBRIDGE

Record of Revisions

CORE REVISIONS

Date	Version	Subject No.	Subject Title	Change Type	Change Description
1/13	2013-1.0	Integrated Contingency Plan	Full Plan Review and Revisions	5 year Plan	New Format
7/13	2013-1.2	Core 1-1	Administration	Annual Maintenance	
		Core 1-1	Enbridge Rail North	Addition	New Asset
		Core 1-1	Enbridge Pipelines	Revised	
		Core 1-4	Management	Revised	
		Core 1-5	Area Contingency	Addition	5 & 6 added
		Core 1 .1	System Map	Revised	
		Core 2-7.3.10	Railroad Facility	Revised	
		Core 2-10	Evacuation	Revised	
		Core 2-15.3	Techniques Section	Revised	
		Core 2-15.3.1	Submerged Oil	Revised	
		Core 2-19.2	Railroad Loading	Revised	
1/14	2014-1.3	Core 1	Master Table of	Addition	Revision Record
3/14	2014-1.4	Cover	New Cover	Revised	Revised Cover
9/14	2014-2.0	Core 1	Annual Review and Updates	Annual Maintenance	Full Revision and rewrite
		Core 2	Annual Review and Updates	Annual Maintenance	Full Revision and rewrite
		Core 3	Annual Review and Updates	Annual Maintenance	Full Revision and rewrite
		Core 4	Annual Review and Updates	Annual Maintenance	Full Revision and rewrite
10/14	2014-2.1	Core 1	Update	Revised	Format of plan- move Company Entities up to Sect.1.0
		Core 2.2.2	Control Center	Revised	Include wording specific to the Northern Region
		Core 2.3.1	Isolation Distance	Revised	Edited- more descriptive
		Core 2.3.1	Isolation Distance	Revised	Edited- more descriptive
		Core 3.2	Training Matrices	Revised	Edited

Date	Version	Subject No.	Subject Title	Change Type	Change Description
11/14	2014- 2.2	Core 1	Enbridge Entities	Revised	Update Entities
3/15	2015-2.4	Core 1.0	Enbridge Entities	Revised	Replace list from Superior Law Dept.
		Core 1.0	Enbridge Entities 24 Hr. Contacts	Revised	Edit North Dakota phone number; U.S. Media phone number
		Core 1.8	U.S. Pipeline System Map	Revised	Replace map (New Line 59 added)
		Core 1,2,3 and 4	Headers and footers	Revised	Headers and footers format updated
5/15	2015-2.5	Core 2.3.1	Isolation Distance	Critical/Revised	Pentane moved from Guide#115 to Guide#128
		Core 2.4.7.9	Freshwater Biological Disinfection	Critical/Revised	Addition of information sheet
08/15	2015-3.0	Core Sections 1, 2, 3, 4	Complete replacement as part of annual review	Annual review	Complete replacement as part of annual review
01/16	2016-3.1	Core Section 1.0	Enbridge Entities	Revised	Entity Name Change from Enbridge Pipelines (Illinois) to Illinois Extension Pipeline Company, L.L.C ("IEPC")
		Core Section 1.1.2	Glossary	Critical Update	Revised and moved the Worst-Case Discharge methodology to Annex 4
08/16	2016-4.0	Core 1-4	Annual Review	Annual	Complete Revision of Core Sections 1-4
02/17	2017-4.1	Core Section 1 & 3	Plan Introduction Elements, Training/Exercise Program	Critical Revisions	Revised version of Canada and U.S. Pipeline System Maps due to re-organizational structuring and boundary changes, changes to Exercise Program to align with PREP Guidelines.
04/17	2017-4.2	Core Section 1	Plan Introduction Elements	Critical	Company 24/7 Emergency Phone Line – removed the call center number for South Prairie in 1.1. Added Tank Fire Prevention Protection sheet, 1.5.6 and Pipeline Inspections sheet, 1.5.7.
		Core Section 2	Core Plan Elements		As per PHMSA Letter of Correction Letter 04/12/2017: Add step by step instructions to the 2.4.9.6 In-situ Burn Guide insert regarding the approval process for in-situ burning,

ANNEX REVISIONS

Effective Date	Version	Subject No.	Subject Title	Change Type	Change Description
1/13	2013-1.0	Integrated Contingency Plan	Full Plan Review and Revisions	5 year Plan	New Format
7/13	2013-1.2	Annex 1.7	Tank Table	Revised	
		Annex 1.8	Pipeline Information	Revised	
		Annex 1.10	Worst-case Discharge	Revised	
		Annex 1.12	Emergency Response Time Maps	Revised	
		Annex 2.3	State Emergency Response Contacts	Revised	
		Annex 2.3	Local Emergency Planning Committees	Revised	
		Annex 2.3	Emergency Contacts	Revised	
1/14	2014-1.3	Annex 1.5	Qualified Individual	Revised	QI Change
		Annex 2.1	Incident Reporting	Revised	IMT Change
8/14	2014-2.0	Annex 1	Critical Update & Annual Review Updates	Annual Maintenance	Major Enhancement Project updates. Updated Equipment lists, Worst-Case Discharge, ER Maps
		Annex 2	Annual Review and Updates	Annual Maintenance	Incident Management Team and Local Emergency Planning Committee updates, new format
		Annex 3	Annual Review and Updates	Annual Maintenance	Unusually Sensitive Area updates Significant/Substantial Harm Maps & Tables
		Annex 4	Annual Review and Updates	Annual Maintenance	Update all regulatory references within plan
		Annex 5	Annual Review and Updates	Annual Maintenance	Update ICP Distribution reference, Update revision list
		Annex 6	Annual Review and Updates	Annual Maintenance	Update Emergency Response Action Plan

Effective Date	Version	Subject No.	Subject Title	Change Type	Change Description
10/14	2014-2.1	Annex 1.4	Incident Commanders (Qualified Individuals)	Critical/Revised	Change QI
		Annex 1.9.1	Regional Pipeline Worst-Case Discharge	Critical/Revised	Worst-Case Discharge
		Annex 2.2.4	Emergency Contact Information	Revised	Notifications updated
		Annex 4	Cross Reference	Revised	Cross Reference updated
		Annex 5.1	Revision Process	Critical/Revised	5 year submittal added, Record of Revisions updated
11/14	2014-2.2	Annex 1.6.2	Tank Table	Critical/Revised	New Tank 41 at Superior Terminal
		Annex 1.9.3-1.9.7	Tank WCD	Critical/Revised	New Tank WCD calculations
		Annex 2.2.3b	Notifications	Revised	LEPC updates
		Annex 3.0.3	Tribal Lands	Revised	Addition of 2 Tribal Lands
1/15	2015-2.3	Annex 1.6.2	Tank Table	Critical/Revised	New Tank 42 at Superior Terminal
		Annex 1.9.3-1.9.7	Tank WCD	Critical/Revised	New Tank WCD calculations New Plan Format - Annex 1
		Annexes- 2 to 5	All Annexes	Revised	New Plan Format
3/15	2015-2.4	Annex 1.9	Worst-Case Discharge	Critical/Revised	Regional Pipeline WCD changed ;Table 5- WCD Calculations; Figure 2- Worst-Case Discharge Map
		Annex 5	Record of Revisions	Revised	Moved to front of ICP
8/15	2015-3.0	Annexes 1,2,3,4,5,6	Complete replacement as part of annual review	Annual Review	Complete replacement as part of annual review
11/15	2015-3.1	Annex 1.6.2, 1.9, 1.11	Worst-Case Discharge	Critical/Revised	Table 2- Reference to line changed to reflect WCD update; Regional Pipeline WCD changed ;Table 5- WCD; Figure 2- Worst-Case Discharge Map; Diluent SDS
02/25/16	2016-3.2	Annex 1.0	Owner & Operator	Critical	Updated Operator name to Enbridge Energy Limited Partnership

Effective Date	Version	Subject No.	Subject Title	Change Type	Change Description
02/25/16	**2016-3.2**	Annex 1.2 & 1.2.1	Interface With Jurisdictional and Company Plans, Contingency Plans	Critical	Updated wording to be more specific around reviewing the NCP and ACPs. Added EPA Region 8 to the list of Contingency Plans
		Annex 1.6.2	Response Zone Description (Information Summary)		Added Tanks 43, 44 and 45 at Superior Terminal to Table 3
		Annex 2.2.4a-d, Annex 2.2.4e	Emergency Contact Information, Husky Tanks at Superior Terminal		Updated Incident Management Team list, added contact information for Husky (Tanks 28 & 29)
		Annex 4.5	Other Regulatory References		Move Worst Case Discharge from Core and updated the methodology
10/03/16	**2016-4.0**	Annex 1-5	Annual Review	Annual	Completed review and revision of Annexes 1-5
		Field Emergency Response Plan	Annual Review		Review, revision and renaming of Annex 6 to Field Emergency Response Plan
12/02/16	**2016-4.1**	Annex 1.11	Safety Data Sheets	Critical	Addition of Canadian Heavy Sweet SDS
		Annex 1.4	Incident Commanders (Qualified Individuals)		Revise Tony Hommerding's title to "Manager, Regional Services"
		Annex 2.2.3a	Emergency Contact Information		Revise Tony Hommerding's title to "Manager, Regional Services"
		Annex 2.2.3b	Incident Management Team List		Revised Incident Management Team list to align with re-organizational structure
		Field Emergency Response Plan	Incident Commanders (Qualified Individuals), Incident Management Team		
03/13/17	**2017-4.2**	Annex 1.2.1	Contingency Plans and Tactical Response Plans	Critical/Revised	Revised Contingency and Tactical Plans list with change of Regional border. Remove "EPA Inland Area Contingency Plan." Add "Minnesota Emergency Operations Plan." Add "Western Michigan ACP." Move "Western Lake Superior Area Contingency Plan (GRP)" from Sub-Area GRPs into master list.
		Annex 1.4	Incident Commanders (Qualified Individuals)		Remove "Regional Services" from Tony Hommerding's title
		Annex 1.6	Response Zone Description (Information Summary)		Revised 1.6.1 Superior Region (#867); 1.6.2 Superior Region Pipeline Information; *Table 1- Pipeline Segments*; Enbridge Energy, Limited

					Partnership includes:; *Table 2- Superior Region Pipelines Beginning and Ending Stationing*; The Superior Region is comprised of:; *Table 4- Superior Region State/County Crossings*; *Figure 1- County Map.* Revise first sentence to include the third entity included in Superior Region "Enbridge Pipelines (Toledo) Inc." Revise end of the first sentence to read "…continues across northern Michigan throughout Wisconsin"
03/13/17	**2017-4.2**	Annex 1.7	Local Spill Response Equipment	Critical	Revised equipment list with change of Regional border; 1.7.1 Spill Response Organizations- Internal and External Locations
		Annex 1.9	Worst- Case Discharge		Revised with change of Regional border; 1.9.1 Regional Pipeline Worst-Case Discharge; *Table 5- Superior Region Worst-Case Discharge Line Calculations; Figure 2- Worst-Case Discharge Map*
		Annex 1.10	Emergency Response Time Maps		Revised all maps to new regional border. 1.10.3 Enbridge Facility Emergency Response Maps; 1.10.4 OSRO Facility Maps
		Annex 1.11	Safety Data Sheets		Addition of CHS Canadian Heavy Sweet
		Annex 2.0.1	Emergency Notification/Activation		Under Regional Management, Add Jerry Christoff under Alternates. Manager Superior Area Ops, Jerry Christoff, 715-398-8357, 218-391-6710
		Annex 2.2	Incident Reporting		Revised and updated regional border changes - contact information- Sections 2.2.3a-2.2.3f; 2.2.3g changed from 2.2.4g and updated with Husky Tertiary Contact email address.
		Annex 2.2.3a	Emergency Contact Information		Under Enbridge Qualified Individuals, add Jerry Christoff, Manager Superior Area Ops, 715-398-8357, 218-391-6710
		Annex 2.2.3d	Government Notifications		Under Federal, add the US Fish & Wildlife and the US Forest Service contact info
		Annex 2.2.3d	Government Notifications		Under States, add MN Dept of Health, NorthEast Region, Public Health Preparedness Consultant info
		Annex 3.0	Unusually Sensitive Area Information		3.0.3 Tribal Lands- Addition of Cass Lake Reservation; Revised with updates from regional border change; 3.0.4 State/local and National

					Parks/Forests; 3.0.10 Recreational Areas; 3.0.13 Water Resources/ Lakes and Streams; 3.0.15 Transportation Areas. Revise the last sentence in the first paragraph to read "…into electronic media, and is accessible through LP Environment."
03/13/17	**2017-4.2**	Annex 3.1	Significant and Substantial Harm Maps and Tables	Critical	Revised with updates from regional border change; Maps; 3.1.1 Unusually Sensitive Area Tables
		Field Emergency Response Plans (FERP)	Contingency Plans, Response Zone Description, Local Spill Response Equipment, Emergency Response Time Maps		Contingency Plans, Response Zone Description, Local Spill Response Equipment, Incident Management Team List, Emergency Contacts, Government Notifications, Emergency Response Time Maps
05/05/17	**2017-4.3**	Annex 1.2.1	Contingency Plans and Tactical Response Plans	Critical	As per PHMSA Letter of Correction 04/12/2017, add the following Contingency Plans: Canuscent Annex III to the Canada – United States Joint Inland Pollution Contingency Plan, Region II (NY/NJ) Regional Response Team Regional Oil and Hazardous Substances Pollution Contingency Plan
		Annex 1.10	Emergency Response Time Maps		Updated OSRO Maps to capture the location of T&T Marine with the updated Superior and Great Lakes boundary change.
		Annex 2.2.3f	Enbridge (U.S.) Required Leak Notifications		Updated the conditions in which reporting must occur within the 1 hour and follow up notification call required within 48 hours at which time Enbridge will supply more information about the incident details.
		Annex 4.1	DOT 49CFR§195		Updated 49CFR§195 to capture the revised regulation around follow up reporting within 48 hours of an incident.
07/14/17	**2017-4.4**	Annex 1.2.1	Contingency Plans and Tactical Response Plans	Critical	As per PHMSA Letter of Corrections, dated June 6, 2017, add the Great Lakes Contingency Plan
		Annex 1.7	Local Spill Response Equipment		Revise list to reflect the information in Maximo, DOJ deliverable
		Annex 1.10	Emergency Response Time Maps		Revise maps to reflect the information in Maximo, DOJ deliverable
		Annex 1.11	Safety Data Sheets		Add drag agent to Line 13, DRA LP 100 Flow Improver
		Annex 2.3.1	Marine Pollution Control Corp. (MPC) Agreement		As per PHMSA Letter of Corrections, dated June 6, 2017, add additional agreement documentation.

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ANNEXES

Section 1 – Table of Contents Page

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1.0 Enbridge Entities

The Integrated Contingency Plan ("ICP") applies to the following companies.

	ENBRIDGE LEGAL COMPANY NAMES
U.S. Owner & Address	Bakken Pipeline Company LP CCPS Transportation, L.L.C. Enbridge Energy, Limited Partnership Enbridge Storage (Cushing) L.L.C. Enbridge Pipelines (FSP) L.L.C. Illinois Extension Pipeline Company, L.L.C. Enbridge Pipelines (Ozark) L.L.C. Enbridge Storage (Patoka) L.L.C. Enbridge Pipelines (Southern Lights) L.L.C. Enbridge Pipelines (Toledo) Inc. North Dakota Pipeline Company L.L.C. 1100 Louisiana Street, Suite 3300 Houston, TX 77002-5216 Phone: (713) 821-2000
Canada Owner & Address	Enbridge Pipelines Inc. Enbridge Pipelines (NW) Inc. Enbridge Pipelines (Athabasca) Inc. Enbridge Southern Lights L.P. Enbridge Pipelines (Woodland) Inc. Enbridge Bakken Pipeline Limited Partnership Hardisty Contract Tankage Enbridge Midstream Inc. Enbridge Operational Services Inc. Enbridge Midstream Inc. 10201 Jasper Ave. Edmonton, Alberta T5J 3N7 Phone: 1-780-420-5210

Throughout this Plan, a reference to the "Company" includes the Enbridge companies listed above.

1.1 Company 24/7 Emergency Phone Line

In Case of Emergency – 24 hr. Contacts	
Edmonton Control Center	1-800-858-5253 US Regions 1-877-420-8800 CDN Regions (Western, Central, Eastern, Northern) 1-888-813-6844 Athabasca and Western Region
Enbridge Media Hotline	1-888-992-0997 Canada 1-877-496-8142 US

1.2 Acronyms / Glossary / Conversion Table

1.2.1 Acronyms

Terminology specific to the U.S. is shaded in grey.

Acronym	Description
AAR/IP	After Action Report/ Improvement Plan
AER	Alberta Energy Regulator
ACP	Area Contingency Plan
API	American Petroleum Institute
ATV	All-Terrain Vehicle
AVP	Automated Valve Placement System
BBL	Barrel (Unit of Volume Equal to 42 Gallons)
BPD	Barrels per Day
C	Degrees Centigrade
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CMT	Crisis Management Team
CNW	Commercially Navigable Waterway (High Consequence Area)
COTP	Captain of the Port
CP	Control Point
CPM	Computational Pipeline Monitoring
CSA	Canadian Standards Association
CWA	Clean Water Act
DOCL	Documentation Unit Leader
DOSC	Deputy Operations Section Chief
DOT	U.S. Department of Transportation
DW	Drinking Water (High Consequence Area)
EAS	Emergency Alert System
EEC	Environmental Evaluation Coordinator
EH&S	Environment, Health, & Safety

Acronym	Description
EMS	Emergency Medical System
EMT	Emergency Medical Technician
ENR	Environment & Natural Resources (Northwest Territories Government)
ENVL	Environmental Unit Leader
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ERD	Emergency Response Directory
ERG	Emergency Response Guidebook
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESA	Environmentally Sensitive Area (High Consequence Area)
E3RT	Enbridge Enterprise Emergency Response Team
ESD	Emergency Shutdown
FAA	Federal Aviation Administration
FE	Functional Exercise
FEMA	Federal Emergency Management Agency
FERP	Field Emergency Response Plan
FID	Flame Ionization Detector
FOSC	Federal On-Scene Coordinator
FP	Flashpoint
FRP	Facility Response Plan
FRT	Field Response Team
FSC	Finance Section Chief
FSE	Full Scale Exercises
FWPCA	Federal Water Pollution Control Act (as amended) (33 U.S.C. 1251 et seq.)
GIS	Geographic Information System
GIUE	Government-Initiated Unannounced Exercise in U.S.
GNWT	Government of Northwest Territories
GPM	Gallons Per Minute

Acronym	Description
GRP	Geographical Response Plans
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCA	High Consequence Area
HPA	High Population Area (High Consequence Area)
IAP	Incident Action Plan
IC	Incident Commander
ICP	Integrated Contingency Plan
ICS	Incident Command System
IDLH	Immediately Dangerous to Life and Health
IMH	Incident Management Handbook
IMT	Incident Management Team
ISB-MGS	In-situ Burn Monitoring Group Supervisor
JIC	Joint Information Center
LEL	Lower Exposure Limit
LEPC	Local Emergency Planning Committee
LMS	Learning Management System
LNO	Liaison Officer
LOC	Level of Concern
LOSC	Local On Scene Coordinator
LPM	Line Pressure Monitor
LSC	Logistics Section Chief
MAOP	Maximum Allowable Operating Pressure
MBS	Material Balance System
NCP	National Contingency Plan
NGL	Natural Gas Liquids
NEB	National Energy Board
NIMS	National Incident Management System
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System

Acronym	Description
NPMS	National Pipeline Mapping System
NRC	National Response Center
NRDA	Natural Resources Damage Assessment
NRS	National Response System
NRT	National Response Team
OPA	Other Populated Area (High Consequence Area)
OPA 90	Oil Pollution Act of 1990
OPR	Onshore Pipeline Regulations
ORM	Operational Risk Management
OSC	Operations Section Chief
OSHA	Federal Occupational Safety and Health Administration
OSRO	Oil Spill Response Organization
PAC	Public Awareness Committee
PAP	Public Awareness Program
PEP	Public Emergency Program
PIA	Post-Incident Analysis
PIO	Public Information Officer
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLC	Programmable Logic Controller
PLM	Pipeline Maintenance
POLREP	Pollution Report
PPE	Personal Protective Equipment
PPM	Parts Per Million
PREP	National Preparedness for Response Exercise Program
PSC	Planning Section Chief
PSI	Pounds per square inch
PSIA	Pipeline Safety Improvement Act
QA/QC	Quality Assurance/ Quality Control
QI	Qualified Individual
RCP	Regional Contingency Plan

Acronym	Description
RCRA	Resource Conservation and Recovery Act
RICP	Regional Integrated Contingency Plan
ROW	Right-of-Way
RP	Recommended Practice
RRT	Regional Response Team
RSO	Radiation Safety Officer
RTTM	Real Time Transient Model
SARA	Superfund Amendments and Reauthorization Act
SCADA	Supervisory Control & Data Acquisition
SCAT	Shoreline Clean-up Assessment Team
SCBA	Self-Contained Breathing Apparatus
SDS	Safety Data Sheet (also known as Material Safety Data Sheet)
SERC	State Emergency Response Commission
SMART	Special Monitoring for Applied Response Technologies
SML	Subject Matter Lead
SOFR	Safety Officer
SONS	Spill of National Significance
SOP	Standard Operating Procedure
SOSC	State On-Scene Commander
SPC	Statistical Process Control
SPCC	Spill Prevention, Control, and Countermeasures
SSHP	Site Safety and Health Plan
SUBD	Support Branch Director
TFR	Temporary Flight Restrictions
TSB	Transportation Safety Board
TTX	Table Top Exercise
UC	Unified Command
UEL	Upper Exposure Limit
USA	Unusually Sensitive Areas
USC	U.S. Code

Acronym	Description
WCD	Worst-Case Discharge

1.2.2 Glossary

Terminology specific to the U.S. is shaded in grey.

Term	Definition
A	
Absorbent Material	Any of several materials designed to absorb oil, both hydrocarbon and non-hydrocarbon.
Access/Staging Areas	Designated areas offering access to spill sites for the gathering and deployment of spill response equipment and personnel.
Adversary	Any individual, group, organization or government that conducts, or has the intention and capability to conduct, activities detrimental to critical assets (e.g., intelligence services of host nations, political terrorist groups, criminals, rogue employees, private interest, site insiders/outsiders).
Adverse Weather	The weather conditions that will be considered when identifying response systems and equipment in a response plan for the applicable operation environment. Factors to consider include significant wave height, ice, temperature, weather-related visibility, and currents within the COTP zone under the U.S. Coast Guard / or Canadian Coast Guard in which the systems or equipment are intended to function.
Alert Levels	A progressive, qualitative measure of the likelihood of terrorist actions, from negligible to imminent, based on government or Company intelligence information. Different fixed or variable security measures may be implemented based on the level of threat to the facility.
Area Contingency Plan	A reference document prepared for the use by all agencies engaged in responding to environmental emergencies in a defined geographic area as described in the Oil Pollution Act of 1990.
Assisting Agency	An agency directly contributing tactical or service resources to another agency.
B	
Barrel ("bbl")	A barrel of crude oil is equal to 42 gallons (approximately 159 liters).
Boom	A temporary floating barrier used to contain an oil spill.
Boom Deployment	The placement of a boom on land or in water to contain a product release.
Business Critical Facilities	Facilities and assets, whether physical or virtual, so vital to the Company that the incapacity or destruction of such systems and assets would have a debilitating impact on people, the environment, property or economic viability of the Company.
C	
Cache	A pre-determined complement of tools, equipment, and/or supplies stored in a designated location, and available for incident use.

Term	Definition
CERCLA	The Comprehensive Environmental Response, Compensation and Liability Act, (U.S.) regarding hazardous substance releases into the environment and the clean-up of inactive hazardous waste disposal sites.
Clean-Up Contractor	Non-Company person contractually engaged to respond to and clean-up an oil spill.
Command Post	A site located in the cold zone where response decisions and activities can be planned, coordinated, and managed. The Incident Commander and regulatory bodies may operate from this location.
Company	Includes companies in the United States and in Canada.
Competent Worker	A person who, because of training and experience, is capable of identifying hazardous or dangerous conditions and has the authority to take prompt corrective measures to eliminate them.
Containment Boom	A flotation/freeboard device, made with a skirt/curtain, longitudinal strength member, and ballast unit/weight designed to entrap and contain the product for recovery.
Contamination Reduction Zone	The area between the contaminated zone and the clean zone. This area is designed to reduce the probability that in the future the area would become contaminated. Also known as the warm zone.
Contingency Plan	A document used by (1) Federal, Provincial/State, local and territorial agencies to guide entities' planning and response procedures regarding spill of oil, hazardous substances, or other emergencies; (2) a document used by industry as a response plan to spills of oil, hazardous substances, or other emergencies.
Contract or Other Approved Means	1. A written contractual agreement with a response contractor. The agreement should identify and ensure the availability of the specified personnel and equipment described under this plan within stipulated response times in the specified geographic areas; 2. Certification by the facility owner or operator that the specified personnel and equipment described under this plan are owned, operated, or under the direct control of the facility owner or operator, and are available within the stipulated times in the specified geographic areas; 3. Active membership in a local or regional oil spill removal organization that has identified specific personnel and equipment described under this plan that are available to respond to a discharge within stipulated times in the specified geographic areas.
Contractor	A company hired to complete specific work and paid directly by the Company.
Control Point ("CP")	A location downstream of a spill site on a stream or river where containment and recovery operations can occur.
Cooperating Agency	An agency supplying assistance other than direct tactical, support, or service functions or resources to the incident control effort.

Term	Definition
Crisis	An incident, emergency, or combination of circumstances that could have a significant negative impact on the public, the environment, or the Company's employees, operations, reputation, earnings, or share value.
Crisis Management Team ("CMT")	The executive group within the Company that functions away from the scene to support the Incident Management Team, facilitate planning, manage business recovery projects and address the implications of the problems and the potential impacts on the Company's viability, operability and credibility. Provides off-site strategic support.
Critical Facility	A facility that meets one or more of the following criteria: • May be considered a viable terrorist target, and a release from the facility has the potential for mass casualties or significant impact on public drinking water affecting a major population center if damaged or destroyed, would have a detrimental impact on the reliability or operability of the pipeline system, significantly impairing the ability to service a large number of customers for an extended period • If damaged or destroyed, would significantly impair other modes of transportation or other critical infrastructures (e.g., electrical power generation, telecommunications, public utility)
Critical Infrastructure	Systems and assets, whether physical or virtual, so vital to the Company that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health and safety or any combination thereof.
Crude Oil	Any liquid hydrocarbon mixture occurring naturally in the earth, whether or not treated to render it suitable for transportation, and includes crude oil from which certain distillate fractions may have been removed and crude oil to which certain distillate fractions may have been added.
Culturally Sensitive Areas	Current, historic, prehistoric, and archaeological resources which include deposits, structures, sites, ruins, buildings, graves, artifacts, fossils, or other objects of antiquity which provide information pertaining to historical or prehistoric culture of people as well as the natural history of the area.
D	
Damage Assessment	The process of determining and measuring damages and injury to the human environment and natural resources, including cultural resources. Damages include differences between the conditions and use of natural resources and the human environment that would have occurred without the incident, and the conditions and use that ensued following the incident. Damage assessment includes planning for restoration and determining the costs of restoration.
Dark Site	Activated to manage internal/ external communications related to any emergency.

Term	Definition
Decontamination ("Decon")	The removal of hazardous substances from personnel and equipment necessary to prevent adverse health effects.
Diluents	A generic term that encompasses any mixture of light liquid hydrocarbons used to dilute a heavier petroleum product (such as bitumen). As a common carrier, Enbridge may transport several different mixtures of diluents.
Discharge	Any spilling, leaking, pumping, pouring, emitting, emptying, or dumping.
Dispersants	Those chemical agents that emulsify, disperse, or solubilize oil into the water column or promote the surface spreading of oil slicks to facilitate dispersal of the oil into the water column.
Diversion Boom	A flotation/freeboard device, made with a skirt/curtain, longitudinal strength member, and ballast unit/weight designed to deflect or divert floating product towards a pick up point or away from certain areas.
Dredging	Underwater excavation activity where heavy equipment is used to collect and remove bottom sediments by scraping or sucking.
E	
Enbridge Enterprise Emergency Response Team ("E3RT")	Comprised of individuals from each business unit (Liquids Pipelines, Gas Processing and Pipelines, Gas Distribution) to ensure that the Company has a highly trained team of that can be called upon within the organization to respond to large scale incidents anywhere within the Company.
Emergency	An unforeseen combination of circumstances or a disruption of normal operating conditions that poses a potential threat to human life, health, property, and/or the environment if not contained, controlled, or eliminated immediately.
Emergency Operations Center ("EOC")	A pre-designated facility established by an agency or jurisdiction to coordinate the overall agency or jurisdictional response and support to an emergency response.
Emergency Organization	The chain of command used during emergency operations to provide effective management of the emergency and available resources.
Emergency Response Guidebook ("ERG")	This Guidebook is for Enbridge responders during the initial phase of a dangerous goods/hazardous materials transportation incident. It is a joint publication by the PHMSA, Transport Canada and the Secretariat of Transport and Communications of the Mexican Government.
Emergency Service	Those activities provided by the provincial/state and local governments to prepare for and carry out any activity to prevent, minimize, respond to, or recover from an emergency.
Enbridge Responder	Individual(s) employed by Enbridge who responds to a release or a potential release of hazardous substances as part of the initial response to the site for purposes of protecting nearby persons, property or the environment from the effects of the release.

Term	Definition
Environmentally Sensitive Areas ("ESA")	Streams and water bodies, aquifer recharge zones, springs, wetlands, agricultural areas, bird rookeries, endangered or threatened species (flora and fauna) habitat, wildlife preserves or conservation areas, parks, beaches, dunes, or any other area protected or managed for its natural resource value.
Exercise Design Team	A team comprised of federal, provincial/state and industry representatives with responsibility for designing an Area Exercise. The exercise design team is charged with working with the lead plan holder to develop the scope, parameters and exercise scenario, although the lead plan holder retains the final decision on these.
External First Responders, First Response Agency	A public health or safety agency (e.g. fire service or police department) charged with responding to a spill during the emergency phase and alleviating immediate danger to human life, health, safety, or property.
F	
Field Response Team ("FRT")	A team of tactical Enbridge responders who take actions at an incident scene to directly respond to the problem and its consequence. Provides on-site tactical support. This team is made up of the Pipeline Maintenance ("PLM") crew or other similar group. Also known as Spill Management Team.
Fish and Wildlife and Sensitive Environments	Areas that may be identified by either their legal designation or by evaluations of Area Committees (for planning) or members of the jurisdiction having authority in the spill response structure (during responses). These areas may include wetlands, National and Provincial/State parks, critical habitats for endangered/threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation areas, reserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and provincial/state lands that are research national areas, heritage program areas, land trust areas, and historical and archeological sites and parks.These areas may also include unique habitats such as aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, and designated seasonal habitats.
Function	In ICS, function refers to the five major activities in the ICS, i.e., Command, Operations, Planning, Logistics, and Finance/Administration. The term function is also used when describing the activity involved, e.g., "the planning function."
G	
Geographic Information System ("GIS")	An electronic information system that provides a geo-referenced database to support management decision-making.
H	
Handle	To transfer, transport, pump, treat, process, store, dispose of, drill for, or produce.

Term	Definition
Harmful Quantity of Oil	The presence of oil from an unauthorized discharge in a quantity sufficient either to create a visible film or sheen or discoloration upon water, shoreline, tidal flat, beach, or marsh, or to cause a sludge or emulsion to be deposited beneath the surface of the water or on a shoreline, tidal flat, beach, or marsh.
Hazardous Substance / Material	Dangerous goods (solids, liquids or gases) that can harm people, other living organisms, property, or the environment, including but not limited to substances otherwise defined as hazardous wastes, dangerous wastes, extremely hazardous wastes, oil, or pollutants that are classified by CERCLA in the U.S and Environment Canada.
Hazardous Waste Operations and Emergency Response ("HAZWOPER")	Training required in the U.S under OSHA *29CFR§1910.120*. for responders who are exposed to or potentially exposed to hazardous substances including hazardous waste. Canadian employees will be required to complete the appropriate training course based on their potential job duties in a cross border response.
Health Hazard	A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed persons.
I	
Incident	An event affecting Company operations that may be an emergency or crisis.
Incident Action Plan ("IAP")	A document Is initially prepared at the first planning meeting that contains general control objectives reflecting the overall incident strategy, and specific action plans for the next operational period. When complete, the Incident Action Plans will include a number of attachments.
Incident Commander ("IC")	Person responsible for all aspects of the response, including developing incident objectives and managing all incident operations. This means the most qualified person, not necessarily the most senior person, on scene.
Incident Command Post	The location at which the primary command functions are executed; may be collocated with the incident base.
Incident Command System ("ICS")	A standardized on-scene emergency management system specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.
Incident Management Handbook ("IMH")	The IMH is intended to be used as an easy reference job aid for responders; designed to assist responders in the use of the National Incident Management System (Incident Command) during response operations.
Incident Management Team ("IMT")	A team that functions at and/or away from the incident scene to support tactical response operations, facilitates planning, and addresses the concerns of public and government agencies.

Term	Definition
Incident Objectives	Statements of guidance and direction necessary for the selection of appropriate strategies, and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed. Incident objectives must be achievable and measurable, yet flexible enough to allow for strategic and tactical alternatives.
Industry	For the purpose of these guidelines, industry means the oil and hazardous substance industry required to submit response plans and comply with exercise requirements, as specified in appropriate vessel, facility, pipeline, and Outer Continental Shelf platform regulations. The USCG, EPA, PHMSA, NEB and AER administer these regulations.
Initial Notification	The process of notifying necessary Company personnel and necessary agencies having jurisdictional authority that a spill has occurred and including all pertinent available information surrounding the incident.
Initial Remediation	Remedial action at a site to eliminate acute hazards associated with a spill. An initial clean-up action is implemented at a site when a spill of material is an actual or potentially imminent threat to public health or the environment, or difficulty of clean-up increases significantly without timely remedial action. All sites must be evaluated to determine whether initial clean-up is total clean-up; however, this will not be possible in all cases due to site conditions (e.g., a site where overland transport or flooding may occur).
Injury	A measurable adverse change, either long- or short-term, in the chemical or physical quality of the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil, or exposure to a product of reactions resulting from a discharge of oil.
In-Situ Burning	A technique that involves the controlled burning of an oil spill at the location of the spill.
Integrated Contingency Plan ("ICP")	A plan to provide guidance to Company personnel on the immediate procedures, notifications and sustained operations in the event of an emergency response incident.
Interim Storage Site	A site used to temporarily store recovered oil or oily waste until the recovered oil or oily waste is disposed of at a permanent disposal site. Interim storage sites include trucks, barges, and other vehicles, used to store waste until the transport begins.
J	
Joint Information Center ("JIC")	A facility established within, or near, the Incident Command Post where the Information Officer and staff can coordinate and provide incident information to the public, news media, and other agencies or organizations. The JIC is normally staffed with representatives from the jurisdiction having authority and the Responsible Party.

Term	Definition
Jurisdiction	A range or sphere of authority. At an incident, public agencies have jurisdiction related to their legal responsibilities and authority for incident mitigation. Jurisdictional authority at an incident can be political/geographical (e.g., city, county, provincial/state, or Federal boundary lines), or functional (e.g., police department, health department, etc.). (See Multi-Jurisdiction).
Jurisdictional Agency	The agency having jurisdiction and responsibility for a specific geographical area, or a mandated function.
L	
Lead Agency	The government agency that assumes the lead for directing response.
Lead Provincial/ State Agency	The agency that coordinates provincial/state support to Federal and/or Local governments or assumes the lead in the absence of Federal response.
Liquid Wastes	Liquids contaminated with solids or mixed with other liquids (e.g., emulsion, contaminated soil).
Local Emergency Planning Committees ("LEPC")	A local governmental entity that identifies and catalogues potential hazards, identifies available resources, mitigates hazards when feasible, and has input into emergency plans for operations occurring in their geographical jurisdiction. According to the U.S. National Response Plan the initial response to an emergency incident or disaster is by local officials. The role of the LEPC is to anticipate and plan the initial response for foreseeable disasters in their jurisdiction.
Local On-Scene Coordinator ("LOSC")	Local Government Representative.
Location Boundaries	Areas where oil may be expected to impact during the first day of a spill event.
Lower Explosive Limit ("LEL")	Air measurement to determine the lowest concentration of vapours that support combustion. This measurement must be made prior to entry into a spill area.
N	
National Contingency Plan ("NCP")	The plan prepared in the U.S. under the FWPCA and CERCLA, and revised from time to time.
National Response Center ("NRC")	The U.S. Federal authorities to be the first notified in the event of an incident.
Natural Resource	Land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other resources belonging to, managed by, held in trust by, appertaining to or otherwise controlled by the province/state, federal government, private parties, or a municipality.
Natural Resource Damage Assessment ("NRDA")	The process of collecting and analyzing information to evaluate the nature and extent of injuries resulting from an incident, and determine the restoration actions needed to bring injured natural resources and services back to baseline and make the environment whole for interim losses. (15CFR§990.30)

Term	Definition
National Incident Management System ("NIMS")	Identifies concepts and principles that answer how to manage emergencies from preparedness regardless of their cause, size, location or complexity.
Non-Persistent or Group I Oil	Refers to a petroleum-based oil that, at the time of shipment, consists of hydrocarbon fractions -- a) At least 50% of which by volume, distill at a temperature of 340° C (645° F); and b) At least 95% of which by volume distill at a temperature of 370° C (700° F).
Non-Petroleum Oil	Oil of any kind that is not petroleum-based. It includes, but is not limited to, animal and vegetable oils.
O	
Oil or Oils	Naturally occurring liquid hydrocarbons at atmospheric temperature and pressure coming from the earth, including condensate and natural gasoline, and any fractionation thereof, including, but not limited to, crude oil, petroleum gasoline, fuel oil diesel oil, oil sludge, oil refuse, and oil mixed with wastes other than dredged spoil.
Oil Spill Cooperative (Mutual Aid)	Multi-company cooperative organization developed by industry to assist with oil spill response and clean up. Typically, manpower and equipment are identified by a company on a voluntary basis.
Oil Spill Response Organization ("OSRO")	An entity that provides oil spill response resources, and includes any for-profit or not-for-profit contractor, cooperative, or in-house response resources that have been established in a geographic area to provide required response resources.
Oil Spill Response Contractors	Persons/Companies contracted to undertake a response action to contain and/or clean up a spill.
Oily Waste	Oil-contaminated waste resulting from an oil spill or spill response operations.
Operations Section Chief	A member of the General Staff who establishes the tactics to meet the incident objectives and directs all operational resources.
Owner or Operator	Any person, individual, partnership, corporation, association, governmental unit or public or private organization of any character.
P	
Persistent Oil	Under OPA 90, persistent oils are petroleum-based oils that do not meet the distillation criteria for non-persistent oil. Persistent oils are classified based on specific gravities as follows: • Group II – specific gravity less than .85; • Group III – specific gravity between .85 and less than .95; • Group IV – specific gravity .95 to and including 1.0.; and • Group V – specific gravity greater than 1.0.
Physical Security	Security systems and architectural features that are intended to improve protection (e.g., fencing, doors, gates, walls, turnstiles, locks, motion detectors, vehicle barriers, hardened glass).

Term	Definition
Post-Emergency Response	The portion of a response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the sites has begun.
PREP	National Preparedness for Response Exercise Program – workable exercise program which meets the intent of section 4202(a) of the Oil Pollution Act of 1990 (OPA 90) in the United States. Enbridge follows PREP guidelines across the system in both the United States and Canada.
Procurement Unit	Functional unit within the Finance/Administration Section responsible for financial matters involving vendor contracts.
Q	
Qualified Individual ("QI")	A qualified individual is the person who is authorized to do the following: (1) activate and engage in contracting with oil spill removal organizations; (2) act as a liaison with the on-scene coordinator; and (3) obligate funds required to effectuate response activates. For Enbridge, this person is typically the Incident Commander.
R	
Regional Response Team ("RRT")	A U.S. Federal response organization, consisting of representatives from specific Federal and state agencies, responsible for regional planning and preparedness before an oil spill occurs and for providing advice to the FOSC in the event of a major or substantial spill.
Response Activities	Refers to the containment and removal of oil from the water and shorelines, the temporary storage and disposal of recovered oil, and the taking of other actions as necessary to minimize or mitigate damage to the environment.
Response Guidelines	Guidelines for initial response that are based on the types of product involved in the spill; these guidelines are utilized to determine clean-up methods and equipment.
Response Plan	A practical plan used by Industry for responding to a spill. Its features include (1) identifying the notification sequence, responsibilities, response techniques, etc. in an easy to use format; (2) using decision trees, flowcharts, and checklists to ensure the proper response for spills with varying characteristics; and (3) segregating information needed during the response from that required by regulatory agencies to prevent confusion during a spill incident.
Response Resources	The personnel, equipment, supplies and other capability necessary to perform the Response Activities identified in a Response Plan.

Term	Definition
Responsible Party	The Owner/Operator of the vessel or facility that is the spill source.
Risk	Potential for damage to or loss of an asset. Risk, in the context of process security, is the potential for a catastrophic outcome.
Rivers and Canals	A body of water confined within the Inland area that has a projected depth of 12 feet or less, including the Intracoastal Waterway and other waterways artificially created for navigation.
S	
Safety-Related Condition (Gas Only)	Any condition on a jurisdictional pipeline facility that lies within 220 yards of any building intended for human occupancy or an outdoor place of assembly or is within the right-of-way (ROW) of an active railroad or an asphalt/concrete paved road/ street / highway that meets one of the following criteria: • A material defect, physical damage or localized pitting on an effectively coated and cathodically protected pipeline operating at or above 20% SMYS and required repair as per Company procedure, • A leak in a pipeline that is characterized by the need for immediate corrective action to protect the public or property, • Unintended movement or abnormal loading by an environmental cause (e.g., earthquake, landslide, flood) that impairs the serviceability of a pipeline, applying sudden occurring movement in particular, • Any equipment malfunction or operating error that causes the pressure in a pipeline to exceed the maximum allowable operating pressure (MAOP) and the plus allowed build-up or overpressure, and • A shutdown of the pipeline or a reduction in operating pressure of 20% or more that is done in reaction to an imminent hazard or a known unsafe condition.
Site Conditions	Details of the area surrounding the facility, including shoreline descriptions, typical weather conditions, socioeconomic breakdowns, etc.
Site Emergency	Means an incident has occurred and the entire terminal, with the exception of critical employees has been sheltered on-site or evacuated.
Site Safety and Health Plan ("SSHP")	The SSHP, at minimum, addresses, includes, or contains the following elements: health and safety hazard analysis for each site task or operation, comprehensive operations work plan, personnel training requirements, personal protection equipment ("PPE") selection criteria, site-specific occupational medical monitoring requirements, air monitoring plan, site control measures, confined space entry procedures (if needed), pre-entry briefings (tailgate meetings, initial and as needed), pre-operations commencement health and safety briefing for all incident participants, and quality assurance of SSHP effectiveness.

Term	Definition
Site Security and Control	Steps that must be taken to provide safeguards needed to protect personnel and property, as well as the general public, to ensure an efficient clean-up operation.
Site Supervisor	A generic term that refers to the employee responsible for the location (i.e., Pipeline Maintenance ("PLM") coordinator/supervisor, technician, terminal supervisor), or designate.
Skimmers	Mechanical devices used to skim the surface of water and recover floating oil. There are four basic categories of skimmers; suction heads, floating weirs, oleophilic surface units, and hydrodynamic devices. These vary in efficiency depending on the type of oil and size of spill.
Sorbents	Materials ranging from natural products to synthetic polymeric foams placed in confined areas to soak up small quantities of oil. Sorbents are very effective in protecting walkways, boat decks, working areas, and previously uncontaminated or cleaned areas.
Source Control	Actions necessary to control the spill source and prevent the continued release of oil or hazardous substance(s) into the environment.
Span of Control	The number of organizational elements that may be directly managed by one person. Span of Control may vary from three to seven, and a ratio of one to five reporting elements is recommended.
Spill Observer	The first Company individual who discovers an oil spill. This individual must function as the responsible person-in-charge until relieved by an authorized supervisor.
Spill Response	All actions taken in responding to spills of oil and hazardous materials (HAZMAT), i.e., receiving and making notifications; information gathering and technical advisory phone calls; preparation for and travel to and from spill sites; direction of clean-up activities; damage assessments; report writing, enforcement investigations and actions; cost recovery; and program development.
Spill Response Personnel	Federal, Provincial/State, Local agency, and industry personnel responsible for participating in or otherwise involved in spill response. All spill response personnel will be preapproved on a list maintained in each Company region.
Staging Area	Location established where resources can be placed while awaiting a tactical assignment. The Operations Section manages Staging Areas.
Stakeholders	Any person, group, or organization affected by, and having a vested interest in, the incident and/or the response operation.
State Emergency Response Commission ("SERC")	A group of officials in the U.S. appointed by the Governor to implement the provisions of Title III of the Federal Superfund Amendments and Reauthorization Act of 1986 ("SARA"). The SERC approves the State Oil and Hazardous Substance Discharge Prevention and Contingency Plan and Local ERPs.
Strategy	The general plan or direction selected to accomplish incident objectives.

Term	Definition
Submerged Oil	Oil suspended beneath the surface or that sinks to the bottom of a body of water.
Substantial Threat of a Discharge	Any incident or condition involving a facility that may create a risk of discharge of Crude Oil and Oil. Such incidents include, but are not limited to storage tank or piping failures, above ground or underground leaks, fires, explosions, flooding, spills contained within the facility, or other similar occurrences.
T	
Tactical Direction	Directions given by the Operations Section Chief including: the tactics appropriate for the selected strategy; the selection and assignment of resources; tactics implementation; and performance monitoring for each operational period.
Tactics	Deploying and directing resources during an incident to accomplish the desired objective.
Technical Specialists	Personnel with special skills or technical expertise who can be used anywhere within the ICS organization.
Temporary Flight Restrictions ("TFR")	Temporary airspace restrictions for non-emergency aircraft in the incident area. TFRs are established by the FAA to ensure aircraft safety and are normally limited to a five-nautical-mile radius and 2000 feet in altitude.
Transfer of Command	An ICS term which means the process of moving the responsibility from one incident command team to another. This term primarily relates to the Incident Commander.
Unusually Sensitive Area ("USA")	A drinking water or ecological resources area that is unusually sensitive to environmental damage from a hazardous liquid pipeline release.
V	
Vendors	Vendors are defined as external parties that provide HAZWOPER training following OSHA standards in *29CFR§1910.120* and also satisfy the OSHA recommendations for instructors in *29CFR§1910.120*; Appendix E "*Training Curriculum Guidelines*".
W	
Wildlife Rescue	Efforts made in conjunction with the appropriate jurisdictional agencies to retrieve, clean, and rehabilitate birds and wildlife affected by an oil spill.
Workers	Company employees and contract workers.
Worst-Case Discharge ("WCD")	Worst Case Discharge is described in detail in Annex 4 of applicable Regional Integrated Contingency Plans.

1.2.3 Conversion Table

Imperial / Metric Conversions

English to Metric		Metric to English	
Length			
1 inch (in)	2.54 centimetres (cm)	1 cm	0.393 in
1 foot (ft)	0.3048 meters (m)	1 m	3.28 ft
1 mile (mi)	1.609 kilometres (km)	1 km	0.621 mi
1 nautical mile (nm)	1. 852 kilometres (km)	1 km	0.540 nm
Area			
1 square foot (ft^2)	929 square centimetres (cm^2)	1 cm^2	0.0129 ft^2
1 square foot (ft^2)	0.0929 square metres (m^2)	1 m^2	10.76 ft^2
1 acre (ac)	4.047 square metres (m^2)	1 000 m^2	0.247 ac
1 square mile (mi^2)	2.59 square kilometres (km^2)	1 km^2	0.386 mi^2
Volume			
1 US Gallon (US gal)	3.785 litres (l)	1 l	0.264 U.S. gal
1 Imperial Gallon (Imp gal)	4.546 litres (l)	1 l	0.220 imp gal
1 Barrel	0.16 cubic metres (m^3)	1m^3	6.29 bbl
1 Barrel (bbl)	159 litres (l)	1 l	0.00629 bbl
Velocity			
1 mile per hour (mph)	1.609 kilometres/hr (kph)	1 km/h	0.621 mph
1 nautical mile per hour (knot)	1.852 kilometres/hr (kph)	1 km/h	0.54 knot
1 foot per second (fps)	0.3048 metre/second (m/sec)	1 m/sec	3.28 fps
1 foot per second (fps)	1.097 kilometres/hr (kph)	1 km/h	0.911 fps
Weight			
1 pound (lb)	0.454 kilogramme (kg)	1 kg	2.205 lb
1 short ton (st)	0.907 tonne (mt)	1 t	1.102 st
1 long ton (lt)	1.016 tonne (mt)	1 t	0.984 lt
Temperature			
$^oF = (^oC\ (9) \div 5) + 32$			
Pressure			
1 pound per square inch (psi)	0.0689 bar	1 bar	14.504 psi
1 pound per square inch (psi)	6.89 kilopascals (kPa)	1 kPa	0.145 psi
1 pound per square inch (psi)	0.704 metre (water column) (mwc)	1 m CE	1.42 psi
1 inch mercury (in Hg)	25.4 mm mercury (mm Hg)	1 mm Hg	0.0394 in Hg
1 atmosphere (atm)	1.033 kg/cm^2	1 kg/cm^2	0.968 atm
1 atmosphere (atm)	760 mm mercury (mm Hg)	1 mm Hg	0.00132 atm
Flow			
1 gallon per minute (gpm)	0.227 $metre^3$ per hour (m^3/hr)	1 m^3/h	4.403 gpm
1 cubic foot per minute (cfm)	1.699 cubic meters per hour (m^3/hr)	1 m^3/h	0.5886 cfm
1 barrel per day (bph)	0.1104 litres per minute (lpm)	1 lpm	9.057 bpd
Power			
1 horsepower (hp)	0.746 kilowatt (kw)	1 kw	1.341 hp

1.3 Purpose and Scope of Plan

The purpose of this Plan is to provide guidance to Company personnel on the immediate procedures, notifications and sustained operations in the event of an emergency originating at any Company area of operations. The Plan's primary purpose is to ensure an effective, comprehensive response that will prevent injury or damage to Company employees and the public and mitigate any possible impact on the environment.

The objectives of the Plan are to:

- Outline the training and exercise program that prepares Enbridge responders.
- Define alert and notification procedures to be followed when an emergency occurs.
- Describe response teams' roles and responsibilities under the Incident Command System ("ICS").
- Document equipment, manpower and other resources available to assist with an emergency.
- Provide guidelines for handling emergency response operations.
- Define organizational lines of responsibility to be adhered to during an emergency
- Describe the Operating Regions or Response Zones and determine the worst case discharge to minimize impacts to environmentally sensitive areas.
- Apply an "All Hazards, All Risks" approach to Emergency Response

The format of the plan aligns with the U.S. National Response Team's ("NRT") Integrated Contingency Plan ("ICP") Guidance (Federal Register #61: 28641 28664). The guidance suggests formatting the ICP into two parts. The "Core" outlines information that is applicable across all operating regions or response zones and is followed by a series of "Annexes" that contains specific information per Response Zone. The ICP is a mechanism to address multiple regulations that the Company is governed by throughout the United States and Canada.

This ICP demonstrates the response capabilities available by the Company to respond to any product release. It is not a guarantee of what will occur or the equipment/deployment sequencing that will be used in an actual spill event. Nothing in this Plan is intended to limit the discretion of Company employees to select any sequence of actions or to take whatever time they deem necessary to maximize the effectiveness of the response, consistent with safety considerations.

This Plan applies to emergency response operations carried out by the on-site field personnel and the Field Response Team ("FRT"), Regional Incident Management Team ("IMT"), and Enbridge Enterprise Emergency Response Team ("E3RT") for any type or size of incident that may occur. It contains guidance for personnel to follow in the event of a release or other emergency situation involving Company assets.

This Plan represents a planning standard, but is not and should not be regarded as a performance guarantee. Response operations in any spill event will be tailored to meet the actual circumstances.

1.3.1 ICP Format Overview

Section 1: Plan Introduction Elements

- Acronyms/Glossary Conversion Table
- Purpose & Scope of Plan Coverage
- Pillars of Emergency Management
- Safety & Operational Reliability
- Inspection
- Regulatory Compliance
- Canada and US Pipeline System Maps

Section 2: Core Plan Elements

- General Guidance
- Discovery/Detection
- Notification
- Initial Response
- Operations
- Demobilization

Section 3: Training & Exercise Program

- Training, ICS, HAZWOPER
- Exercise Requirements

Section 4: Forms & Templates

- Company & Industry Forms

Annex 1: Facility & Locality Information

- Pipeline Information
- Worst Case Discharge (U.S. only)
- Equipment
- Response Time Maps

Annex 2: Notification Procedures

- Internal / External notification and support response agencies

Annex 3: Environmentally Sensitive Area Information

- Environmentally Sensitive Information (Schools, hospitals, waterways, roads)

Annex 4: Regulatory Cross Reference

- Regulatory Compliance List

Annex 5: Administration

- Plan Maintenance
- Record of Revision

Field Emergency Response Plan

- Focuses on first response actions and contains the most relevant information for first responder groups internal and external to Enbridge

1.4 Pillars of Emergency Management

The four pillars of emergency management are: prevention and mitigation, preparedness, response, and recovery. All four pillars link to the environmental management system. *Figure 1- The Emergency and Security Cycle* shows linkages between programs and processes.

Mitigation & Prevention
Enbridge takes an "all hazards" approach to mitigation and prevention which includes programs, plans and actions intended to reduce or remove the effects of Emergency incident and Security threats, and preventing exposures from turning into larger emergency incidents with long-term significant impacts.

Preparedness
Preparedness includes the programs, plans, and actions taken prior to an Emergency incident or Security threat to ensure that Enbridge can deliver an effective response. Despite efforts made through mitigation and prevention, Emergency and Security incidents can occur and preparing for an effective response and recovery is critical.

Response
Response is the activation, mobilization, and coordination of all necessary resources and activities to manage a hazard, exposure, or a threat's immediate consequences as it escalates into and exists as an emergency or elevated threat level.

Recovery
Recovery includes the programs, plans and actions which aim to restore the affected area back to its pre-incident or better condition. Recovery programs and activities should ensure that resources (people, teams, and equipment) are replaced/replenished/debriefed and the response is reviewed as part of a continuous improvement process which feeds back into the full Emergency and Security Management Cycle.

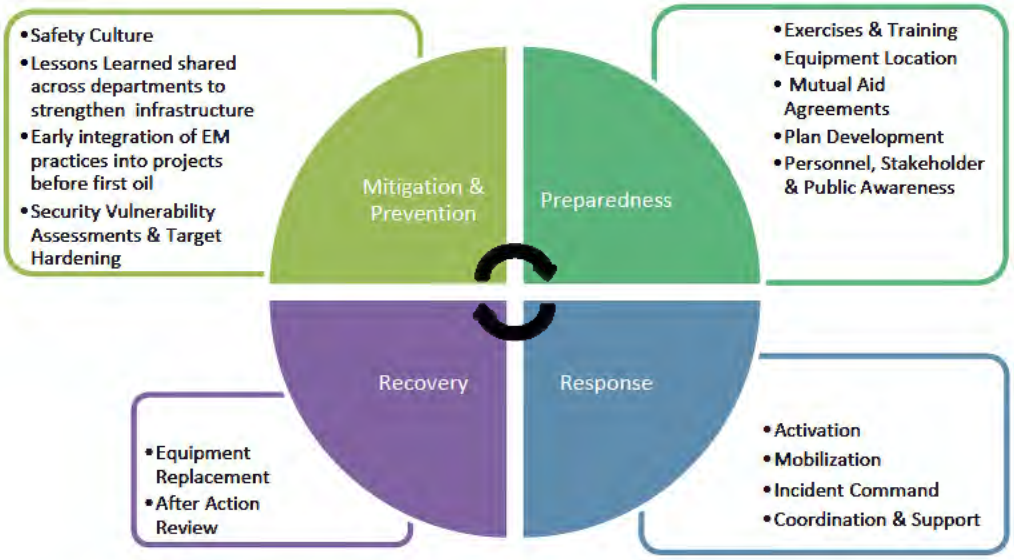

Figure 1: The Emergency and Security Management Cycle

The Company takes action to mitigate and prevent emergencies from occurring; *Section 1.5 – Safety and Operational Reliability* and *Section 1.6 – Inspections* provide an overview of these efforts. Despite efforts made through mitigation and prevention, emergency and security events can occur. *Section 2: Core Plan Elements* is designed to guide the Company through the response phase.

This document and all response activities support the Enbridge LP Environmental Policy: The Company will minimize the consequences of emergency events by ensuring prompt and effective response.

1.4.1 Enbridge Emergency Response and Support Teams Hierarchy

Enbridge's Emergency Response has been structured to ensure that appropriate resources and support can be deployed to suit the complexity and severity of the emergency, from the boots on the ground (Field Response Team) to additional levels of support as needed. Both tactical and strategic response and support has been considered.

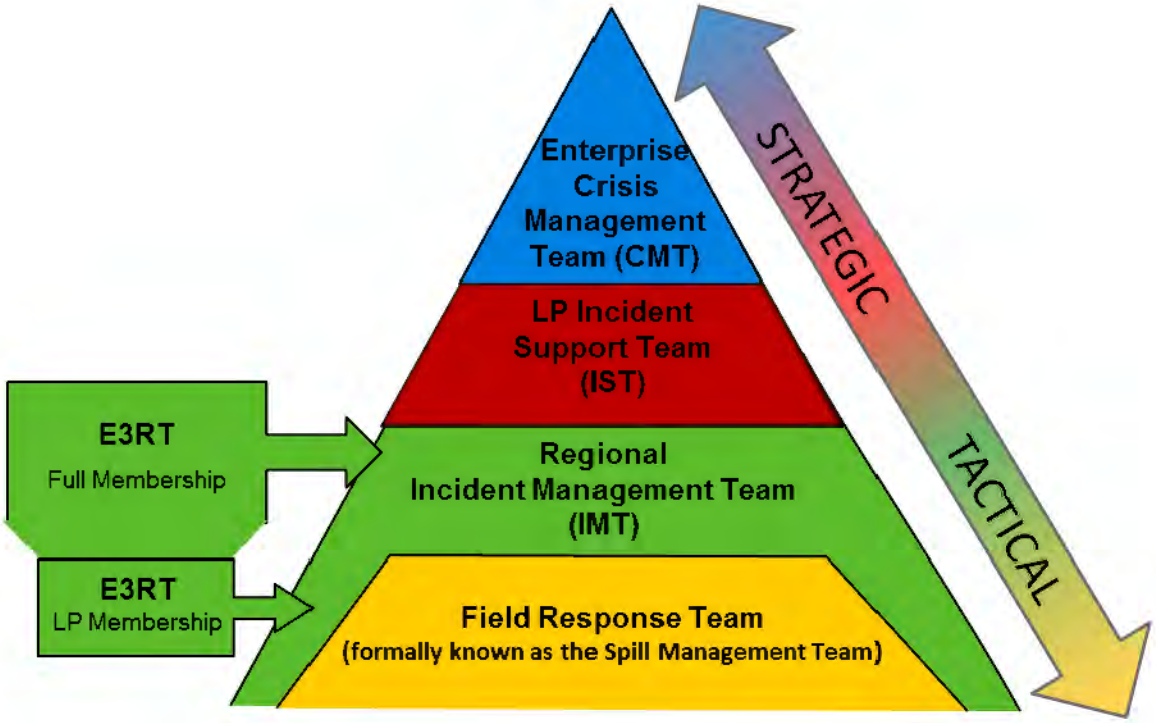

Figure 1.4.1a Emergency Response and Support Structure

Each team's primary objective is described below as well as the suggested guidance document(s) which further describes the team's roles, responsibilities and procedures.

Enterprise Crisis Management Team - Strategic (EXTERNAL TO IMS 07)

As identified in the Enterprise Crisis Management Plan (external to this framework and IMS 07): Responsible for "Actions taken away from the scene to support and assist the IST and [IMT] in planning, business recovery projects and address the implications of the problem and its potential on the Company's viability, operability and credibility"

Guiding Plan: Enterprise Crisis Management Plan

LP Incident Support Team – Strategic

Actions taken at and/or away from the incident scene to support the IMT, facilitate planning, and manage business recovery projects.

Guiding Plan: LP Incident Support Plan

Incident Management Team – Tactical & Strategic (Regional)

Actions taken at and/or away from the incident scene to support tactical response operations, facilitate planning, and address the immediate concerns of the public and government agencies. *Guiding Plan: Integrated Contingency Plan*

LP Membership - Enbridge Enterprise Emergency Response Team

At the request of the Regional Incident Management Team (IMT), the LP membership of E3RT will provide LP mentorship to the IMT, and/or fill substantive roles in the IMT. LP members would deploy first, followed by the remainder of the E3RT membership for future operational periods.

Full Membership - Enbridge Enterprise Emergency Response Team

At the request of the Regional Incident Management Team, the full membership of this cross-business unit team of individuals, who are specially trained to support significant incidents, will fill roles in the IMT.

Field Response Team – Tactical

Actions taken by responders at an incident scene to directly attack the problem and its consequences.

Guiding Plans: Field Emergency Response Plan (Integrated Contingency Plan), Tactical Response Plan/Control Point Maps, Pre-Fire Plan and other tools

1.5 Safety and Operational Reliability

1.5.1 Corrosion Mitigation

For external corrosion prevention, the Company generally manages corrosion of buried pipelines by using approved long-life pipeline coatings supplemented with cathodic protection. Above-ground facilities are generally inspected annually and provided with protective coating systems to prevent corrosive deterioration. These primarily include buildings, above-ground pipelines and tanks.

In order to prevent internal corrosion of the pipelines, the Company may use one or more of the following methods; chemical injection, pigging and corrosion inhibitors, and inspections of pipelines including high population density areas and environmentally sensitive areas with inline inspection tools, where appropriate. Some pipelines may be hydrostatically tested.

1.5.2 Facility Spill Mitigation

Several spill mitigation measures are built into the design of facilities and emergency shutdown procedures. The following spill mitigation measures are found in the current design Company standard:

- Gas and fire detection alarms announced in Control Center for immediate shut down and isolation;
- Remotely-operated, electrically-actuated isolation valves;
- Releases resulting from pump seal failures are piped to sump tanks;
- Above ground piping in stations to allow visual inspection and early detection of leaks; and
- Buildings over pumping stations to contain spills and any spray resulting from a release. On-site and on-call employees are trained as initial responders, and would focus on public/employee safety, isolation and containment upon arriving at any spill.

The Company has a number of safety systems and practices in place to prevent the occurrence and mitigate the subsequent consequences of any release. The systems are designed to alert operators with alarms. Pipeline operators are trained to respond to the various system alarms in order to identify, and mitigate the consequences immediately. These systems include:

- Regularly scheduled visual and aerial monitoring and inspections
- Marker signs and signage with emergency contact number for the public
- System wide third-party alerts/emergency telephone line in the Control Center
- The Supervisory Control and Data Acquisition (“SCADA”) system
- Local Control System sensors and shutdown, isolation capability
- Scheduled line balance calculations
- Computational Pipeline Monitoring (“CPM”) Systems, based on DNV-GL SPS, Atmos Pipe and/or in-house developed software for leak detection and system protection
- High and low pressure alarms
- Leak Prevention practices and procedures

- Release detection equipment and procedures
- Pipeline and breakout tank inspection and testing procedures
- Recognition of emergency conditions and prediction of the consequences
- Leak response actions
- Public Awareness and education.

The routine responsibilities that ensure releases will be detected and mitigated as soon as possible by personnel may include, but are not limited to the following:	
✓	Regularly scheduled visual and aerial monitoring
✓	Routine walk-through and monitoring of process equipment to ensure proper operation of all equipment at each facility
✓	Immediate response to alarms and signals that may indicate a possible release
✓	Identification, de-energizing the system, isolation and containment of a release as soon as safely possible
✓	Notify the Regional on-call representative

1.5.3 Leak Detection Systems

The Company has a comprehensive approach to leak detection where pipelines are monitored for possible leaks using multiple complementary methods. These include CPMs, scheduled line balance calculations, Controller monitoring, visual surveillance and internal line inspection tools. Each method has a different approach featuring differing technology, resources and timing. Used together, these methods provide a complementary and comprehensive leak detection strategy intended to mitigate the consequences of any release.

Visual Inspection of Facilities & Pipeline Right-of-Way
Line patrols (aerial and ground) and third-party reports of oil or oil odors are used to identify leaks. Aerial line patrols are performed at intervals not exceeding two weeks and managed by Field Operations. Both aerial and ground patrols can also be completed whenever there are concerns about pipeline integrity. Third-party reports are handled through the emergency telephone line, managed by the Control Center.

Marker Signs
ROW marker signs are installed and maintained at road and water crossings and other noticeable points and provide an emergency 24-hour telephone number to be used by any person wishing to report a concern including a pipeline leak.

Third-Party Damage Prevention & Reporting System
If the systems are properly designed, constructed, operated and maintained, then the most probable cause of release is third-party damage. In order to minimize any damage caused by a third-party a number of steps may be taken, including but not limited to the following:

Prevention of Third-Party Damage	
✓	The facilities are designed to reduce the chance of third-party damage. For example, most of the facilities are buried or located within fenced and locked areas
✓	Inspectors are onsite during any Enbridge work near a pipeline
✓	Areas especially sensitive to third-party damage are road, railroad, and water crossings. Pipelines in these areas usually have increased pipeline wall thickness, burial depth, or the pipeline is encased to reduce the chance of damage
✓	Company participates in one-call pipeline locating and notification systems where available
✓	Company conducts education programs to reduce the possibility of third-party damage

The Company's Third-Party Reporting System allows external parties to report visible oil or oil odors. The Company manages third-party reports through the emergency telephone line, and communicates with affected public and local emergency officials through its Public Awareness Program ("PAP"). The Company may also conduct focused additional patrols upon review of the status of a pipeline.

SCADA Description & Controller Monitoring

The SCADA system collects and displays a comprehensive set of pipeline operating data, including flows and pressures updated in real-time. The Pipeline Controller monitors this data, to identify unexpected operational changes, such as pressure drops, that may indicate a leak. Additional sensors monitored through SCADA such as the detection of combustible gases, pump seal failures, equipment vibration levels, leak alarms and sump levels can also be used by the Controller to identify potential leaks.

The SCADA system provides automatic backup pressure protection through a number of subroutines, including an extension to the Line Pressure Monitor ("LPM") alarm system. The LPM alarm system monitors station discharge and suction pressures and can initiate set-point reductions, unit shutdowns, or entire line shutdowns as necessary to avoid overpressure situations. In addition to SCADA's primary functions, it runs several analytical tools, including the generation of preconfigured or customized graphical trends and reports that may be used in the analysis of pipeline operations and that assist in the assessment of operational changes.

Local Control System sensors and shutdown description

Locally, the mainline pump station's control system is comprised of numerous instrumentation and electrical devices that are all connected directly or indirectly to a Programmable Logic Controller ("PLC"). The PLC's main function is to control, monitor, and protect the station and various electrical equipment from overpressure, surges, abnormal operating conditions, and other anomalies by shutting down and locking out the appropriate equipment in order to protect the environment, facilities, public, and station personnel.

Scheduled line balance calculations

These are calculations of oil inventory and performed at fixed intervals, typically every two and 24 hours. A rolling 24-hour calculation based on volume balance is completed at a specific frequency each day. The purpose of these calculations is to identify unexpected losses of pipeline inventory that may indicate a possible leak. The Company utilizes line balance calculations within the Commodity Movement Tracking system.

Computational Pipeline Monitoring System (CPM) – description including critical instrumentation

The Company uses one or more CPM systems as its primary real-time system for detecting leaks on its liquid pipelines. A CPM is a computer-based monitoring approach that uses continuous measurements of pipeline conditions. This is an industry standard for dedicated leak detection. The industry standard that defines CPM is *API 1130*. The CPM systems are designed to meet the requirements of *CSA Z662* Annex E, and *API 1130*.

Real-time Transient Model (RTTM) based CPMs

A vendor based software application is used to create real-time transient models of the pipeline systems. These models combine a static description of the pipeline including the length, diameter and roughness of pipe with real-time operating data such as flow and pressure. The result is a sophisticated computer model of the pipeline that accurately replicates the real-time behavior of the pipeline.

The Enbridge Material Balance System (MBS) utilizes the RTTM software to detect leaks. The system uses flow measurements to divide the pipeline into one of more volume balance sections and includes overlapping sections when multiple flow measurements are available. It calculates the imbalance in each volume balance section and is optimized to look for various leak sizes. The MBS systems are capable of detecting leaks during all operations, including steady flow, transients, with or without column separation and shutdown/shut-in.

The Automated Pressure Deviation or APD system also uses the RTTM software to detect leaks. This algorithm uses closed valves to divide the pipeline into sections. It is only enabled during shut-in operation but may provide superior leak detection sensitivity during this operation.

Other CPMs used by Enbridge

Enbridge also uses different vendor application software to create a compensated volume balance leak detection system. These systems also segment the pipeline and are optimized to find a variety of different leak sizes. Sophisticated statistical analysis is used to evaluate imbalances. Separate software modules provide leak detection capabilities during flowing and shut down operations.

Another leak detection layer implemented and developed by Enbridge is the Rupture Detection system (RDS) which uses station suction and discharge pressures and applies pattern recognition algorithms to quickly and reliability detect ruptures.

CPM System - CPM Alarm Analysis procedures

In addition to the pipeline controllers, a dedicated Leak Detection Analyst (LDA) is on shift 24x7 to provide root cause alarm analysis support to the control room. The LDA uses procedures that provide step by step instructions on performing root cause analysis of leak alarms. In addition, the procedure also provides detail on the protocol for communications between the Leak Detection Analyst and the Control Center to ensure consistent, effective alarm analysis and response.

Routine Inspections

Personnel perform routine station walk-around inspections and terminal rounds when they are on-site for preventative maintenance or repair activities. Equipment and facilities are checked for evidence of leaks or spills in addition to various other observations such as security, equipment operation, etc. The condition of facilities, equipment and tanks are informally observed by personnel on-shift. If issues are observed or repairs required, they are reported through the MAXIMO maintenance management system. Formal preventative maintenance activities are assigned, tracked and documented through MAXIMO, as well.

Formal safety inspections at manned locations are performed quarterly, during which personnel may also detect leaks.

Right-of-Way Patrols

Patrols of the entire Right Of Way (“ROW”) and the land adjacent to the ROW are performed at intervals not exceeding three weeks (21 days), but a minimum of 26 times per calendar year using methods of walking, driving, flying or other appropriate means. Any spill, abnormal surface condition or activity observed by ground personnel or the pilot is immediately reported to the closest attended regional location for further investigation response, or to the Control Center.

Safe Fill

When pipeline receipts or transfers are made, the volumes used in the calculations for space available use a safe fill height as the maximum operating level.

Receipt Monitoring

Terminal employees coordinate all receipts with pipeline representatives. This involves determination of the volume of each product grade prior to receipt. The receipt progress, incoming volumes and high level alarm signals are monitored at all times when product is being transferred into the terminal from the pipeline by the Control Center.

Tank Gauging

Each tank scheduled to receive a receipt is gauged prior to receipt to confirm that space is available for the receipt.

High Level Alarms

All tanks are equipped with high level alarms. High level alarms are indicated by an audible signal as well as visual indication in the Control Center. A signal is also sent to the Control Center and requires immediate contact with the facility operator. Alarms are tested periodically in accordance with Company preventive maintenance procedures.

Volume Reconciliation

Tanks are gauged at month end as part of the Company's physical inventory reconciliation program.

Pipe Testing

The Company's Risk Management ("RM") department has extensive testing guidelines of all pipeline systems throughout their entire geographical operational area.

Observations and Documentation

The conditions of tanks and equipment are observed when employees responsible for the operation and maintenance of the terminal are on shift. Documentation of these conditions will be logged periodically at the discretion of the local supervisor.

1.5.4 Oil Inventory Control System

Physical Inventory

This currently serves as the basis for comparing an inventory-reporting period with the previous reporting period. Current practice uses end of month physical inventory calculated in net barrels per petroleum measurement.

Railroad Facility Throughput

Facility throughput is product leaving a tank through a railroad loading rack with meters. Meters on railroad loading racks are to be calibrated according to a set interval. They are also reconciled in conjunction with physical inventory, taken as well as on a standalone basis. Quantity loaded shall be determined on a net basis using temperature from temperature probes and density from the Micro Motion Corriollis meters, which are mounted at each load arm and measured in gross barrel quantities from meter pulses. These throughput quantities shall be deducted from inventory.

Product Variation

A physical inventory can be taken to compare with the book inventory quantity, if necessary. The difference between the book and physical quantity is a product variation. Variations may be positive or negative. Statistical Process Control is the basis for determining whether this

variation should trigger an investigative effort to determine whether product is unknowingly being discharged.

Statistical Process Control

Control limits (both upper and lower) are set for each product variation based upon historical information at each facility. Product variations between the control limits are considered to be satisfactory and do not require an investigation or documentation. These variations inside of limits are considered to be a "random" occurrence that is an inherent part of the control process. The control limits will be periodically checked to determine if they are still valid or whether process changes or improvements have invalidated them.

1.5.5 Public Awareness & Education

The safety of the public and employees and the protection of the environment are of the highest importance to Enbridge. A key component of the Company safety and community involvement program is an effective PAP, which targets those stakeholders who share the Company's goal of safe, reliable and environmentally responsible operations. The Company is committed to effective communications with the Company's key stakeholders through an ongoing, relevant PAP.

The goal of Enbridge's PAP is to continually educate the public residing adjacent to the pipeline ROW as well as police and fire departments and other organizations/agencies about:

- Call-before-you-dig programs
- Location of the pipeline
- Potential emergencies involving the pipeline and safety procedures in the event of an emergency
- Products transported
- Safe working practices when working/excavating near the pipeline.

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Tank Fire Prevention and Protection

Each tank is designed in accordance with API 650, and maintained in accordance with API 653. Specific fire prevention mitigation measures that apply:

- Hazardous area designations and including safe work permit process to restrict hot work;
- Continuous fluid level monitoring by remote Control Center, with graduated high level warning, and high-high level alarm notification to remote Control Center;
- Independent high-high level mechanism;
- Primary and secondary floating roof seals to reduce flammable and explosive emissions;
- Floating tank roof grounding shunts and bonding cables; and
- Tank grounding rods and cables.

The following fire protection measures are found in the current tank design standard:

- Tank spacing, secondary containment and lot grading in accordance with NFPA 30;
- Semi-fixed or fully-fixed foam delivery system designed to address tank rim seal fires;
- Automated roof-top fire detection, with notification to remote Control Center; and
- Hydrant system (as required) for foam delivery or adjacent tank cooling.

Since terminal design standards have evolved over time, not all tanks are equipped with fire protection measures; however a Pre-Fire Plan has been prepared for each individual terminal. These plans contain specific fire protection information for each tank, and are reviewed with local fire departments and specialized tank fire fighters. Tanks that are not equipped with foam delivery systems or hydrant cooling are typically spaced greater than one diameter apart in individual secondary containment areas to reduce the risk to adjacent tanks.

Larger tank terminals are manned at all times. Personnel are trained to respond to incipient fires (up to, and including a rim seal fire) in accordance with the Pre-Fire Plans. Local fire fighters and specialized tank fire-fighting capabilities and resources are also identified in the Pre-Fire Plans for fires beyond the incipient stage. Tank fire foam deployment drills are conducted at all terminals.

Tank Fire Prevention and Protection

Storage Tank Overfill Lines

All overflow or vent lines on bulk storage tanks, as well as the building heating oil and gasoline additive tanks, are directed into the tank's secondary containment areas.

Visual Tank / Breakout Tank Inspection

High level alarms on storage tanks are inspected routinely to simulate actual operating conditions to ensure that overfill during tank filling operations are adequately detected.

Tank Inspections Annual, Five year, 20 year

The visual tank inspection will include tank foundation and associated piping. All tankage, pumping equipment, piping and related terminal equipment are inspected every working day for leakage, malfunctions of seals, etc. Storage tanks are inspected monthly and annually and findings are recorded. Facility Operators visually inspect the exterior of aboveground storage tanks. Facility operators visually inspect all tanks each working day for leaks. Daily tank gauges are reviewed for evidence of product loss that would indicate a leak in the tank. Any visible oil leaks from tank seams, gaskets, rivets and/or bolts are corrected immediately.

The visual tank inspection checklist presented below has been included as guidance for inspections and monitoring. Also included in the visual tank inspection will be an inspection of the tank foundation and associated piping. All tankage, pumping equipment, piping and related terminal equipment are inspected every working day for leakage, malfunctions of seals, etc. Storage tanks are inspected monthly and annually and findings are recorded. These records shall be maintained for a minimum of five years.

Check tanks for leaks, specifically looking for:

- Drip marks
- Discoloration of tanks
- Puddles containing stored materials
- Corrosion
- Cracks
- Localized dead vegetation
- Various tank inspections are performed in addition to normal terminal rounds.

Visual Tank / Breakout Tank Inspection cont.

Monthly Inspections

Visually inspect the exterior of aboveground storage tanks monthly for:

- Evidence of leaks (e.g., on shell, flanges and mixers);
- Changing conditions (e.g., shell distortions, settlement or heaving and active corrosion) oil or water in tank lot/pad or on roof; and
- Condition of the foundation, paint coatings, floating roof, insulation systems and appurtenances.

Annual Inspections

Visually inspect aboveground storage tanks annually for:

- Condition of the foundation;
- Condition of platforms and ladders;
- Condition of roof legs, manholes, vents and drains;
- Leaks in pontoons;
- Condition of seals;
- Condition of rescue tank davit; and
- Seal gap measurements as required.

Monthly and annual tank inspections are typically assigned, tracked and documented in the MAXIMO maintenance management system. Formal in-service and out-of-service inspections are also performed, in accordance with API 653

Check foundation for:

- Cracks
- Discoloration
- Settling
- Gaps between tank and foundation
- Damage caused by vegetation roots

Check piping for:

- Corrosion
- Discoloration
- Droplets of stored material
- Bowing of pipe between supports
- Evidence of stored material seepage on valves and seals
- Localized dead vegetation

Visual Tank / Breakout Tank Inspection cont.

Facility operators visually inspect all tanks each work week. Daily tank gauges are reviewed for evidence of product loss that would indicate a leak in the tank. Any visible oil leaks from tank seams, gaskets, rivets and/or bolts are corrected immediately. Tank roof drains and firewall drains are normally kept closed. The Company's major tanks have tank gauges which transmit oil heights to the Operations Control Center, where tank levels are monitored continuously. The tank gauges have alarms set for each tank for high tank level, low tank level, and emergency low tank level. Each tank also has an independent device which gives an alarm for emergency high tank level.

Secondary Containment Inspection

The secondary containment areas shown on the site plans will be inspected on an annual basis. The inspections will include checking for the following:

Dike or berm system:

- Level of precipitation in dike/available capacity
- Proper dike drain operation (Tank lot drainage pattern)
- Excessive debris or vegetation in the tank lot
- Signs of erosion or damage to the tank berm
- Proper warning signs in place (Location/status of pipes, inlets, drainage beneath tanks, etc.)

Secondary containment:

- Cracks
- Discoloration
- Presence of stored materials (standing liquid)
- Corrosion
- Valve conditions

Storm water Drainage

Storm water within a containment structure (station/terminal containment or tank berms) is visually inspected for an oily sheen or suspended solids. If visual inspection indicates that storm water may be contaminated, storm water samples are collected and sent to a laboratory for analysis. Adequate remediation of contaminated storm water is required prior to release. Retention and drainage ponds are inspected for erosion, available capacity, presence of stored material, debris, and stressed vegetation.

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Pipeline Inspections

All pipelines within the Company Pipeline System are monitored on a regular and routine basis. Control Center personnel monitor and control line pressures and product flow rate, operate remote controlled valves, operate pumps and engines, and monitor the type of product currently in the line at any given point. These Control Centers are operated on a 24-hour basis. Should a leak occur, the operators monitoring the lines can have the line shut down within 13 minutes. The operators can then dispatch field personnel to physically inspect the line in the area of the suspected leak.

Lines that are not connected to the SCADA System are generally smaller crude gathering pipelines. These lines are observed regularly by facility/pipeline maintenance personnel. In addition to these inspections, aircraft will fly along the pipeline on a regular schedule to inspect the lines.

Buried Piping

When a leak is detected from a buried pipe, the Company will excavate, examine, and evaluate the pipe for the cause of the failure. Localized pipe failures will be repaired or replaced. For extensive pipe failures requiring substantial reconstruction, the Company will upgrade to the standard specified under the applicable regulations.

Elevated Pipes

Elevated pipelines to the loading racks are sufficiently high and the supports adequately protected to prevent tank trucks from accidentally hitting them. Speed limit signs posted at the entrance of each loading rack bay are intended to limit any impact damage to aboveground pipelines.

Dike Drainage

Drainage of precipitation accumulation from dike areas is performed only after inspection of the accumulation to ensure compliance with applicable water quality standards. Any water possessing a film, sheen or discoloration on the surface is not discharged until such sheen has been physically removed with the use of absorbent pads.

Drain valves are sealed and locked at all times except when there is an operator on-site who:

- Inspects the water for a film, sheen, or discoloration;
- Removes any film, sheen, or discoloration;
- Monitors the discharge; and,
- Records the discharge event in the SPCC plan.

Pipe Supports

In accordance with good engineering practice and petroleum industry standards, pipe supports are designed to minimize abrasion and corrosion and allow for expansion and contraction of the pipeline.

Delivery Lines and Manifold

The facility tests the delivery lines and manifold on an annual basis with a two 2) hour recorded pressure test.

High Level Alarms

High level alarms on storage tanks are inspected routinely to simulate actual operating conditions to ensure that overfill during tank filling operations are adequately detected. Results of high-level alarm inspections are recorded in the SPCC plan once every six months.

Cathodic Protection System

The entire pipeline, including stations and terminals are protected by a cathodic protection system to protect buried piping from external corrosion. Cathodic protection rectifiers are read bi-monthly to ensure proper operation. A full cathodic protection system survey is performed annually, with required remediation actions to be performed within one year.

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1.5.8 Prevention of Security Related Threats

Lighting

Facility lighting is appropriate with the operation and the type and location of the facility to assist in the discovery of discharges and to prevent discharges occurring through acts of vandalism. Lighting at the facility is provided to illuminate tanks, loading racks, offices and entrance/exit gates.

Security Programs

The Company has Security Plans for pipeline and terminal facilities; some are regulated security facilities. Access to the Security Plans is restricted and provided on a “need-to-know” basis, in all cases. The Company will assign an Intelligence Officer in an emergency situation, as needed to support the Incident Commander (“IC”).

All Terminal/Station Security Plans are kept in a controlled area. Access to these plans is limited and controlled due to the sensitive nature involved. Relative information is distributed and communicated to those individuals whose job involves security concerns. Upkeep of these plans is the responsibility of Regional Management which is aligned with the Corporate Liquid Pipelines Security Management Plan.

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1.6 Regulatory Compliance – Canada and U.S.

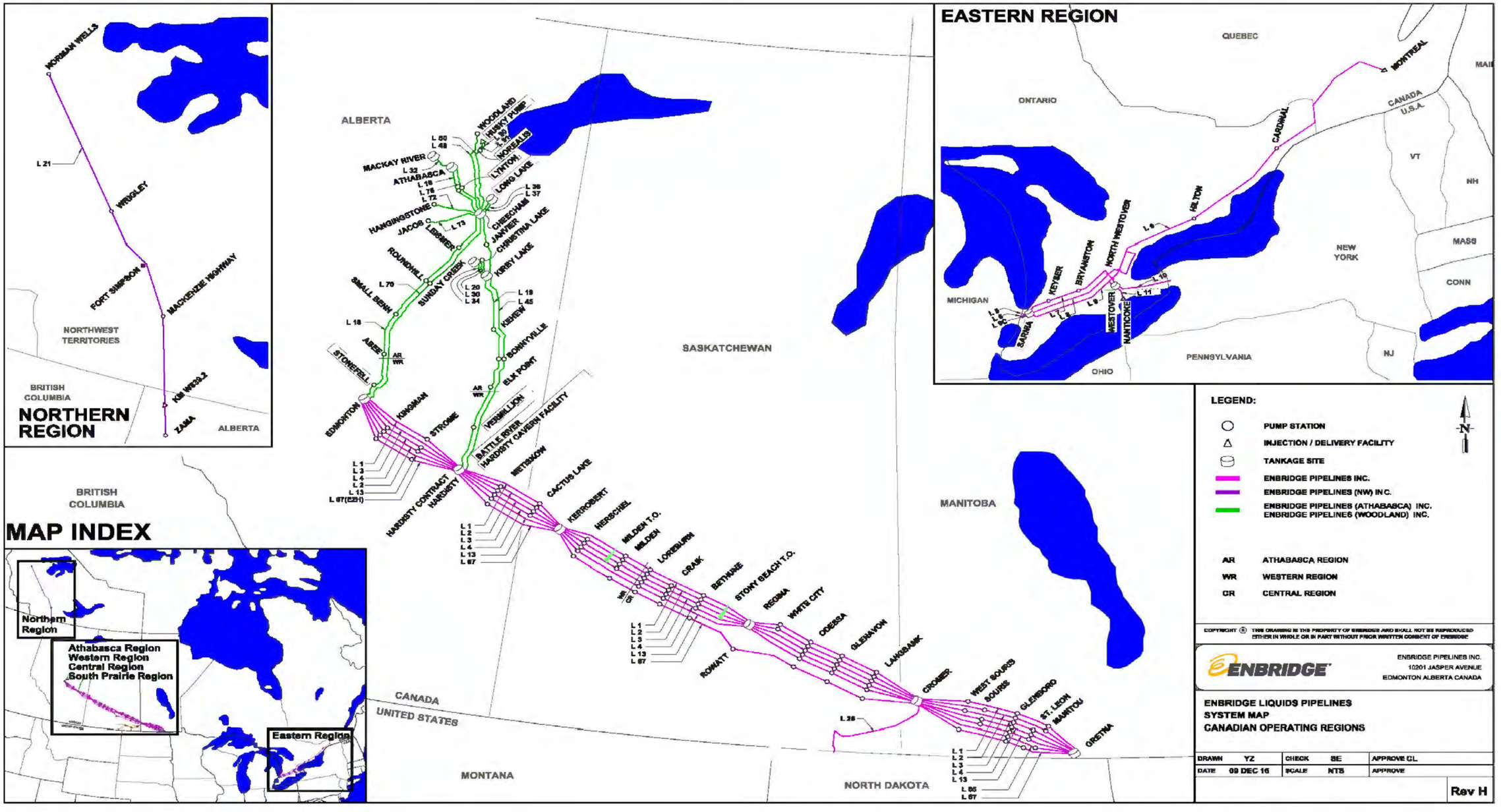
This ICP is based on the National Incident Management System ("NIMS") and the Incident Command System ("ICS"). This Plan utilizes the standard format guidance provided for by the U.S. National Response Team. As such it has been developed to allow assimilation of other Federal, Provincial and State agencies into the Plan.

	The Plan is intended to satisfy the requirements of regulatory agencies mandating written procedures to address planning and response to emergencies, including:
✓	Alberta Energy Regulator ("AER") • Pipeline Act, RSA, c P-15, Sections 35-36 • Pipeline Rules, AR 91/2005, Sections 8, 27 and 76 • AER Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry, 2009 • AER Directive 056: Energy Development Applications and Schedules
✓	• Alberta Environment and Parks ("AEP")Environmental Protection and Enhancement Act, RSA 2000, c.E-12Sections 110 to 112 • Release Reporting Regulation, AR 117/1993
✓	Environment Canada • Canadian Environmental Protection Act 1999, SC 1999, c. 33, Sections 95, 96, 169, 178 Part 8 (Section 193 to 205) • Federal Halocarbon Regulations, 2003, Release Reports, section 32-33
✓	Fisheries and Oceans Canada • Fisheries Act, RSC 1985, c F-14, Section 38(4) – (6)
✓	Manitoba Ministry of Environment • The Environment Act, CCSM, c. E125, Section 30.1 • Notice and Reporting Regulation, MR 126/2010
✓	National Energy Board ("NEB"): • National Energy Board Onshore Pipeline Regulations SOR/99-294,Sections 32-36, 46,52, Incident Reports • National Energy Board Event Reporting Guidelines
✓	Northwest Territories • Environmental Protection Act, RSNWT 1988 c.E-7 Section 5. • Spill Contingency Planning and Reporting Regulations, NWT Reg 063-93 • A Guide to Spill Contingency Planning & Reporting Regulations, March 2011 • Indian and Northern Affairs Canada, INAC Guidelines for Spill Contingency Planning, April 2007
✓	Ontario Ministry of Environment • Environmental Protection Act, RSO 1990, c. E.19 Part X (Spills) 2 • Classification and Exemption of Spills and Reporting of Discharges, Ont. Reg 675/98 • Spills Reporting A Guide to Reporting Spills & Discharges, May 2007

The Plan is intended to satisfy the requirements of regulatory agencies mandating written procedures to address planning and response to emergencies, including:	
✓	Quebec Minister of Sustainable Development, Environment and Action against Climate Change • Environment Quality Act, CQLR, c. Q-2 • Regulation Respecting Halocarbons, QCLR, c. Q-2, r. 29 • Regulation Respecting Hazardous Material, CQLR, c. Q-2, r. 32
✓	Saskatchewan Ministry of Environment • The Environmental Management and Protection Act, 2010, SS 2010, c E-10 -22 , Sections 9-10 • Environmental Spill Control Regulations, Section 4
✓	Saskatchewan Ministry of the Economy • The Emergency Planning Act, SS 1989-90, c. E-8.1 • Pipelines Regulations, 2000, RRS c. P-12.1, Reg. 1, Sections 20-21 • The Oil and Gas Conservation Regulations, 2012, RRS c. O-2, Reg. 6, Section 99
✓	Transport Canada • Transportation of Dangerous Goods Act, 1992, SC 1992, c. 34, Section 18 • Transportation of Dangerous Goods Regulations, SOR/2015-100 Part 8, Accidental Release and Imminent Accidental Release Report Requirements
✓	Transportation Safety Board ("TSB"): • Transportation Safety Board Regulations, SOR/2014-37, Section 4

The Plan is also intended to satisfy the requirements of regulatory agencies (primarily DOT PHMSA) mandating written procedures to address planning and response to emergencies, including:	
✓	Oil Pollution Act of 1990 "OPA 90"
✓	The Department of Transportation's ("DOT") regulations as defined in *49CFR§192.615, §194, §172.600 Subpart G and* similar regulations issued by the state agencies
✓	The Department of Transportation's ("DOT") regulations as defined in *49CFR§195.403*
✓	The Department of Transportation's ("DOT") regulations as defined in *49CFR§172.600*
✓	United States Coast Guard ("USCG"), *33CFR§154*
✓	The National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") and applicable Area Contingency Plans ("ACPs")
✓	OSHA's *29CFR§1910*
✓	Applicable State and local requirements
✓	U.S. Environmental Protection Agency's ("EPA") Oil Pollution Prevention Regulations, *40CFR§112*, that requires a Non-Transportation Related Facility Response Plan
✓	Company has opted to follow the PREP Guidelines for exercise/drilling purposes
✓	American Petroleum Institute ("API") 1162.

1.7 Canada Pipeline System Map



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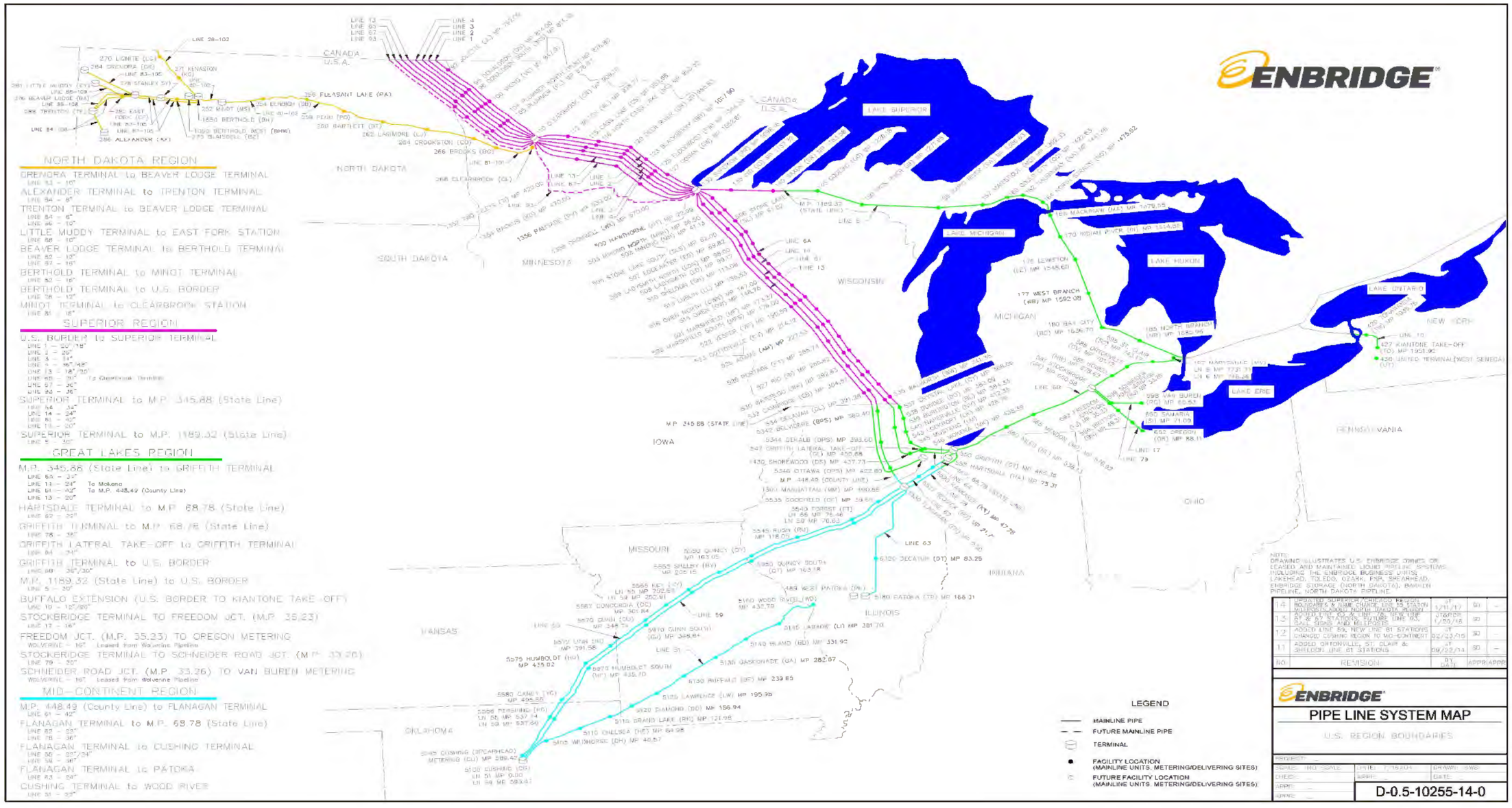

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2.0 General Guidance

2.0.1 Guiding Objectives

Section 2 of this document provides guidance on emergency response and management during an incident. Enbridge will prudently over respond to any incident with priorities in the following order:

- **P**eople
- **E**nvironment
- **A**ssets
- **R**eputation

Additionally, during a response, the following **objectives** (what you plan to do in priority order) and **strategies** (how you plan to accomplish objectives) should be considered. Not all objectives apply to all incidents:

Objectives	Strategies
1. **Ensure the Safety of Citizens & Response Personnel**	• Establish site control (hot zone, warm zone, cold zone and security) • Consider evacuations, as needed • Establish vessel and/or aircraft restrictions • Monitor air in impacted areas • Develop Site Safety and Health Plan ("SSHP") for response personnel • Ensure safety briefings are conducted • Manage medical emergencies/injuries
2. **Control the Source**	• Complete emergency shutdown • Initiate temporary repairs • Transfer product
3. **Manage Coordinated Response Effort**	• Complete or confirm notifications • Activate ICS and facilities (command post, etc.) • Ensure local, Aboriginal and tribal officials are included in response organization • Initiate emergency response Incident Action Plan ("IAP") • Ensure mobilization and tracking of response resources and personnel • Complete documentation • Evaluate planned response objectives vs. actual response (debrief)
4. **Maximize Protection of Environmentally-Sensitive Areas**	• Implement pre-designated response strategies • Identify resources at risk in impacted and potential impacted areas • Track pollutant movement and develop trajectories/plume modeling • Conduct visual assessments (e.g., over-flights) • Develop/implement appropriate protection tactics

Objectives	Strategies
5. Contain and Recover Spilled Material	• Deploy containment boom at appropriate spill source and collection areas
6. Recover and Rehabilitate Injured Wildlife	• Conduct injured wildlife search and rescue operations
7. Remove Oil from Impacted Areas	• Conduct clean-up efforts
8. Minimize Economic Impacts	• Consider tourism, vessel movements, and local economic impacts throughout response • Protect public and private assets, as resources permit • Establish damage claims process
9. Keep Stakeholders Informed of Response Activities	• Provide forum to obtain stakeholder input and concerns • Provide stakeholders with details of response actions, concerns and issues, and address as practical • Provide elected officials details of response actions
10. Keep the Public Informed of Response Activities	• Provide timely safety announcements • Establish a Joint Information Center ("JIC") • Conduct regular news briefings • Manage news media access to spill response activities • Conduct public meetings, as appropriate
11. Minimize Business Interruption	• Identify business interruption and potential business interruption issues • Conduct notifications of joint venture partners • Assist with internal/external investigations.

2.0.2 Documentation

Records will be made and kept as events occur that capture the following information:

- Notification
- Response Actions
- Communications with Non-Company Personnel
- List of All Persons On-Scene
- Costs Incurred

The IC is responsible for the maintenance of complete and accurate records of all events that occur during any response activity in chronological order as it is essential for legal requirements, and post-incident review.

When an emergency has been declared, the Law Department should be notified early on to provide direction on records management. The Law Department will advise of specific requests for document retention, including managing and classifying incident emails per Email Management Policy

Each group within the response organization is responsible for compiling and maintaining adequate records. If the ICS has not been fully activated, the IC must maintain and keep an accurate, chronological record of the key events related to the release.

Standards for response documentation are illustrated below:

Standards for Management of Records	
✓	Response documentation is a record of activities and not a place for analysis, conclusions, speculation, opinions, or comments
✓	Records will be complete to capture the whole sequence of events
✓	Records will be clearly stated to support the recovery costs at a later date
✓	Only relevant information will be recorded
✓	Records will include the name and position of the person who prepared the document
✓	Records will be managed and available throughout the response
✓	A scribe will be appointed to document
✓	All entries will include a time and date to reconstruct sequences of events at a later date.

Essential Emergency Response Documentation

- **Level 1 Emergency** – ICS 201 packet (verbal or written depending on the nature of the emergency)
- **Level 2 Emergency** – ICS 201 packet, followed by an IAP for multiple operational periods
- **Level 3 Emergency** – Detailed IAP created for each operational period.

If software is utilized in any emergency response (including drills and exercises) to develop an Incident Action Plan, all documents will be stored on the system and printed for retention at the regional office as per the Record Retention Policy. .

Unit/Individual Logs from each ICS group will be maintained from the time of emergency confirmation until the operations are completed and will be handed in to the documentation unit at the end of every operational period.

Incident Records

Electronic Documentation

When an emergency has been declared, the Law Department should be notified early on to provide direction on records management. All emails will be stored in an email folder created specifically for the incident. The Law Department will advise of specific requests for document retention.

Visual Records

Photographs

Photographs will be used to record the following information:

- Initial conditions at the release site;
- Containment and response activities (chronological progression);
- Aerial photographs (if possible);
- Overall “panoramic” view of the site to tie-in permanent features;
- Conditions at the end of the response operations; and
- Recovery of the area over time.

The following information will be written on each photograph immediately after development:

- Release name and location;
- Date and time;
- Photographer’s name and contact number;
- Location where the photograph was taken and direction the camera was facing (use copy of site sketch where possible), and
- Specific information being documented.

Video

Use video with a verbal commentary to supplement (not replace) photographs if appropriate. Verbal comments are only used to reference information pertaining to the release site and associated activities.

2.0.3 Personal Protective Equipment

Appropriate personal protective equipment ("PPE") will be worn/used during response activities, meaning appropriate to the hazard and to the activities the responder will be undertaking. Responders will be trained and experienced in the use, care and maintenance of PPE and are responsible for personal items.

At minimum, these measures may include:

Personal Protective Equipment	
The Safety Officer and/or Site Supervisor will determine the PPE requirement based on the work to be conducted, a documented hazard assessment, and other factors as listed below.	
Respiratory:	Wear a positive pressure air supplied respirator in situations where there may be potential for airborne exposure above exposure limits as identified by air sampling. If exposure concentration is unknown, or if conditions immediately dangerous to life or health (IDLH) exist, a National Institute of Occupational Safety and Health (NIOSH) approved self-containing breathing apparatus (SCBA) or equivalent shall be operated in a pressure demand or other positive pressure mode.
Head:	Approved hard hats shall be worn unless all overhead hazards have been eliminated.
Gloves:	Gloves shall be used based on emergency conditions and shall be sufficient for work being performed.
Eye/Face:	Approved safety or prescription safety glasses with fitted side shields and protective lenses shall be worn to safeguard against potential eye contact, irritation or injury. Depending on conditions of use, a face shield may also be necessary.
Foot:	Safety boots with a minimum of 6" (15 cm) ankle support to the top of the boot from the heel is required, unless on a controlled or supervised site/facility tour or when not exposed to hazards that would require foot protection.
Hearing:	Hearing protection shall be worn where exposed to noise at 85 dBA or above.
Clothing:	Full length pants and long sleeves shall be worn on any facililty or work site. Approved High Visibility Safety Apparel (HVSA) shall be worn when required by hazard assessment, in areas of heavy congestion or when working near traffic areas. Flame Resistant (FR) garments are required inside fenced or operating facilities, where there is a potential for flame exposure or as based on a hazard assessment. Imperveous clothing should be worn as needed.
Other Protective Equipment:	A source of clean water should be available in the work area for flushing eyes and skin.
	Suggestions for the use of specific protective materials are based on readily available published data. Users should check with the Safety Officer and follow Company safety policies.

** Other PPE maybe required based on hazard assessment*

• PPE Use and Limitations	
Several factors must be considered when selecting and using PPE	
✓	The protective clothing, gloves and boots must be resistant to permeation or penetration by oil and other chemicals that may be encountered on the site
✓	Protective clothing and gloves should be durable for heavy work
✓	Protective clothing and glove materials must maintain protection and flexibility in hot or cold weather conditions
✓	Protective clothing must be large enough to fit over other clothing without ripping and tearing
✓	For respirator use, procedures must be in place for the proper selection, use, care, and fit testing of the respirators. Additionally, the wearer must be advised as to respirator cartridge expected life and of monitoring for contaminant breakthrough, etc.
✓	Protective footwear must have non-slip soles. Additionally, conditions may require the use of steel toe and/or steel shank footwear
• Work Duration	
The work duration is expected to last for the full shift and will involve moderate to heavy physical exertion during clean-up activities.	
• PPE Maintenance and Storage	
PPE will be maintained and stored by an assigned work crew. Protective clothing and gloves will be evaluated during and at the end of each shift and will be replaced as necessary. Boots and other PPE may be decontaminated for re-use.	
• PPE Decontamination and Disposal	
PPE may be decontaminated in designated areas by assigned crews using soap or another suitable cleanser and rinse water. The cleaning solution used will be disposed of in properly labeled containers according to applicable regulations. Contaminated protective gloves and any other PPE to be disposed of will be placed in properly labeled bags and disposed of according to applicable regulations.	

• PPE Training and Proper Fitting	
All site clean-up workers, supervisors/managers and others entering the contaminated zone will be given training in proper use of PPE. The training will include:	
✓	How to use PPE
✓	When and where to use the PPE
✓	How to inspect PPE to determine if it is working properly
Care will be taken to ensure workers are provided properly fitted PPE.	
• PPE Donning and Doffing Procedures	
Prior to starting work, all site clean-up workers and others required to wear PPE will be trained in proper donning and doffing procedures.	

2.1 Discovery/Detection

2.1.1 Observation, Discovery & Detection

The detection of a discharge from the Company pipeline system may occur in a number of ways, including: Discharge detection by Company personnel, pipeline patrols, or the general public. Discharge detection by the SCADA system and or controller at the Control Centre which monitors flow and pressure on most lines as well as tank oil levels

2.1.1.1 Pressure Alarm

In the event of a change in pressure beyond a specified range, the operator will be signaled by an alarm which may result in the operator shutting down the associated pipeline or process equipment.

Control Center Alarm Procedures	
✓	Ensure that the pipeline/terminal is in a safe state
✓	Notify supervisor/manager of any abnormal operation
✓	Once a shutdown decision has been made personnel will be dispatched to assess situation
✓	The supervisor/manager may request a field inspection of the pipeline ROW in question to identify the source of the suspected leak
✓	In the event a release is discovered along the pipeline, this Plan will be activated
✓	In the event a release is not found, an investigation into the cause of the pressure change will continue until determined.

If a release is detected, personnel are directed to notify the proper authorities (see *Annex 2- Notification Procedures*).

Facility Discharge Detection (Tanks, Terminals and Piping)

Enbridge facilities are equipped with high level alarms including mechanical switches.. The Control Center also receives an alarm if this "high level" is reached. When the Company receives these alarms, the alarming tank is shut down, and immediate contact with the facility operator on duty or on-call personnel is established. The high level alarm is set below the tank overfill height to ensure adequate time to shut down the line before overfilling occurs.

2.1.1.2 Discharge Mitigation

This section provides guidelines for controlling a release near the source and mitigating the associated consequences. Source control and mitigation involve anything from shutdown of operations to containing a spill, dispersing a vapor cloud, protecting a sensitive area, recovering the spilled material, or other such activities that are involved in an emergency response.

Company personal have been trained to respond to abnormal pipeline/facility operations. Source control will be maintained with the following systems and procedures:

- Company facilities are equipped with Automated Emergency Support Systems (e.g., sumps, safety control valves, emergency shutdowns, etc.). These systems can alarm Control Centre operators and close individual valves or the entire pipeline/facility.
- In the event the incident does not allow automatic control, the operator has the ability to control a release by manually activating shutdown devices or closing valves, etc.
- In the event the source cannot be controlled by the pipeline operator or remotely with a safety system, the Company will activate this Plan and assemble a team to respond to the situation.

Initial Actions For a Pipeline Incident:	
✓	Shutting down the pipeline
✓	Isolating the line section by closing the appropriate valves
✓	Dispatch first responder to assess

Initial Actions For a Tank Leak/Overfill:	
✓	Terminating operations to the tank, if in progress
✓	Transferring the tank contents into available tankage or back into the pipeline
✓	Dispatch first responder to assess

Source control measures are implemented as close as possible to the source of a spill to minimize the extent of the affected area and generally involve:	
✓	Construction of barriers, trenches, or earthen berms for containment
✓	Construction of berms or trenches for diverting spill to containment area
✓	Deployment of containment booms in waterways down- current of the source
✓	Deployment of recovery equipment (pumps, vacuum trucks, skimmers)

Leak Detection System

We monitor our pipelines for possible leaks using multiple methods, each with a different focus and each using a different technology, resource and timing. Together these methods provide overlapping and layered leak detection capabilities:

Controller (Operator) monitoring – Our Supervisory Control and Data Acquisition (SCADA) system is designed to identify operational changes, such as pressure drops, that may indicate a leak. This SCADA system also monitors vapor concentrations, pump-seal failures, equipment vibration levels, and sump levels.

Computational pipeline monitoring – We constantly monitor pressure, temperature and other key data from thousands of points along our systems to quickly identify and respond to unexpected changes. Computer – based systems use measurement and pipeline data to detect anomalies that could indicate possible leaks.

Scheduled Line Balance Calculations – Many times a day, at regularly scheduled intervals, we calculate and confirm that the volumes of crude oil we receive into our pipeline system precisely match the volumes we deliver.

Visual surveillance – We conduct regular aerial and ground line patrols on our system, and we operate emergency telephone hot lines for third party reports.

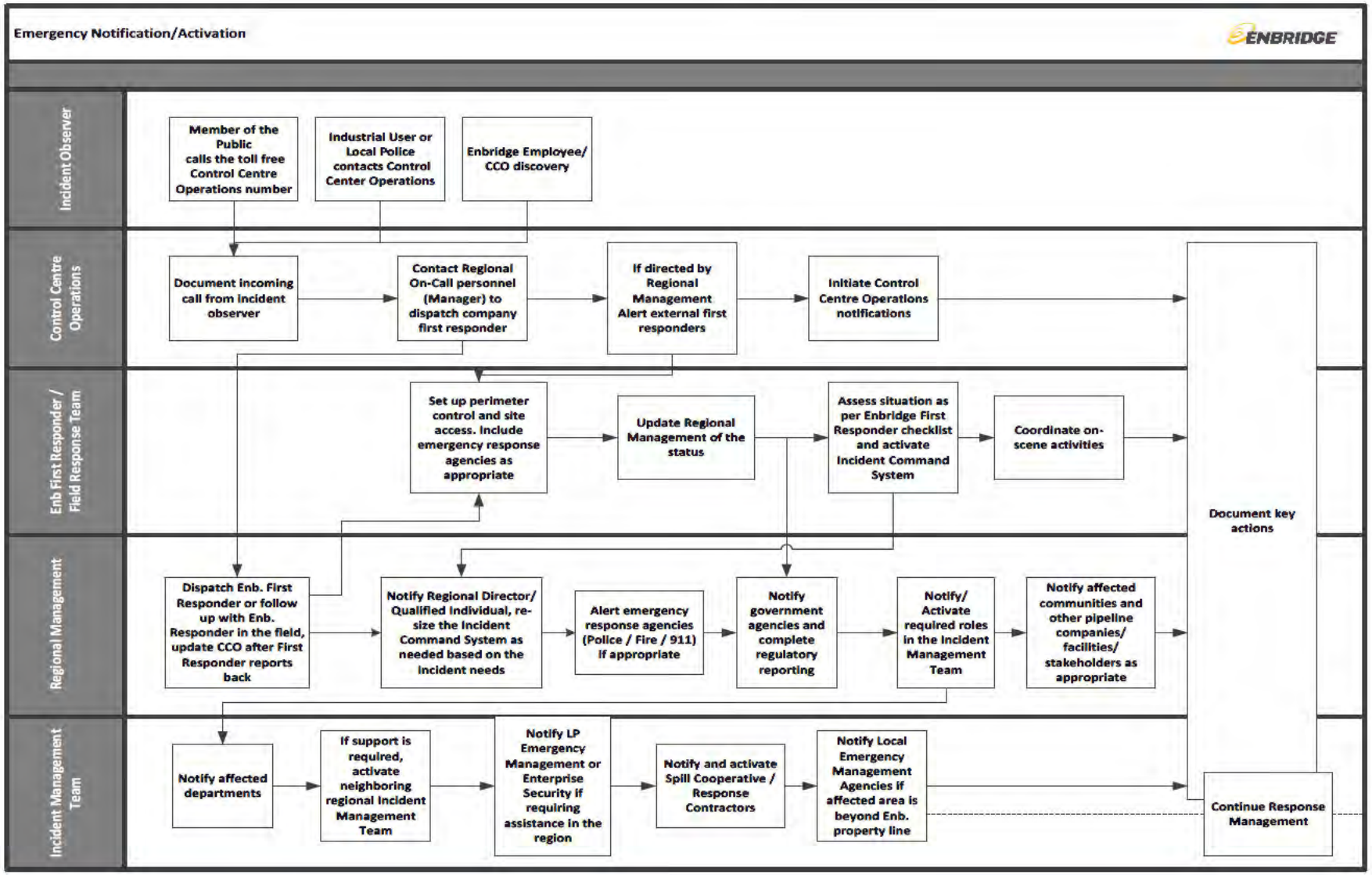
2.2 Notification and Communication

General guidelines on the procedures and sequence for making the various internal and external notifications following any type of product release or other emergency incident can be found in this Plan in *Annex 2*. The information provided herein focuses primarily on general notifications and reporting. Relevant internal and external notifications will be found in the geographic specific Geographical Annex of the ICP along with all notification checklists applicable to that area.

The purpose of the notification process is to:

- Protect the safety of the public and responders;
- Control potential environmental effects as effectively and quickly as possible; and
- Meet regulatory requirements.

The notification process is triggered by an emergency or suspected emergency that is detected by, or reported to, the Control Center by the public, contractors, external first responders or an employee.


Emergency Notification/Activation
ENBRIDGE
Incident Observer
Control Centre Operations
Enb First Responder / Field Response Team
Regional Management
Incident Management Team
Member of the Public calls the toll free Control Centre Operations number
Industrial User or Local Police contacts Control Center Operations
Enbridge Employee/ CCO discovery
Document incoming call from incident observer
Contact Regional On-Call personnel (Manager) to dispatch company first responder
If directed by Regional Management Alert external first responders
Initiate Control Centre Operations notifications
Set up perimeter control and site access. Include emergency response agencies as appropriate
Update Regional Management of the status
Assess situation as per Enbridge First Responder checklist and activate Incident Command System
Coordinate on-scene activities
Document key actions
Dispatch Enb. First Responder or follow up with Enb. Responder in the field, update CCO after First Responder reports back
Notify Regional Director/ Qualified Individual, re-size the Incident Command System as needed based on the incident needs
Alert emergency response agencies (Police / Fire / 911) if appropriate
Notify government agencies and complete regulatory reporting
Notify/ Activate required roles in the Incident Management Team
Notify affected communities and other pipeline companies/ facilities/ stakeholders as appropriate
Notify affected departments
If support is required, activate neighboring regional Incident Management Team
Notify LP Emergency Management or Enterprise Security if requiring assistance in the region
Notify and activate Spill Cooperative / Response Contractors
Notify Local Emergency Management Agencies if affected area is beyond Enb. property line
Continue Response Management

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2.2.1 Field Notifications

Any person who observes or becomes aware of a release shall immediately report the incident to the Control Center and Regional Management. Information should be documented on the Receiving Emergency Information form, located in *Section 4 - Forms*.

Enbridge First Responder

The Enbridge Responder on-scene will:

- Contact Regional Manager on call – see Regional Manager On Call Schedule
- Contact Control Center
- Follow Annex 2-Notification Procedures to activate the Regional IMT; and
- Work with the first responding agency on scene to ensure a coordinated response.

Regional Management/Representative

As the scope of the incident requires, Regional Management will:

- Dispatch Enbridge Responder to investigate the report;
- Notify the Control Center if an Enbridge Responder has been dispatched;
- Depending on the circumstances of the emergency, consider launching aircraft for situational awareness; and
- Activated Incident Management Team as required.
- See Annex 2 - Notification Procedures for required regulatory Notifications
- Call response agencies/oil spill removal agencies (Annex 2).

In the Northern Region, the Regional Management will contact stakeholders and authorities.

2.2.2 Control Center

Any abnormal operating condition detected by the Control Center, or any reported or observed emergency or possible emergency situation, will be given an emergency status until the report is confirmed or negated. Follow up investigation and confirmation of a spill, or threat of spill, will be done immediately.

The Control Center personnel will notify:

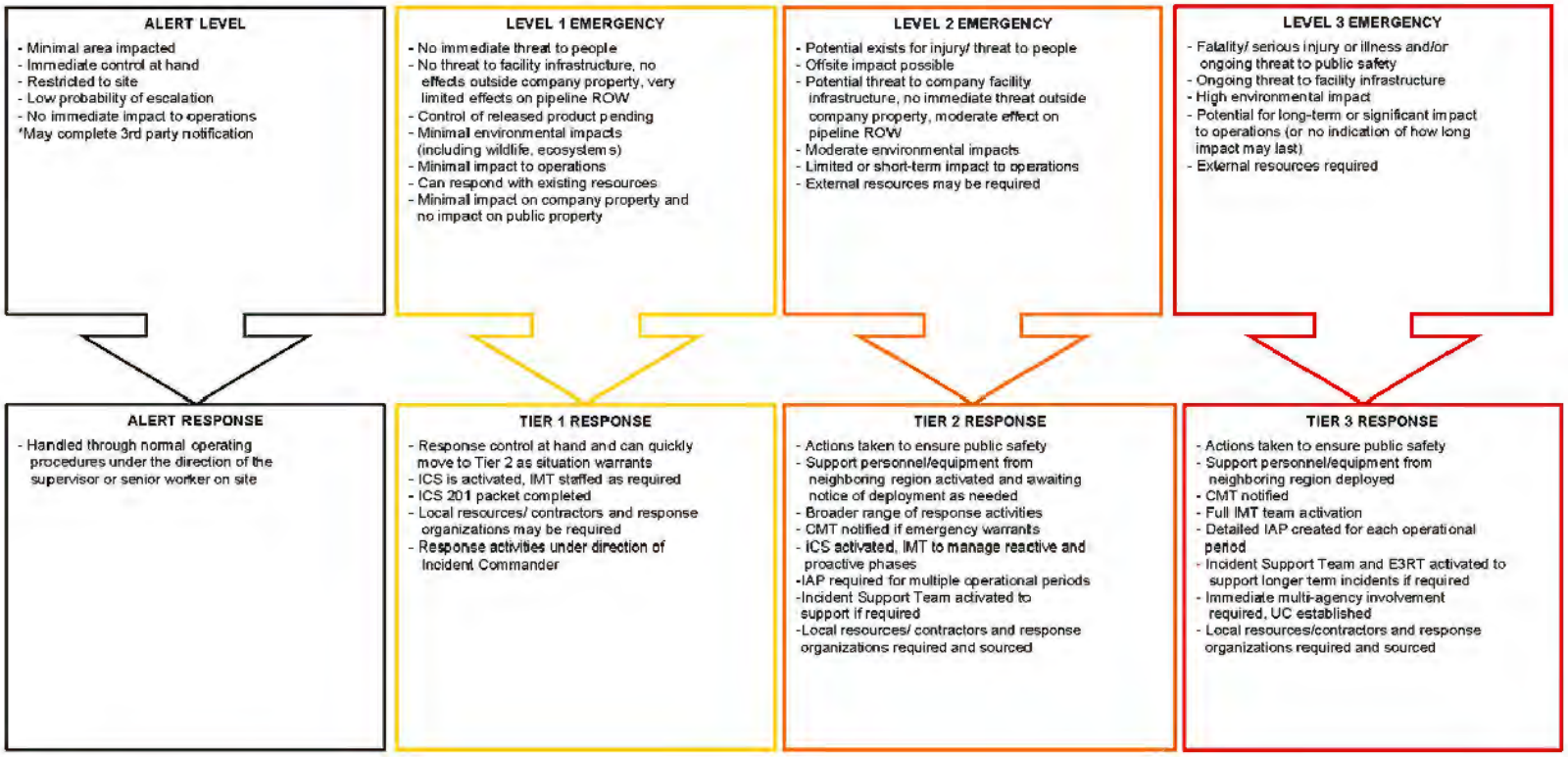
- Regional on-call representative,
- Others identified in the Control Center operations procedures; and
- The Municipal/Community emergency services will be notified at the request of Regional Management);

The Control Center and IMT will confirm that additional notifications are completed, including those to:

- Government agencies
- Local authorities
- Response contractors
- Aboriginal groups in Canada, or Tribal Representatives in the U.S.
- Stakeholders

2.2.3 Classification of the Incident

Figure 1



Note:
1) Regulatory classification levels may not align with Enbridge Classifications
2) In Eastern Region, 3rd party notifications will be reported for alert level incidents

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2.2.4 Third-Party Notifications - Jurisdiction having Authority

The IC is responsible for assuring that all required notifications/reports are completed in a timely manner for all incidents. All contact with external agencies must be properly documented. The Control Center is a 24/7 support tool designed to provide communication assistance to the IC to facilitate a timely response to emergency situations. Upon completion of the initial notifications and the implementation of the initial response actions, periodic follow-up notifications should be made to the applicable agencies.

For reporting guidelines for all agency contact information, refer to *Annex 2.*

2.2.5 External Communications

All Public statements and notification must be pre-approved by the Public Information Officer (PIO) if appointed, and approved by the Incident Commander (IC).

Regional Management (or designate) should notify On-call PIO of any of any emergency situation where external public communication may be required. The PIO may be activated at any time by the Incident Commander in any operational incident or emergency.

Refer all media and general public inquiries to the PIO.

The Liaison Officer (LNO) also works with the PIO to develop messaging. The LNO is responsible to communicate with specific stakeholder groups as determined by the size, scale and complexity of the incident. This may include but is not limited to:

- Aboriginal / Tribes/ Indigenous groups
- Community Leaders
- Government Representatives (elected and public service, various jurisdictions)
- Regulators

External Communications should:

1. **Focus on Priorities**

   The company's priority in an emergency is to protect the public and responders, limit environmental impact and resolve the problem calmly, professionally and safely while ensuring stakeholders are kept informed.

2. **Coordinate with Local Resources**

   Local fire, police and emergency medical service (EMS) officials will be requested to communicate the emergency situation to those in proximity to the incident. The LNO role (which may be filled by groups such as Community Relations, Stakeholder Relations and Aboriginal Relations representatives or Land Agents for the area) will also contact/follow up with local landowners, municipal representatives, government, regulators, Aboriginal/Indigenous groups and other stakeholders.

Initial Response Phase - Enbridge First Responders

Enbridge First Responders should use the following to respond to the Media until a Public Information officer is available:

- Provide media members with the toll free media line (1-888-992-0997 in Canada and 1-877-496-8142 in the US)
- Communicate with the public and media in a calm, professional and respectful manner, showing concern for their safety.
- State that you are not an official spokesperson for the company but a representative will respond to their inquiry as quickly as possible.

Crisis Communications

This section serves as a general guide for the Incident Management Team in making critical decisions related to public information management. This applies to response personnel communicating with the public, stakeholders and the media regarding real or potential emergencies. The objective is to establish Enbridge as an early, credible source of information, reduce speculation and inaccuracies in reporting and to ensure consistent messaging and information flow regardless of channel or audience.

Methods stated here are as-needed and may not apply in every emergency.

In a larger incident, additional support outside of the Incident Management Team may be required. The Crisis Communications and Response Team supports the Incident Management Team and may be activated for two purposes:

- To support Enbridge's communications response during an operational upset through the Public Information Officer, and
- To engage in strategic internal and external communications and reputation management for operational and non-operational crises (e.g. financial stories, negative media, etc.).

The Crisis Communications and Response Team is aligned with the Incident Command System, and enables a communications structure that supports Enbridge's emergency response teams. This team reports to the Incident Management Team PIO and/or LNO based on the nature of the incident.

Crisis Communication Activities	
	The PIO, with authorization from the IC:
	Gathers information to develop a communications plan and messaging
	If appropriate, releases a statement to media
	If appropriate, activates web specialists to post a statement on the company website
	Works with LNO to develop messaging for communication with stakeholders
	If appropriate, issues emergency bulletins containing key information for internal and external communications
	The PIO issues status updates through modes listed above
	The IC, PIO and LNO coordinate internally, and then reach out to local emergency service officials and local/regional emergency management agencies regarding status updates.
	As safe access permits, LNO team and/or Land Right-of-Way Agents, in cooperation with local public safety officials, go door-to-door to notify landowners of the possible impact on their property and establish how future communication will be handled for updates.
	If necessary, a community center is established (led by PIO) to address questions/comments/concerns of residents in the area.
	The PIO will document all public inquiries regarding the incident allowing the Company the ensure responses are made in a timely manner.
	Lands and Right-of-Way personnel gather emergency contact information from the database of all property owners, residents and tenants along the pipeline system.
	Lands and Right-of-Way Agents obtain emergency contact information including:
	area map indicating location of pipeline and location of residences or workplaces
	names
	addresses, including GPS coordinates
	phone numbers (home and mobile)
	email addresses
	mobile text message capability
	In the event of potential impact to public health due to extended exposure to air or waterborne substance, generally a notice is distributed by the local public health department, followed by a news release to media and notification to residents.

Alternate Means of Communication	
	If appropriate, under the responsibility of the PIO (upon approval from the IC), an incident call center/hotline incident-specific website and community center may be established where individuals can contact the company regarding the status and support being provided to the community by the company.
	In the event of an extended evacuation, the company provides daily updates to explain what is being done to return evacuees to their homes and to discuss and accommodate their needs. This messaging is coordinated with the applicable Local Authority(s).
	If appropriate, an incident-specific website will be activated to manage external communication related to an emergency.
Public Evacuation / Shelter-in-Place	
	If an evacuation or shelter-in-place order is necessary, the PIO and LNO will support public safety officials and may assist with coordination under the direction of that authority. E.g. Lands & Right-of-Way agents could assist by notifying the public and adjoining facilities.
	If a public warning system or Emergency Alert System (EAS) is present and accessible, it may be used by local authorities to communicate emergency information and actions to the public. PIO and LNO should support Local Authorities by ensuring they have the right information and necessary details to define clear public emergency actions.
	The LNO works with local public safety officials and local public emergency organizations (i.e., Red Cross) to establish and furnish shelters to house and feed evacuees.
	The PIO, via Senior Communications Officer, notifies Executive Leadership (Incident Support Team and if activated the Crisis Management Team) of any evacuation or shelter-in-place messaging

2.3 Initial Response

Initial command actions are those taken by local personnel immediately upon becoming aware of a release or emergency incident, before the Company Response Teams (Field Response Team "FRT" and Incident Management Team "IMT") are formed and functioning. Timely implementation of these initial steps is of the utmost importance because they can greatly affect the overall response operation.

Immediate actions are required at the onset of an emergency response to mitigate the extent of a release, minimize the potential hazard to human health and the environment, as well as implement an effective response. It is also important to act decisively and in doing so, create a professional working atmosphere among the Company and regulatory authority personnel and public officials. This section is intended to provide guidance for determining the appropriate initial response and notification actions that should be carried out in the event of a release or other emergency incident.

It is the IC's responsibility to first make the appropriate, and to initiate response operations until a transfer of command occurs and the IMT has been activated.

2.3.1 Initial Response Procedures

A person evaluating a situation must assess the circumstances surrounding an event, to determine if an emergency situation exists, and respond accordingly. Company personnel are trained in hazards or emergency recognition procedures as described below.

An emergency in pipeline and facility operations often originates with the unexpected release of product. Uncontained commodities and high vapor concentrations present substantial hazards for fires or explosions until they dissipate to safe levels. In these situations, sources of ignition must be controlled to eliminate fire and explosion hazards. The Company has strict rules for controlling sources of ignition within its properties to avoid such explosions or fires. Potential sources of ignition become more difficult to control on public property. Early detection and quick response are the best actions to reduce the hazards.

The purpose of this section is to identify the response checklist/procedures (which follow below) based on the type of incident that could occur at a Facility and related pipeline systems. The checklists below are developed to allow the field personnel the ability to make sound decisions during the initial response to an incident. The checklists are not meant to substitute for emergency response knowledge, training, or sound judgment calls and do not account for all circumstances. In the event of any type of incident, it is imperative that the safety of **all** personnel be considered **first** and the protection of the environment second.

The level of required response is dependent upon the severity of the release, the size, potential environmental, social and economic impact and the expected public interest in the event. Company personnel and provision contractors will be familiar with the tiered response model and how emergencies are classified. Any employee/contractor who first observes an emergency will immediately report the details to the Control Center.

The Control Center employee that receives notice of a potential emergency will immediately call Regional Management to dispatch the Enbridge Responder on-call.

For planning purposes, potential emergencies will be classified by emergency levels. The classification levels are necessary for determining an appropriate tiered response. Escalating levels result in increased required resources, notification requirements and potential increased response complexity to deal with the emergency.

See the *Emergency Classification and Tiered Response Table* located in *Section 2.2*, which defines emergency response levels and the appropriate tiered response to support emergency operations.

Immediate actions will be taken at the onset or discovery of an incident to mitigate the effects and carry out an effective response. **Under no circumstances** will personnel place themselves in harm's way or be directed to do so by others when performing response activities.

Such actions include, but are not limited to:

- For a natural gas release, contacting local law enforcement for possible reverse 911 (or local emergency responder) public notifications or activation of public alarm systems (e.g. Emergency Broadcast System, Public Awareness Announcements, etc.) ensuring the health and safety of the public; evacuation to safe areas as necessary and restricting access to the area;
- Securing the site using best methods available;
- If necessary, contacting local emergency response agencies (police, fire and EMS) for assistance;
- Taking measures to reduce or control the impact of the emergency (e.g., block culverts/sewers, dam ditches, shut down ignition sources), maintaining the safety of personnel involved in these activities;
- Coordinating with response personnel arriving at the site; and
- Documenting key events using best methods available. All documents and logs drafted during an initial response will be submitted to the Documentation Unit for permanent retention.

2.3.1.1 Initial Response

Purpose: To be used when exploring a suspected or reported emergency. Safe work practices will be followed per the following guidelines (the order of these actions will depend on the situation).	
EXPLORE- To be reviewed by the First Responder prior to taking any immediate action.	
☐	Notify Senior staff on-site immediately if a pressure drop has been observed or a leak is suspected and stop all product transfers. Close all automatic isolation valves, if available.
☐	Conduct a field level hazard assessment to identify and mitigate all hazards including potential for fire, explosion, and hazardous toxic vapors. • Determine the wind direction and approach cautiously from upwind. • Explore the suspected release area only when wearing appropriate PPE using the buddy system if possible. • Ensure safety of personnel in the area. • Eliminate or shut off all potential ignition sources in the immediate area • Use intrinsically safe equipment (e.g., flashlights, two-way radios, gas detectors with audible alarms).
☐	If appropriate, request surveillance fly-over to determine: • If there is any abnormal activity and dead vegetation in the vicinity of a pipeline; • Size and description of oil slick; • Direction of movement; • Coordinates of leading and trailing edge of oil slick; • Sensitivities endangered; and • Areas of population that are threatened. If radio contact cannot be made; the line flyer will land report to Company management by telephone
☐	Maintain regular/scheduled communication with the Control Centre and Regional Management/on-call person.
APPROACH	
☐	If hazards cannot be safely mitigated, move to a safe upwind location, monitor the incident, and keep people out the hot zone.
☐	Are people injured or trapped? Are there outside people involved in rescue or evacuation?
☐	Are there immediate signs of potential hazards such as: • Electrical lines down or overhead? • Unidentified liquid or solid products visible? • Vapors visible? • Smells or breathing hazards evident? • Fires, sparks or ignition sources visible? • Holes, caverns, deep ditches, fast water or cliffs nearby? • Is local traffic a potential problem? • Ground conditions (select one) ☐ Dry ☐ Wet ☐ Icy
CONFIRM & CONTROL	
☐	Begin a 214A Individual log when notified of an incident and continue documenting key actions throughout the response.
☐	Determine level of response needed, hazards of product(s) involved and proper response guidelines to be followed. Confirm identification of spilled material and check the SDS sheets. Consider the following: • Assess the spill threat, site safety, and parameters such as spill volume, extent and direction of movement. • Has pipeline(s) been shut down? • Has wind direction been confirmed and windsock erected? • Has the public been protected or evacuation considered if necessary? • Have all ignition sources been identified and eliminated? • Have personal protection and safety requirements been established and communicated? • Is adequate fire protection equipment available and in place? • Are tank and VAC-truck electrical equipment properly grounded? • Have decontamination sites and procedures been established? • Are activities and events being logged/ documented? • Eliminate sources of vapor cloud ignition, consider the ignition of NGL. Shut down all engines and motors. • Establish Exclusion zone and Safe Work Areas (Hot, Warm, and Cold).

CONFIRM & CONTROL (con't)	
☐	If on water, consult Control Point and HCA maps for appropriate response strategies for incoming resources. • Review pipeline alignment sheets to become familiar with the location of mainline valves and elevation characteristics. • Review ESA maps for the location of any sensitive area that may be impacted (Annex 3).
☐	Once support has arrived conduct transfer of command and start preparing for tactical and planning meetings.
COMMUNICATION/NOTIFICATIONS	
☐	Initiate actions to notify government agencies including local authorities of area affected or at risk areas via the Control Centre, Regional Management or designate. • Complete notifications for emergency call-out, including regulatory agencies. This will be done by Regional Management or designate. • If excavating, has One-Call agency been notified? • Has a Preliminary Incident Report been issued? • Has a radio channel been established for communication between the site and other personnel in field? • Notify External Emergency Services as appropriate. Work with local law enforcement to make sure all personnel/citizens are a safe distance away from the hazard area. • Notify the appropriate Company management. • Advise neighboring property owners and operators of any threat to their property or personnel. • Notify appropriate federal, state and local government agencies, including local utilities.
INCIDENT COMMAND	
☐	Once it has been determined to activate the ICS, the IC will initiate the following actions: • Confirm that containment equipment and oil spill contractors have been deployed. • Integrate local evacuation plans into the Unified Command decision-making process. Work with response team once they arrive on site to establish a workable Incident Command Post and Communications Center. • Direct initial response actions • Begin development of an initial incident action plan (ICS 201 Forms).
EMERGENCY SHUT DOWN PROCEDURES	
☐	The following emergency shutdown procedures should be initiated if company personnel are threatened by the release of product from a pipeline to the environment or when coordinating activities for prompt and safe repair of the pipeline and the return to normal operating conditions: • Shutting in the line at the nearest block valves. • Notifying the nearest pump station and/or the appropriate Control Center. • Maintenance crewmembers should notify their immediate supervisor who will in turn notify appropriate Company contacts. • If the exact location of the leak is unknown, the immediate supervisor will request a line flyer, or if it is at night, manpower might be used to walk the line. Once a leak site has been located, the following information should be obtained: • Have all ignition sources been eliminated? • Are any water intakes at risk? • Are any schools, homes or commercial properties at risk and should they be evacuated? • Should access to the area be restricted (roads blocked)? If so, assistance should be requested from law enforcement agencies. • Have local response agencies been advised of the product's characteristics and handling precautions which are described in the SDSs? • Are railroads or utility companies in the area and have they been notified? • Will product flow into any waterways or roadways? • In the U.S. work with Company Environmental Department to conduct a Natural Resource Damage Assessment. The Control Center should be notified following an assessment of the release site; an evaluation should be made regarding the effect of downtime on product scheduling. Appropriate report, logs & notifications will be made.

2.3.2 Isolation Distance (Hot, Warm, Cold)

Establish initial control perimeters based on the following guidelines (see *Figure 1*):

- Hot Zone
- Warm Zone– could initially be considered containment area
- Cold Zone

The following table depicts safe distancing as recommended by the latest edition of the Emergency Response Guidebook (ERG) by the Department of Transportation and Transport Canada. Reference to the latest edition of the ERG is further recommended to confirm safe distancing relative to the site specific conditions.

Set up a Command Post, Staging Areas, and Decontamination Stations as necessary for the circumstances.

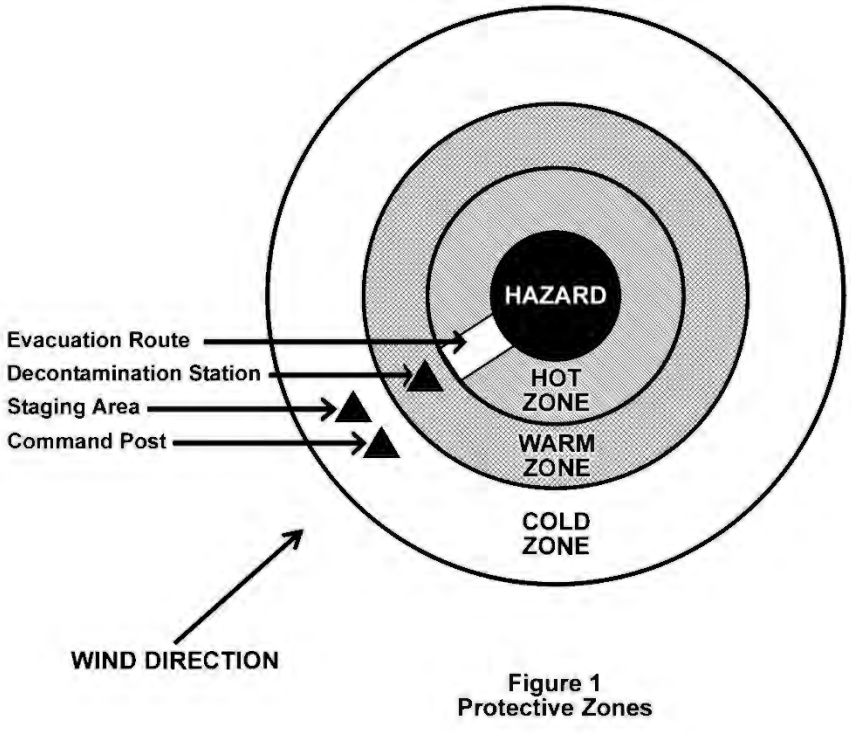

Figure 1
Protective Zones

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Isolation Distance / Emergency Response Guidebook * ** ***

Product	Guide #	ID #	Immediate Precautionary Evacuation Measure	Large Spill Evacuation	Evacuation in the Event of a Fire
Condensate(Diluent), Natural Gas, Butane, Ethane, Methane, Propane	115	1971, 1011, 1075, 1035, 1078	100 meters (330 feet)	800 meters (½ mile)	1,600 meters (1 mile)
Napthalene Crude	133	1334	25 meters (75 feet)	100 meters (330 feet)	800 meters (½ mile)
Petroleum Crude Oil, Petroleum products, Pentane, Hexane, Heptane, Octane, Nonane, Decane	128	1270, 1267, 1265,1268, 1208, 1206, 1262, 1920, 2247	50 meters (150 feet)	300 meters (1,000 feet)	800 meters (½ mile)
Petroleum sour crude oil, flammable, toxic	131	3494	60 meters (200 feet)	800 meters (½ mile)	800 meters (½ mile)
Benzene, Toulene, Xylene	130	1114, 1294, 1307	50 meters (150 feet)	300 meters (1,000 feet)	800 meters (½ mile)
Hydrogen Sulfide Gas	117	1053	100 meters (330 feet)	300 meters (1,000 feet)	1,600 meters (1 mile)

* Flash Fire and Vapor Cloud Explosion should be considered potential hazards in structurally condensed areas (heavy urban areas) especially under low wind, stable weather conditions. Pool Fires should be considered potential hazards in structurally condensed areas (heavy urban areas) especially if wind speed is high and ignition is delayed (product has pooled significantly). These hazards may result in a travelling flame front, damaging overpressure or exposure to thermal radiation, therefore responders should use the distances identified for "Evacuation in the Event of a Fire" even if no fire is present. In a full bore rupture where there is a risk of Flash Fire or Vapor Cloud Explosion, these distances should be doubled.

** Additional conditions that should be considered when determining an evacuation zone include weather, full bore rupture, wind speed, overcast/clear sky and day/night

*** These substances may also present a Toxic Inhalation Hazard (TIH) and night time distances will defer from above.

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2.3.3 Setting Up On-Site Work Areas

The IC or designate will assess the accessibility of the site and will separate the site into three distinct areas to clearly identify the high risk areas and to reduce the hazards to the on-site responders. The three areas could be defined as the safe area, the hazardous area and the decontamination (or "Decon") area.

Protective Zones
To minimize spreading contamination from an emergency site to unaffected areas, the Safety Officer must record protective zones (see Figure 1) on the ICS 201-5 Site Safety and Control Form. Protective zones should identify:

- Hot Zone
- Warm Zone
- Cold Zone.

Hot Zone
The hot zone is the release site or site of clean-up operations. Any area that requires respiratory protection must be within the boundary of a designated hot zone. Access to the hot zone is restricted to trained and properly equipped emergency response personnel only. Personnel not involved in emergency operations must be prevented from entering and escorted off the site if necessary.

Warm Zone
The warm zone is a transition zone where equipment may be cleaned, and contaminated clothing removed, before leaving the site. Follow the established Decon plan. Appropriate PPE is required.

Cold Zone
The cold zone is the largest zone and includes all areas not immediately involved in the emergency. Take all possible efforts to ensure contamination does not spread to this area.
Air monitoring delineates the perimeter where air contaminants and combustible vapors cease to be detected. The cold zone must be established outside of this perimeter. Locate the Command Post and staging area (pre-deployment staging area for equipment arriving on site) in the cold zone. For large incidents, ensure that the Command Post is not positioned near the incident.

2.3.4 Evacuation

2.3.4.1 Personnel Evacuation

Evacuation plans will be located in the applicable facility. All evacuation directives will be communicated through an audible signal, either through voice by the Designated Individual, such as PLM supervisor, Emergency Warden, Area Supervisor, Area Manager or Area Coordinator, or by the activation of an alarm system. All facility personnel are trained routinely in evacuation and emergency response procedures. The facility contains no critical

equipment that requires employees to continue to operate after the evacuation notification is made.
The purpose of the evacuation plan is to provide some guidance in the event shutdown and evacuation are necessary. In the event of an incident, the facility operator will stop the flow of product by normal operating procedures. The facility supervisor/manager shall be notified immediately of the emergency. All facility personnel should evacuate with the exception of any individuals designated to remain on site. The Fire Department will be notified if there is a fire. Arriving personnel, equipment and fire resources will be met at the main gate or muster point of the facility, unless deemed unsafe to do so. Tactical deployment of arriving resources will depend on the current situation.

Evacuating personnel shall proceed in an orderly manner. The Supervisor/Manager or Designated Individual will account for all employees and arrange for medical assistance as required. When the alarm is sounded or a signal to evacuate is given all personnel should:

Evacuation Checklist	
✓	Immediately stop work activities.
✓	Check the wind direction
✓	Move upwind or cross wind
✓	Check the wind again
✓	Conduct a head count to account for all personnel known to be at the facility
✓	Assist in alerting and escorting personnel, including visitors and contractors to the appropriate muster point
✓	Notify the Control Center
✓	Assist in hazard control activities as requested
✓	Assist in search and rescue of missing persons
✓	Injured personnel will be transported to the nearest emergency medical facility. All other personnel will remain at the evacuation point until the "All Clear" signal is given.
Note: Evacuation should be carried out in an orderly manner. Personnel should walk, NOT run or panic.	

Personnel evacuation direction is further defined as follows:

- **Facility Employees** - All Company employees who are not directly involved with the abatement of the emergency will immediately evacuate the area of the emergency. They will proceed via an unthreatened route to the facility main gate and remain in a "stand by" mode until instructed by the Facility Management to do otherwise. Should access to the facility main gate be threatened by the emergency, proceed to a location on the facility unthreatened by the emergency and notify the Emergency Warden and/or Area Supervisor/Manager and/or Designated Individual of your whereabouts as soon as practical.

- **Contractors, Freight Haulers, Vendors and Other Visitors** - All non-Company personnel will immediately evacuate the area when notified of an emergency. All material loading or unloading will cease. Personnel will proceed to the facility main gate via an unthreatened route. Non-Company personnel will exit immediately upon approval of the Facility Management. Should access to the facility main gate be threatened by the emergency, proceed to a location on the facility unthreatened by the emergency and notify the Emergency Warden and/or Area Supervisor/Manager and/or Designated Individual of your whereabouts as soon as practical. After personnel evacuation is initiated, emergency response agencies and teams will be notified (either from on-site or off-site immediately after the evacuation was completed), and immediate response actions will be initiated to minimize threats to human health and the environment.

2.3.4.2 Community Evacuation

Evacuation of the public should only proceed when it is safe to do so and ONLY in cooperation and coordination with Local Emergency Services. As identified under community emergency response plans, the responsibility and decision to evacuate is a community responsibility. The Company will support the evacuation and cover the cost of the response.

It is important to remember that evacuations beyond Company property will have to be initiated and coordinated with local emergency response/management organizations which have the legislative authority to order the movement of persons. State, Provincial, Territorial, First Nation and local authorities have primary responsibility and authority for evacuation planning and for the transportation, sheltering, public safety, and security of persons and non-Federal property within their respective jurisdictions. The unique challenges that might confront State, Provincial, Territorial, First Nation and local governments during a mass evacuation could require them to request additional assistance, of either a logistical or operational nature, from within their province, from other provinces pursuant to mutual aid and assistance compacts, or from the Federal government.

The Company:

- Should ensure that local emergency response/management organizations are provided with a clear recommendation to evacuate the public should the Company become aware of an immediate threat to life and safety that may not be under action by first responders.
- Will serve only in an advisory capacity during an evacuation order and may assist with the logistics of an evacuation.
- Must provide as much product information as possible to any emergency management organization coordinating an evacuation. The latest version of the Emergency Response Guidebook (“ERG”) should be consulted in order to determine safe evacuation distances.

The priority for all Company personnel in any emergency is protecting the public and responders.

Prevent public access to the emergency site while there is any danger of explosion, fire, hazardous vapors or other hazardous conditions. For example:

- Seal off routes into the emergency site and establish a security perimeter
- Contact local police to set up road blocks at all access points, as applicable
- Employees/contractors, police and/or security personnel can be used, as well as physical barriers (e.g., barricades, reflective tape) to control access to hazardous areas.

Coordinate with external emergency response agencies (e.g., police, fire and EMS departments) to establish appropriate response measures for public protection as required, including:

- Monitoring for hazardous atmospheres;
- Evacuating people from the area (homes and businesses);
- Eliminating ignition sources near a release site;
- Preventing ignition sources from entering a release site; and
- Stopping traffic (e.g., on roads, rail lines, bridges), as required.

In the unlikely event that evacuation plans were required beyond the boundary of the facility, the designated individual would communicate further directives. These plans will include guidance of where to move potentially affected parties to minimize threats to human health and the environment. This will be accomplished in conjunction with local emergency response officials. The notification mechanisms will be based on monitored air quality and other situations that might arise during the emergency.

Evacuation is recommended for incidents in which the plume is visible and egress can occur in any direction away from the plume. A recommendation to evacuate should be made by a Qualified Individual/Incident Commander with access to LEL monitors and or air quality monitoring.

Under the direction of the IMT, community evacuation will be coordinated with the local authority. The recommendation to evacuate would be the decision of the IC. Refer to the ERG for product/evacuation guidance.

If the public must be evacuated before external response agencies arrive or if these agencies are not available, the IC must take all steps necessary to ensure public protection (e.g., assigning Company employees to begin a door to door evacuation), then turn over these duties to community agencies as soon as possible.

For long-term releases, evacuation is preferred to sheltering if public safety can be assured during the evacuation process. Evacuation is a viable public protection measure in circumstances when:

- The location of the plume is known and safe egress routes can be assured.
- The release will not likely be contained in the near future.
- Visibility and road conditions are good.
- The residents clearly understand their directions.

Residents should also be evacuated during ongoing emergency flaring or burning if their health and safety could be affected by the operation.
In planning an evacuation, the following must be considered:

- The size and expected duration of the release;
- Egress routes;
- Current and expected meteorological conditions; and
- The potential for unexpected ignition.

Sheltering is the primary public protection measure for high vapor pressure products and when the hazard is of limited duration. Sheltering within a building creates an indoor buffer to protect affected individuals from higher (more toxic) concentrations that may exist outdoors. The goal is to reduce the movement of air into and out of the building until either the hazard has passed or other appropriate emergency actions can be taken (such as evacuation).

Sheltering indoors is a viable public protection measure in circumstances when:

- There is insufficient time or warning to safely evacuate the public.
- Residents are waiting for evacuation assistance.
- The release will be of a limited size and /or duration.
- The location of the release has not been identified.
- The public would be at a higher risk if evacuated.

In conjunction with shelter-in-place and evacuation strategies, a natural gas release may be ignited at the source in order to reduce public exposure to the hazard. If an immediate threat to human life exists and there is not sufficient time to evacuate the hazard area the IC is authorized to ignite the release.

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2.4 Operations

2.4.1 Enbridge's Response Management System

2.4.1.1 Cross Border Response

For a larger scale incident, employees may be required to corss the border to support relieve Incident Management Team members, contact HR.mobility@enbridge.com prior to traveling across the border.

2.4.1.2 Incident Command Structure

The ICS enables a well-managed response and limits the effects of an emergency through the rapid, effective, coordinated response of resources. ICS is the standard international practice for emergency management, and clarifies the roles of personnel involved in emergency response. ICS is effective for emergency response because essential information and resources are organized into a logical structure for planning and implementing the required actions. It also provides a flexible preplanned emergency response organizational structure for any type or size of incident. The structure of the ICS required depends on the nature and complexity of the emergency, and is based on need, rather than rigid organizational structure. For Level 1 emergencies, one position may assume many responsibilities, whereas in higher-level emergencies (Levels 2 and 3), several positions may be required. The IMT would be mobilized, as appropriate, to fill ICS roles. The FRT functions under the Operations section in the ICS.

The FRT consists of trained personnel that will respond to all Company emergency incidents. Trained and qualified third-party contractors will be called on to fill the Incident Command System/Unified Command (ICS/UC) roles as required, including but not limited to positions in the Operations, Planning and Logistics sections. Note as well, that if requested by the local governing emergency management agency, Enbridge may provide a technical specialist to a community's Emergency Operations Center.

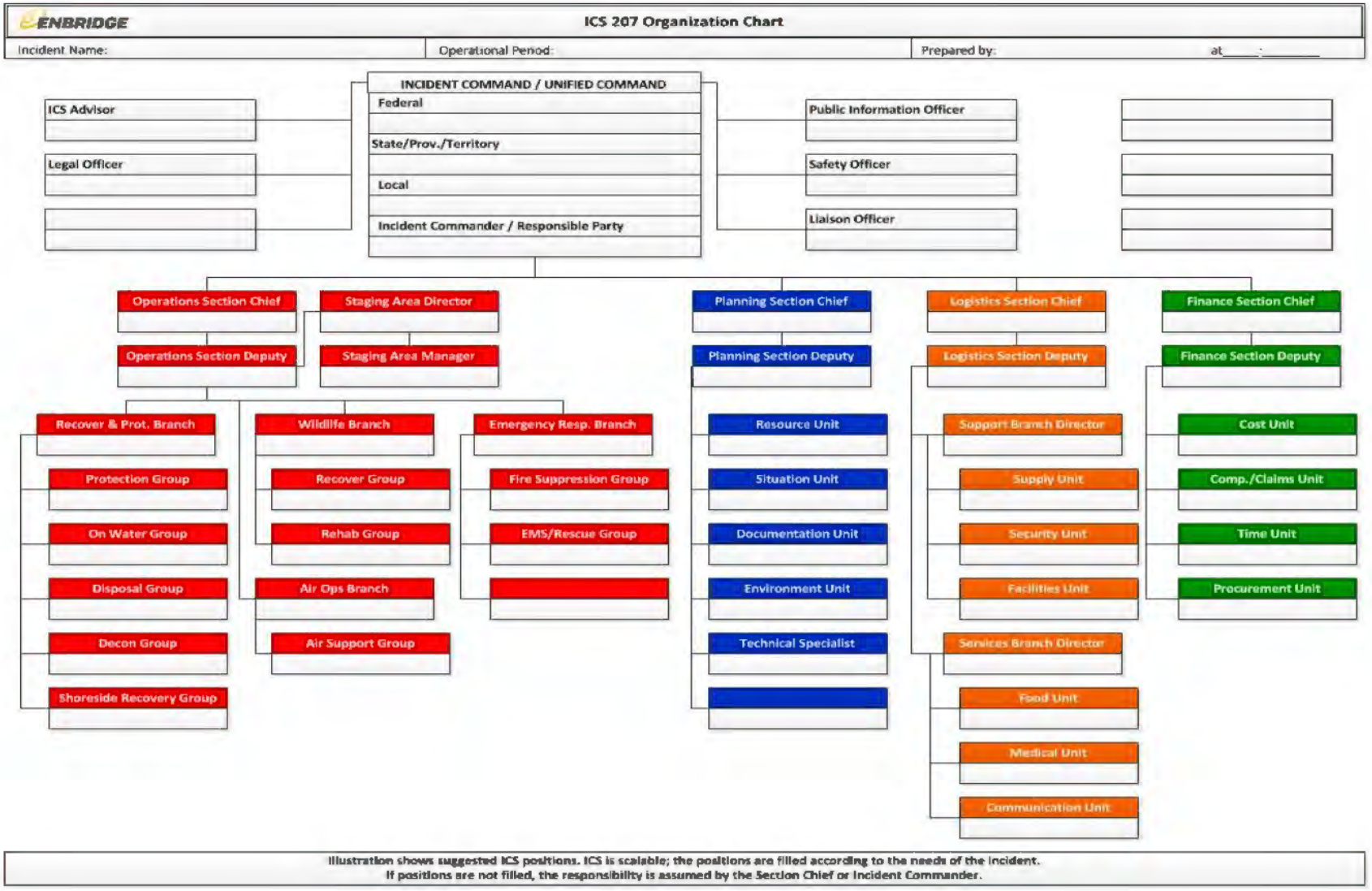
Key responsibilities for the FRT are aligned with the ICS organizational structure (Refer to ICS 207 Organization Chart).

Assignment of responsibilities in the ICS starts with the top position (i.e., IC) and works down, as required. The IC and SOFR roles must be filled at all times during the emergency. The IC would mobilize positions directly beneath, as required. When a position is not mobilized, the position directly above would assume the responsibilities. ICS when activated requires as a minimum an IC and Safety Officer positions.

Determine the level of emergency and tier of response required to effectively manage the response. Refer to the Company Emergency Classification and Tiered Response Chart located in *Section 2.2 Notification Procedures*.

ICS Is Scalable And Will Be Activated To Meet The Needs Of An Emergency	
Level 1	ICS is activated, IMT staffed as required, at minimum I/C and Safety Officer will be staffed
Level 2	ICS is activated; IMT to manage reactive and proactive phases. Command and general staff will be required with the potential to fill additional positions. CMT will be notified based on significant incident criteria
Level 3	Full IMT will be activated, CMT is notified.

2.4.1.3 ICS 207 Organization Chart



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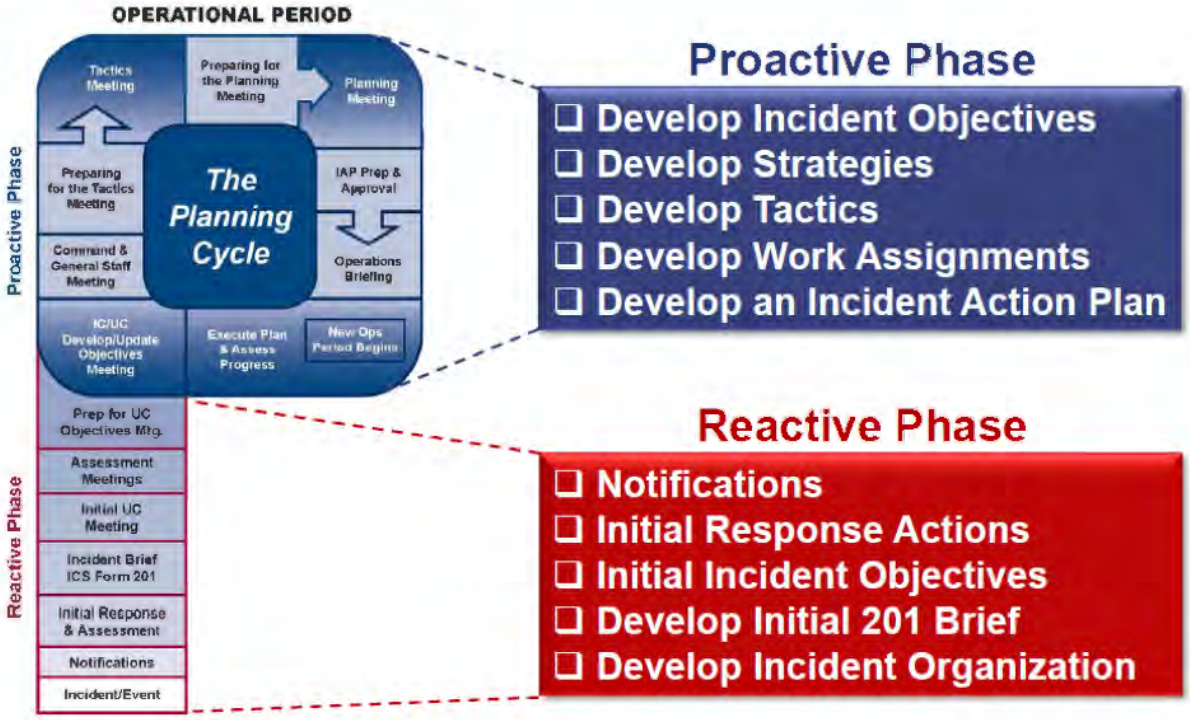
2.4.1.4 Operational Period Planning Cycle

In more complex Level 2 or 3 emergencies, planning for the next operational period will take place in the proactive phase. The move from reactive to proactive will be situation specific and depends on the incident, skill set and staff available. Once the scale and scope of the event has been determined (a situational assessment is complete and a common operating picture has been established), the IC should discuss with the IMT and determine when a move into the proactive phase would be appropriate. A detailed IAP will be put together and the following meetings will be conducted to ensure all personnel are briefed on the objectives and have the appropriate work plan in hand.



2.4.1.5 ICS Roles and Responsibilities

The roles and responsibilities under the Incident Command System are identified on the following pages by ICS section.

INCIDENT COMMAND / UNIFIED COMMAND

FEDERAL

STATE / PROVINCIAL

INCIDENT COMMANDER / RESPONSIBLE PARTY

Overall Management of the incident

ICS ADVISOR

Responsible for providing continuity and consistency throughout the response organization

INCIDENT SUPPORT TEAM LIASION

Responsible for updating the Incident Support Team

DEPUTY INCIDENT COMMANDER

Special projects and replacement

PUBLIC INFORMATION OFFICER

Develops and releases information about the incident to the news media, incident personnel and other appropriate agencies and organizations

LIAISON OFFICER

Contact for all responding resources and outside agencies

SAFETY OFFICER

Develops and recommends measures for assuring personnel safety and assess and/or anticipates hazardous and unsafe situations

LEGAL OFFICER

Legal advice

Command Staff Roles 2.4.1.5a

Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit including medication, computer and climate specific work wear.
- ❑ Inform your people leader as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH) and role specific requirements.
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations: Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Abide by and champion Enbridge Values and Code Conduct.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions, own it then report it to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure any equipment you require is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Wear the appropriate vest and role identification where possible
- ❑ Understand and enforce safe working hours and lead by example
- ❑ Consider Human Factors in decision making
- ❑ Exercise emergency authority to stop and prevent unsafe acts.
- ❑ Maintain Individual/Activity Log (ICS 214a).

Incident Commander

The IC's responsibility is the overall management of the incident. On most incidents, the command activity is carried out by a single IC. The IC is selected by qualifications and experience. Deputies may also be used at the section and branch levels of the ICS/UC organization. Deputies should have the same qualifications as the person for whom they work, as they must be ready to take over that position at any time. When span of control becomes an issue for the IC, a Deputy IC/Chief of Staff may be assigned to manage the Command Staff.

Incident Commander and Qualified Individual Checklist

- ❑ Serve as initial point of contact for response personnel in initial response.
- ❑ Assess incident situation, declare emergency level, and activate ICS system.
- ❑ Ensure regulatory notifications have been completed.
- ❑ Establish appropriate communications with external agencies.
- ❑ Oversee initial and ongoing response actions.
- ❑ Notify and activate local resources/contractors/ response organizations as required.
- ❑ Obtain a briefing from the prior IC (201 Briefing).
- ❑ Determine incident objectives & general direction for managing the incident.
- ❑ Establish the immediate priorities.
- ❑ Establish a command post (if applicable).
- ❑ Brief Command Staff and General Staff and ensure routine updates occur
- ❑ Ensure planning meetings are scheduled as required.
- ❑ Approve and authorize the implementation of an IAP.
- ❑ Ensure that adequate safety measures are in place.
- ❑ Coordinate activity for all Command Staff and General Staff.
- ❑ Coordinate with key people and officials.
- ❑ Approve requests for additional resources or for the release of resources above approved threshold.
- ❑ Keep internal and external stakeholders informed.
- ❑ Evaluate/Approve the use of trainees and auxiliary personnel. Other response personnel, such as volunteers and casual workers, will not be used unless there is a prevalent need, at that time.
- ❑ Authorize release of information to the news media.
- ❑ Ensure ICS 209 is completed and forwarded to appropriate higher authority.
- ❑ Analyze incident potential against environment, organizational impact and safety consequences.
- ❑ Consider need for extended (24-hour) coverage.
- ❑ Once a situation improves, the decision to downgrade the level is made by the Incident Commander and the applicable regulating agencies. All the affected persons and the media must be kept informed of the status of the emergency.
- ❑ Order the demobilization of the incident when appropriate.
- ❑ Ensure the ICS structure is being followed and address any discrepancies between line leadership and ICS leadership
- ❑ Motivate staff and celebrate milestones, progress and achievements
- ❑ Lead by example, be calm, listen well and communicate clearly, your attitude will affect others.

Deputy Incident Commander

The Deputy Incident Commander may assume responsibility for a specific portion of the primary position, work as relief, or be assigned other tasks. The Deputy should always be as qualified to make decisions and manage the incident as the Incident Commander.

Deputy Incident Commander Checklist

- ❑ If no assistant has been assigned to the Incident Commander, support the Incident Commander by documenting details of the emergency, focusing on activities and decisions made.
- ❑ Manage the flow of traffic to and communication with the Incident Commander so that the Incident Commander can focus on managing the incident.
- ❑ Conduct status update meetings.
- ❑ See Incident Support Team Liaison
- ❑ Deal with some day to day decision making.
- ❑ Assume duties of the Incident Commander, if required.

Public Information Officer

The PIO is responsible for developing and releasing information about the incident to the news media, to incident personnel, and to other appropriate agencies and organizations. Only one primary PIO will be assigned for each incident, including incidents operating under a Unified Command and multiple jurisdiction incidents. The PIO may also have assistants as necessary, and the assistants may also represent assisting agencies or jurisdictions. Agencies have different policies and procedures relative to the handling of public information.

Public Information Officer Checklist

- ❑ Review common responsibilities.
- ❑ Assist the UC/IC with maintaining a positive public perception of effective response activities
- ❑ Engage public and media via social media
- ❑ Breif the IC/UC regularly on media and public issues
- ❑ Review public messaging material developed by the Joint Information Center prior to distribution
- ❑ Determine from the ICS/UC if there are any limits on information release.
- ❑ Develop material for use in media briefings.
- ❑ Obtain IC/UC approval of media releases (after legal reviews it if possible)
- ❑ Inform media and conduct media briefings.
- ❑ Arrange for tours and other interviews or briefings that may be required.
- ❑ Manage a Joint Information Center if established.
- ❑ Obtain media information that may be useful to incident planning.
- ❑ Review current information summaries and/or displays on the incident and provide information on the status of the incident to assigned personnel.

For all media and public inquiries; the following will be recorded:

- ❑ Date and time of the inquiry;
- ❑ Name, employer and city of the media reporter;
- ❑ Questions and answers provided; and
- ❑ Time and station of any media broadcasts.

Liaison Officer

Incidents that are multi-jurisdictional, or have several governmental agencies involved, may require the establishment of the LNO position on the Command Staff. Only one primary LNO will be assigned for each incident, including incidents operating under UCS and multi-jurisdiction incidents. The LNO may have assistants as necessary, and the assistants may also represent other agencies or jurisdictions.

Liaison Officer Checklist

- ❑ Be a contact point for agency representatives; ensure updates are provided in a timely manner.
- ❑ Maintain a list of assisting and supporting agencies, including name and contact information. Monitor check-in sheets daily to ensure that all agency representatives are identified.
- ❑ Assist in establishing and coordinating interagency contacts.
- ❑ Keep agencies supporting the incident aware of incident status (to include Historical/Archeological and Aboriginal Contacts).
- ❑ Monitor incident operations to identify current or potential inter-organizational problems.
- ❑ Participate in planning meetings, providing current resource status, including limitations and capability of assisting agency resources. Create advisory groups as necessary.
- ❑ Coordinate response needs for cooperating agencies activities with the OSC during responses.
- ❑ Coordinate response resource needs for incident investigation activities with the OSC.
- ❑ Ensure that all required agency forms, reports and documents are completed prior to demobilization.
- ❑ Brief IC/UC on agency issues and concerns.
- ❑ Coordinate activities of visiting dignitaries.

Ensure the following information is documented

- ❑ Authority limits (e.g., financial, contractual, supervisory, media/public relations, etc.);
- ❑ Work delegation agreements;
- ❑ Government approvals;
- ❑ Follow-up requirements/responsibilities;
- ❑ Landowners/stakeholders' permission to enter land from landowner/government;
- ❑ Agreement on dealings with sensitive areas;
- ❑ Consensus on alternative requirements regarding items (accommodations, water, livestock relocation, etc.);
- ❑ Work with finance on any initial cost/inconvenience agreement.
- ❑ Agreements for use of cooperative equipment.

Incident Support Team

- ❑ Collect and report situational updates to Incident Support Team where applicable
- ❑ Communicate requests, constraints, and opportunities between the Incident Commander and Incident Support Team

Safety Officer

The SOFR function is to develop and recommend measures for assuring personnel safety and to assess and/or anticipate hazardous and unsafe situations. Only one primary SOFR will be assigned for each incident. The SOFR may have specialists, as necessary, and the assistants may also represent assisting agencies or jurisdictions. Safety assistants may have specific responsibilities, such as air operations, hazardous materials, etc.

Safety Officer Checklist

- ❑ Identify hazardous situations associated with the incident associated with the location, weather and operations.
- ❑ Complete the initial IAP site safety and control analysis (ICS 201-5).
- ❑ Participate in tactics and planning meetings, and other meetings and briefings as required.
- ❑ Review the IAP for safety implications.
- ❑ Provide safety advice in the IAP for assigned responders.
- ❑ Exercise emergency authority to stop and prevent unsafe acts.
- ❑ Investigate accidents that have occurred within the incident area.
- ❑ Assign assistants, as needed.
- ❑ Review and approve the medical plan (ICS 206).
- ❑ Develop the site safety plan and publish site safety plan summary (ICS 208) as required.
- ❑ Coordinate with governmental safety agencies to ensure compliance with approved safety practices.
- ❑ Assign daily safety meetings at command post and work sites.

Ensure the following safety information specific to the release is recorded

- ❑ ICS Safety Officer (including relief activities, timing, etc.);
- ❑ Safety meetings (e.g., date, time, location, topics, attendees, action items);
- ❑ Hazard assessments, permits, inspections, and job observations;
- ❑ Identification and resolution of safety concerns;
- ❑ Identification of hazards and mitigation measures;
- ❑ Incidents/near misses/observations;
- ❑ Safety equipment and resources;
- ❑ Other emergency equipment (e.g., fire, medical, etc.);
- ❑ Records of atmospheric monitoring related to occupational hygiene.
- ❑ Copies of SDS;
- ❑ Records of conversations with safety regulators;
- ❑ Initial emergency site air testing results; and
- ❑ Air monitoring results for ongoing work at an emergency site.
- ❑ Develop some specific orientation to highlight unique incident hazards.
- ❑ Develop daily safety message as a focus for all meetings (ICS 223).

ICS Advisor

ICS Advisor is Responsible for providing continuity and consistency throughout the response organization, the ICS Advisor provides ICS expertise to the Incident Commander and the response team.

- ❑ Assist with the establishment of an appropriate ICS structure.
- ❑ Provide ICS expertize to the ICS and Incident Management Team
- ❑ Attend all planning meetings to ensure meeting continuity
- ❑ Be available to attend press briefing and clarify technical issues

Intelligence Security

The Intelligence Officer provides the Incident Commander with a conduit to intelligence information that can have a direct impact on the safety of response personnel and influence tactical decisions. The Intelligence Officer also ensures that sensitive information is handled in accordance with the prescribed safeguards

- ❑ Collect and analyze incoming intelligence information from all sources.
- ❑ Determine the applicability, significance, and reliability of incoming intelligence information.
- ❑ As requested, provide intelligence briefings to the ICS/UC.
- ❑ Provide intelligence briefings in support of the ICS Planning Cycle.
- ❑ Provide Situation Unit with periodic updates of intelligence issues that may impact operations.
- ❑ Answer intelligence questions and advise Command Staff and General Staff as appropriate.
- ❑ Supervise, coordinate, and participate in the collection, analysis, processing, and dissemination of intelligence.
- ❑ Assist in establishing and maintaining systematic, cross-referenced intelligence records and files.
- ❑ Establish liaison with all participating law enforcement agencies.
- ❑ Conduct first order analysis on all incoming intelligence and fuse all applicable incoming intelligence with current intelligence holdings in preparation for briefings.
- ❑ Prepare all required intelligence reports and plans.
- ❑ As the incident dictates, determine need to implant Intelligence Specialists in the Planning and Operations Sections.
- ❑ Liaise with LP Corporate Security

Legal Officer

Legal Officer Checklist

- ❑ Review common responsibilities.
- ❑ Obtain briefing from the IC.
- ❑ Advise the IC/UC, as appropriate, on all legal issues associated with response operations.
- ❑ Establish documentation guidelines for and provide advice regarding response activity documentation to all incident personnel.
- ❑ Provide legal input to the Documentation Unit, the Compensation/Claims Unit, and other appropriate units as requested.
- ❑ Review press releases, documentation, contracts and other matters that may have legal implications for the Company.
- ❑ Participate in ICS meetings and other meetings, as requested.
- ❑ Participate in incident investigations and the assessment of damages (including natural resource damage assessments).
- ❑ Liaise with Risk & Insurance

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Operations Section Roles 2.4.1.5b

OPERATIONS SECTION CHIEF
Manages operations directly applicable to the primary objectives

OPERATIONS SECTION DEPUTY OR ON-SCENE COMMANDER
Support Operations Section Chief

STAGING AREA DIRECTOR
Supervises staging area managers and coordinates their activities

STAGING AREA MANAGER
Receives, maintains, checks-in/out, stores and distributes resources

RECOVERY & PROTECTION BRANCH DIRECTOR
Oversee & implement containment & cleanup

- **PROTECTION GROUP** — *Deploy containment*
- **ON WATER GROUP** — *Manage water recovery*
- **DISPOSAL GROUP** — *Coordinate on-site activities*
- **DECON GROUP** — *Decontamination*
- **SHORESIDE RECOVERY GROUP** — *Shoreside cleanup*

WILDLIFE BRANCH DIRECTOR
Minimize wildlife injuries

- **WILDLIFE RECOVERY GROUP** — *Search & tag wildlife*
- **WILDLIFE REHAB GROUP** — *Oversight facility ops*

AIR OPS BRANCH DIRECTOR
Logistical support to aircraft

AIR SUPPORT GROUP
Coordinate support to aircraft

EMERGENCY RESPONSE BRANCH DIRECTOR
Implement emergency measures

- **PUBLIC SAFETY LEADER** — *Coordinate public protection*
- **FIRE SUPPRESSION GROUP** — *Suppression & resources*
- **EMS/RESCUE GROUP** — *Coordinate response*
- **LAW ENFORCEMENT GROUP** — *Directing law enforcement activities and manage public protection action*

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Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual/Activity Log (ICS 214a).

Operations Section Chief

The OSC, a member of the General Staff, is responsible for the management of all operations directly applicable to the primary mission. Assignment as the OSC will be based on qualifications and experience. If a response is federalized or has federal participation, the OSC will normally be selected from the agency with the most jurisdictional responsibility for the incident and will work in the ICP.

The OSC activates and supervises organization elements in accordance with the IAP and directs its execution. The OSC also directs the preparation of Unit operational plans, requests or releases resources, makes expedient changes to the IAP, as necessary, and reports such to the IC.

Based on the needs of the incident, the Operations Section Chief may establish an:

On-Scene Commander

- ❑ Coordinates and directs on-scene operational activities under the direction of the OSC or Deputy On-Scene Commander (DOSC).

Or Branch Director(s)

- ❑ Responsible for the implementation of the portion of the IAP appropriate to the branches.

Operations Section Chief Checklist

- ❑ Review common responsibilities.
- ❑ Obtain briefing from IC/UCS.
- ❑ Request sufficient section staffing for both operations & planning activities.
- ❑ Convert operational incident objectives into strategic and tactical options through a work analysis matrix.
- ❑ Coordinate and consult with the Planning Section Chief (PSC), SOFR, technical specialists, modeling scenarios, trajectories on selection of appropriate strategies and tactics to accomplish objectives.
- ❑ Identify kind and number of resources required to support selected strategies.
- ❑ Subdivide work areas into manageable units.
- ❑ Develop work assignments and allocate tactical resources based on strategy requirements.
- ❑ Coordinate planned activities with the SOFR to ensure compliance with safety practices.
- ❑ Prepare ICS 234 Work Analysis Matrix with PSC to ensure Strategies, Tactics and tasks are in line with ICS 202 Response Objectives to develop ICS 215.
- ❑ Participate in the planning process and the development of the tactical portions (ICS 204 and ICS 220) of the IAP.
- ❑ Assist with development of long-range strategic, contingency, and demobilization plans.
- ❑ Supervise operations section personnel.
- ❑ Monitor need for and request additional resources to support operations as necessary.
- ❑ Evaluate and monitor current situation for use in next operational period planning.
- ❑ Utilize valve schematics and control point maps, digital copies can be accessed by typing the URL into the browser http://myteamsites.cnpl.enbridge.com/sites/EmergencySM/maps/default.aspx
- ❑ Interact and coordinate with Command staff on achievements, issues, problems, significant changes special activities, events, and occurrences.
- ❑ Troubleshoot operational problems with other IMT members.
- ❑ Implement the IAP.
- ❑ Supervise and adjust operations organization and tactics as necessary.
- ❑ Participate in operational briefings to IMT members as well as briefings to media, and visiting dignitaries.
- ❑ Assemble/dissemble task force/strike teams as appropriate.
- ❑ Identify/utilize staging areas.
- ❑ Develop recommended list of Section resources to be demobilized and initiate recommendation for release when appropriate.
- ❑ Receive and implement applicable portions of the Incident Demobilization Plan.

Operations Section Deputy

The Operations Section Deputy is as fully qualified as an OSC. The roles of the DOSC are flexible. Specifically, the DOSC may support the OSC in a relief capacity;

- ❑ To oversee operations in the ICP while OSC participates in the incident planning process; or
- ❑ To supervise field operations in lieu of an On-Scene Commander. The DOSC may be selected from other organizations / agencies / jurisdictions in a multi- agency/multi-jurisdictional incident.
- ❑ Refer to Operations Section Chief duties.

On-Scene Commander

Coordinates and directs on-scene operational activities under direction of the Operations Section Chief or Deputy as necessary and provided a Deputy OSC is not assigned to that task. The On-Scene Commander may also be assigned to supervise Operations Branch Directors in the field and is responsible for providing input into the IAP development as well as implementation of the IAP for all field tactical operations.

- ❑ Review common responsibilities.
- ❑ Ensure response activities are implemented in accordance with the IAP.
- ❑ Ensure all response personnel are aware of and follow guidelines set forth in the Site Safety Plan (ICS 208)
- ❑ Report all injuries to the Safety Officer.
- ❑ Coordinate site access control with the Security Officer.
- ❑ Review Division/Group Assignment Lists (ICS Form 204) and modify based on effectiveness of current operations.
- ❑ Direct or coordinate tactical field activities either directly or through supervision of Operations Branch Directors, Division/Group Supervisor, or Task Force/Strike Team Leaders.
- ❑ Request maps and charts of impacted areas as required to support field operations.
- ❑ Assign specific work tasks to Division /Group Supervisors.
- ❑ Resolve logistics problems reported by subordinates
- ❑ Receive Incident Status Summary input from the Division/Group Supervisors and forward to Situation Unit
- ❑ Report to Operations Section Chief when the IAP is to be modified and significant change in status of events.
- ❑ Approve accident and medical reports originating from the field.

Staging Branch Director

The Staging Branch Director is responsible for supervising the Staging Area Managers as well as coordinating their activities including assigning Staging Area Managers and receiving, maintaining, checking –in/out, storing, and distributing resources. The Staging Branch Director is only activated if multiple staging areas are established that require multiple Staging Area Managers. The Director will generally remain in the ICP and supervise the Staging Area Managers from there.

Staging Branch Director Checklist

- ❑ Review Common Respensibilities.
- ❑ Proceed to Command Post.
- ❑ Establish communication with all Staging Area Managers in the field.
- ❑ Establish consistent check-in/out functions at each Staging Area using the ICS 211p (personnel) and 211e (equipment) forms as well as the ICS 210 Change of Status form.
- ❑ Determine any support needs for equipment, feeding, sanitation and security and provide to Staging Area Manager or Logistics Section Chief.
- ❑ Assist Staging Area Managers with maintenance service for equipment at Staging Area as appropriate.
- ❑ Respond to request for resource assignments. (Note: This may be direct from the OSC/DOSC or via the Incident Communications Center.)
- ❑ Determine required resource levels from the OSC/DOSC.
- ❑ Advise the OSC/DOSC when reserve levels reach minimums.
- ❑ Coordinate with Staging Area Managers and Logistics Section regarding staging requirements for ordered and en-route resources.
- ❑ Demobilize Staging Area(s) in accordance with the Incident Demobilization Plan.
- ❑ Debrief with OSC/DOSC or as directed at the end of each shift.

Staging Area Manager

The Staging Area Managers (STAM's) are individually assigned by the Staging Branch Director to a specific staging area and responsible for managing all activities within that area which includes establishing, maintaining, check-in, storage, and distribution of resources at staging. The Managers report to the Staging Branch Directors and are typically utilized when multiple staging areas are established. The Managers should work closely with the Security Manager, Resource Unit, Operations, and Logistics.

Staging Area Manager Checklist

- ❑ Review common responsibilities.
- ❑ Proceed to staging area.
- ❑ Establish staging area layout.
- ❑ Obtain briefing from person you are relieving, if applicable.
- ❑ Determine any support needs for equipment, feeding, sanitation, and security.
- ❑ Establish check-in function as appropriate.
- ❑ Coordinate with Logistics Section Chief regarding equipment requests.
- ❑ Determine required resources levels from the OSC/DOSC.
- ❑ Ensure security of staged resources.
- ❑ Post area for identification and traffic control.
- ❑ Request maintenance service for equipment at staging area as appropriate.
- ❑ Respond to request for resource assignments.
- ❑ Advise the OSC/DOSC when reserve levels reach minimums.
- ❑ Maintain and provide status to Resource Unit of all resources in staging area.
- ❑ Demobilize staging area in accordance with the Demobilization Plan.
- ❑ Debrief with OSC/DOSC or as directed at the end of each shift.

Recovery and Protection Branch

The Recovery and Protection Branch Director (typically activated only for oil spills) is responsible for overseeing and implementing the protection, containment and cleanup activities established in the IAP.

Recovery and Protection Branch

- ❑ Review Branch Director Responsibilities.
- ❑ Identify Divisions, Groups, and resources assigned to the Branch.
- ❑ Obtain briefing from OSC/DOSC/On-scene Commander and person you are relieving.
- ❑ Implement IAP for Branch by assigning specific work tasks.
- ❑ Develop with subordinates alternatives for Branch control operations.
- ❑ Review Division/Group Assignment Lists (ICS 204) for Divisions/Groups within the Branch. Modify lists based on effectiveness of current operations.
- ❑ Attend planning meetings at request of the OSC/DOSC/On-scene Commander.
- ❑ Ensure through chain of command that Resources Unit is advised of changes in the status of resources assigned to the Branch.
- ❑ Report to OSC/DOSC/On-scene Commander when: the IAP is to be modified; additional resources are needed; surplus resources are available; or hazardous situations or significant events occur.
- ❑ Approve accident and medical reports originating within the Branch.
- ❑ Consider demobilization well in advance.
- ❑ Debrief with OSC/DOSC and/or as directed at the end of each shift.

Protection Group

The Protection Group Supervisor is responsible for the deployment of containment, diversion, and adsorbent/absorbent materials in designated locations in compliance with the IAP. Depending on the size of the incident, the Protection Group may be further divided into Teams, Task Forces and Resources.

Protection Group Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Implement Protection Strategies in the IAP.
- ❑ Direct, coordinate, and assess the effectiveness of protective actions.
- ❑ Modify protective actions, as needed.
- ❑ Maintain Individual Log (ICS 214a).

On Water Group

The On Water Recovery Group Supervisor is responsible for managing on water recovery operations in compliance with the IAP. The Group may be further divided into Teams, Task Forces and Single Resources.

On Water Group Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Implement Recovery Strategies in the IAP
- ❑ Direct, coordinate, and assess the effectiveness of on water recovery actions.
- ❑ Modify recovery actions as needed

Disposal Group

The Disposal Group Supervisor is responsible for coordinating the on-site activities of personnel engaged in collecting, storing, transporting, and disposing of waste materials in compliance with the IAP.

Disposal Group Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Implement the Disposal Portion of the IAP.
- ❑ Ensure compliance with all hazardous waste laws and regulations.
- ❑ Maintain accurate record of recovered materials.
- ❑ Maintain Individual Log (ICS 214a)

Shoreside Recovery Group

The Shoreside Recovery Group Supervisor is responsible for managing shoreside cleanup operations in compliance with the IAP.

Shoreside Recovery Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Implement Recovery Strategies in the IAP.
- ❑ Direct, coordinate, and assess the effectiveness of shoreside recovery actions.
- ❑ Modify recovery actions as needed.

Decon Group

The Decontamination Group Supervisor is responsible for the operations of the decontamination element and for providing decontamination, as required by the CP.

Decon Group Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Implement Decontamination Plan.
- ❑ Determine resource needs to implement Decontamination Plan and requisition through Logistics using ICS 213 Resource Request.
- ❑ Establish the Contamination Reduction Corridor(s).
- ❑ Identify contaminated people and equipment.
- ❑ Supervise the operations of the decontamination element in the process of decontaminating people and equipment.
- ❑ Direct and coordinate decontamination activities.
- ❑ Maintain control of movement of people and equipment within the Contamination Reduction Zone.
- ❑ Brief Site Safety Officer on conditions.
- ❑ Maintain communications and coordinate operations with the Entry Leader.
- ❑ Maintain communications and coordinate operations with the Site Access Control Leader and the Safe Refuge Area Manager (if activated).
- ❑ Coordinate the transfer of contaminated patients requiring medical attention (after decontamination) to the Medical Group.
- ❑ Coordinate handling, storage, and transfer of contaminants within the Contamination Reduction Zone.

Operations Section Roles 2.4.1.5b

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Operations Section Roles Emergency Response 2.4.1.5c

OPERATIONS SECTION CHIEF
Manages operations directly applicable to the primary objectives

OPERATIONS SECTION DEPUTY OR ON-SCENE COMMANDER
Support Operations Section Chief

STAGING AREA DIRECTOR
Supervises staging area managers and coordinates their activities

STAGING AREA MANAGER
Receives, maintains, checks-in/out, stores and distributes resources

RECOVERY & PROTECTION BRANCH DIRECTOR
Oversee & implement containment & cleanup

- **PROTECTION GROUP** — *Deploy containment*
- **ON WATER GROUP** — *Manage water recovery*
- **DISPOSAL GROUP** — *Coordinate on-site activities*
- **DECON GROUP** — *Decontamination*
- **SHORESIDE RECOVERY GROUP** — *Shoreside cleanup*

WILDLIFE BRANCH DIRECTOR
Minimize wildlife injuries

- **WILDLIFE RECOVERY GROUP** — *Search & tag wildlife*
- **WILDLIFE REHAB GROUP** — *Oversight facility ops*

AIR OPS BRANCH DIRECTOR
Logistical support to aircraft

AIR SUPPORT GROUP
Coordinate support to aircraft

EMERGENCY RESPONSE BRANCH DIRECTOR
Implement emergency measures

- **PUBLIC SAFETY LEADER** — *Coordinate public protection*
- **FIRE SUPPRESSION GROUP** — *Suppression & resources*
- **EMS/RESCUE GROUP** — *Coordinate response*
- **LAW ENFORCEMENT GROUP** — *Directing law enforcement activities and manage public protection action*

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Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper dispesition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual Log (ICS 214a).

Emergency Response Branch Director

The Emergency Response Branch Director is primarily responsible for overseeing and implementing emergency measures to protect life, mitigate further damage to the environment, and stabilize the situation. For a USA incident designate a Law Enforcement Group Supervisor and for a Canadian incident designate a Public Safety Leader.

Emergency Response Branch Director Checklist

- ❑ Review Branch Director Responsibilities
- ❑ Develop with subordinates alternatives for Branch control operations.
- ❑ Attend planning meetings at the request of the OSC/ DOSC/On-scene Commander
- ❑ Review Division/Group Assignment Lists (ICS Form 204) for Divisions/Groups the within the Branch. Modify lists based on effectiveness of current operations.
- ❑ Assign specific work tasks to Division/Group Supervisors.
- ❑ Report to OPS when: the IAP is to be modified; additional resources are needed; surplus resources are available; or hazardous situations or significant events occur.
- ❑ Approve accident and medical reports (home agency forms) originating within the Branch.

Fire Suppression

The Fire Suppression Group Supervisor, when activated, is under the direction of the OSC. The Fire Department's initial Operations Section Chief at a maritime fire is often redesignated the Fire Suppression Branch Director under a UC. The Director is responsible for the assigned portion of the IAP that deals with fire suppression activities, assignment of resources within the branch, reporting progress of control activities, and status of resources within the branch in compliance with the IAP.

Fire Suppression Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Prioritize responses to incident-related fires.
- ❑ Determine resource needs.
- ❑ Direct and coordinate firefighting mission.
- ❑ Manage dedicated firefighting resources.
- ❑ Brief Emergency Response Branch Director on activities.

EMS / Rescue Group

Search and Rescue Mission Coordinator

The SMC is typically a government agency representative designated (usually pre-designated) by the SAR Response System for each specific SAR mission and coordinates the overall response to a SAR mission in compliance with the IAP.

- ❑ Gather detailed information relating to the distress situation.
- ❑ Issue an Urgent marine Information Broadcast (UMIB) to inform mariners in the area of the distress situation.
- ❑ Conduct SAR operations in accordance with SAR procedures and Standards.
- ❑ Assign an SAR On-Scene Coordinator (SAR OSC) as appropriate.
- ❑ Use search planning tools to develop search plans that optimally use available resources.
- ❑ Ensure all documentation to the Documentation Unit Leader.

Search and Rescue On-Scene Coordinator

The SAR OSC coordinates the SAR mission on-scene using the resources made available by SMC.

Search and Rescue On-Scene Coordinator

- ❑ Establish and maintain communications with the SMC.
- ❑ Assume operational control and coordination of all SRUs assigned until relieved or mission is completed.
- ❑ Establish and maintain communications with all SRUs using assigned on scene channels.
- ❑ Require all aircraft to make "operations normal" reports to the SAR OSC.
- ❑ Establish a common altimeter setting for all on scene aircraft.
- ❑ Obtain necessary information from arriving SRU's, provide initial briefing and search instructions, and provide advisory air traffic service to aid pilots in maintaining separation from one another.
- ❑ Carry out SAR action plans.
- ❑ Receive and evaluate all sighting reports, and divert SRUs to investigate sightings.
- ❑ Obtain search results from departing SRUs.
- ❑ Submit sequentially numbered situation reports (SITREPs) to the SMC at regular intervals.

Law Enforcement Group (USA)

Under the direction of the Emergency Response Branch Director, the Law Enforcement Group Supervisor is responsible for coordinating and directing all law enforcement activities related to the incident, including but not limited to, isolating the incident, crowd control, traffic control, evacuations, beach closures, and/or perimeter security in compliance with the IAP.

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Determine resource needs.
- ❑ Direct and coordinate law enforcement response.
- ❑ Manage dedicated law enforcement resources.
- ❑ Manage public protection action (e.g., evacuations, beach closures, etc.)
- ❑ Brief Emergency Response Branch Director on activities.

Public Safety Leader

Under the direction of the Emergency Response Branch Director, the Public Safety Leader is responsible for coordinating and directing all public safety actions related to the incident, including but not limited to, isolating the incident, air monitoring, evacuations, and establishing a resident registration center.

In the US, some of these responsibilities would be under the Law Enforcement Group – see "Law Enforcement Group (USA)

- ❑ Confirm communication links with the Emergency Response Branch Director and the Operations Section Chief.
- ❑ In conjunction with the Emergency Response Branch Director, the Operations Section Chief and the Planning Section Chief, develop and implement an Incident Action Plan (IAP)..
- ❑ Assign personnel to assume the following positions as required: Air Monitoring (LEL), Reception Centre Representative, Roadblocks.
- ❑ Dispatch trained air monitoring personnel with the appropriate hand-held LEL monitors to record concentrations at the nearest un-evacuated residences downwind of the incident site.
  - ❑ Mobilize third party mobile air monitoring units.
  - ❑ Maintain communication with the applicable government regulator and environment agency regarding air monitoring needs and activities.
- ❑ Determine the need for and location of Roadblocks to isolate and secure the area.
  - ❑ Ensure all Roadblock personnel are properly trained and have appropriate roadblock kits.
  - ❑ Ensure all Roadblock personnel have the legal authority to restrict access to the area.
- ❑ In conjunction with the Operations Section Chief determine the hazard area; identify the residents, businesses, industrial operators, and / or transients in the area; and determine the initial public protection measures to be taken and determine the need for evacuation / sheltering. This is based on air monitoring (LEL) readings at the nearest downwind residence.
- ❑ Review resident lists, industrial users lists, reception centres, and telephone numbers within the ERP.
- ❑ Assess public impact in conjunction with the local authorities and discuss public protection measures.
- ❑ Prioritize residents and industrial users to establish the order of evacuation. Coordinate evacuation or shelter of residents, industrial users (via Telephoners).
  - ❑ Determine who needs to be notified and what script will be used: Shelter-in-Place or evacuation message.
  - ❑ If residences are evacuated, a reception centre must be established and it must be located in a safe area away from the hazard.
  - ❑ Determine and notify landowner / occupant(s) as soon as possible.
- ❑ Establish in coordination with Logistics the alternate drinking water sources for the public where required
- ❑ Determine the need for helicopters to identify human activity in the area.
- ❑ Regularly update the Emergency Response Branch Director and the Operations Section Chief .
  - ❑ Confirm communication links with: Air Monitors, Reception Centre, Roadblocks, and Telephoners. Personnel should check in at scheduled intervals.
  - ❑ Review and confirm evacuation of residents, area industrial users, transients, etc. from the area.
- ❑ If required, request that a Notice to Airmen (NOTAM) is issued to restrict the airspace abeve the hazard area.

Roadblock

In the event of an emergency, roadblock locations and road detours will be established. Enbridge may initially establish and maintain roadblocks until relieved by highway maintenance contractors or police. The Public Safety Leader must be continuously updated by Roadblock personnel so that all vehicles entering and exiting tare accounted for.

- ❑ In conjunction with the Public Safety Leader, determine the need for and location of roadblocks.
- ❑ Pickup and check roadblock kits.
- ❑ Proceed to roadblock locations.
- ❑ Confirm communication links.
- ❑ Establish roadblocks to secure the hazard area.
- ❑ Monitor area for LEL with personal monitors and document readings.
- ❑ Report all reading changes / increases to the Public Safety Leader.
- ❑ For your own safety, ensure the Public Safety Leader is notified immediately if readings are approaching 10% LEL.
- ❑ Document all incoming and outgoing traffic, personnel, and equipment.
- ❑ Forward information given to you by people passing through your location to the Public Safety Leader.
- ❑ Maintain communication with the Public Safety Leader.
- ❑ Maintain roadblock locations. Do not leave until requested to do so by the Public Safety Leader or until relieved by other Roadblock personnel.
- ❑ Assist with post-incident activities.

Air Monitoring Unit

LEL or other toxic substance concentrations will be monitored continuously during the incident response. It is crucial that Air Monitors continuously update the Public Safety Leader with monitored results. If air monitoring readings show high levels of LEL the Public Safety Leader may need to initiate evacuation / shelter of additional residences, change the location for site control or ignite the release (if applicable).

- ❑ Oblain and check equipment and information (maps, forms, communications, reports, monitors, safety, and breathing equipment).
- ❑ Confirm communication links.
- ❑ Monitor closest downwind public location or residence.
- ❑ Monitor environment for adverse effects.
- ❑ Document and report all readings at established intervals to the Public Safety Leader.
- ❑ For your own safety, ensure the Public Safety Leader is notified immediately if readings are approaching 10% LEL.
- ❑ Prepare Mobile Monitoring Plan.

Telephone Unit

In the event of an emergency in which residents and industrial users need to be sheltered and / or evacuated, a team of Telephoners will be established to contact people in the area and provide instructions to ensure their safety. The Public Safety Leader must be continuously updated with the Telephoner's progress so that unsuccessful contact attempts can be followed up on immediately.

- ❑ Confirm resident contact lists are available.
- ❑ Confirm communication links.
- ❑ In conjunction with the Public Safety Leader, determine who needs to be notified (residents, businesses, industrial users, etc.).
- ❑ Review with the Public Safety Leader the telephoner scripts to be used: Shelter-in-Place or Evacuation Phone Message.
- ❑ Contact residents and industrial users and advise them to evacuate or shelter.
- ❑ Document all resident interactions and report this information to the Public Safety Leader . Immediately advise the Public Safety Leader about unsuccessful contacts and any residents requiring assistance.
- ❑ Assist with post-incident activities.

Reception Centre Unit

In the event of an emergency in which residents need to be evacuated, a Reception Centre must be established to receive and register the evacuees. A Reception Centre Representative is assigned to manage / coordinate activities at the Reception Centre. The Reception Centre Representative continuously updates the Public Safety Leader with a list of those who have, and have not, checked in at the Reception Centre.

- ❑ Confirm Reception Centre is available for use.
- ❑ Establish Reception Centre.
- ❑ Confirm communication links.
- ❑ Receive evacuees and maintain a Reception Centre Registration Log.
- ❑ Arrange for food and accommodations for the evacuees.
- ❑ Record and follow up on all evacuees who choose to make their own accommodation arrangements.
- ❑ Arrange for temporary care of pets (if necessary) and the security of evacuated property.
- ❑ Establish and oversee compensation administration activities at the reception centre.
- ❑ Reimburse evacuees for their immediate out-of-pocket expenses and log details on a Resident Compensation Log.
- ❑ Where possible, provide evacuees with information regarding their property and the incident.
- ❑ Forward all media and incident inquiries to the Public Information Officer.
- ❑ Report all names of evacuees who have registered at the Reception Centre to the Public Safety Leader.
- ❑ Document activities using the Emergency Actions Log.
- ❑ Assist with post-incident activities.
- ❑ Confirm information to be released to public with the Public Information Officer.
- ❑ Address resident concerns and forward them to the Public Safety Leader.

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Operations Section Roles Wildlife 2.4.1.5d

OPERATIONS SECTION CHIEF
Manages operations directly applicable to the primary objectives

OPERATIONS SECTION DEPUTY OR ON-SCENE COMMANDER
Support Operations Section Chief

STAGING AREA DIRECTOR
Supervises staging area managers and coordinates their activities

STAGING AREA MANAGER
Receives, maintains, checks-in/out, stores and distributes resources

RECOVERY & PROTECTION BRANCH DIRECTOR
Oversee & implement containment & cleanup

- **PROTECTION GROUP** — *Deploy containment*
- **ON WATER GROUP** — *Manage water recovery*
- **DISPOSAL GROUP** — *Coordinate on-site activities*
- **DECON GROUP** — *Decontamination*
- **SHORESIDE RECOVERY GROUP** — *Shoreside cleanup*

WILDLIFE BRANCH DIRECTOR
Minimize wildlife injuries

- **WILDLIFE RECOVERY GROUP** — *Search & tag wildlife*
- **WILDLIFE REHAB GROUP** — *Oversight facility ops*

AIR OPS BRANCH DIRECTOR
Logistical support to aircraft

- **AIR SUPPORT GROUP** — *Coordinate support to aircraft*

EMERGENCY RESPONSE BRANCH DIRECTOR
Implement emergency measures

- **PUBLIC SAFETY LEADER** — *Coordinate public protection*
- **FIRE SUPPRESSION GROUP** — *Suppression & resources*
- **EMS/RESCUE GROUP** — *Coordinate response*
- **LAW ENFORCEMENT GROUP** — *Directing law enforcement activities and manage public protection action*

ENBRIDGE

Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual Log (ICS 214a).

Wildlife Branch Director

The Wildlife Branch Director is responsible for minimizing wildlife injuries during spill responses; coordinating early aerial and ground reconnaissance of the wildlife at the spill site and reporting results to the SUL; advising on wildlife protection strategies, including diversionary booming placements, in-situ burning, and chemical countermeasures; removing of oiled carcasses; employing wildlife hazing measures as authorized in the IAP; and recovering and rehabilitating impacted wildlife.

A central Wildlife Processing Center should be identified and maintained for, evidence tagging, transportation, veterinary services, treatment and rehabilitation storage, and other support needs. The activities of private wildlife care groups, including those employed by the RP, will be overseen and coordinated by the Wildlife Branch Director.

Wildlife Branch Director Checklist

- ❑ Review Branch Director Responsibilities.
- ❑ Develop the Wildlife Branch portion of the IAP.
- ❑ Supervise Wildlife Branch operations.
- ❑ Determine resource needs.
- ❑ Review the suggested list of resources to be released and initiate recommendation for release of resources.
- ❑ Assemble and disassemble teams/task forces assigned to the Wildlife Branch.
- ❑ Report information about special activities, events, and occurrences to the OPS.
- ❑ Assist the Volunteer Coordinator and Training Specialist in determining training needs of wildlife recovery volunteers.
- ❑ Conduct all wildlife protection, recovery, and rehabilitation activities in compliance with the IAP.

Wildlife Recovery Group

The Wildlife Recovery Group is responsible for coordinating the search or collection and field tagging of dead and live impacted wildlife and transporting them to the processing center(s). This group should coordinate with the Planning Situation Unit and Air Operations Branch Director in conducting aerial and group surveys of wildlife population in the vicinity of the spill. They should also deploy acoustic and visual wildlife hazing equipment, as needed.

Wildlife Recovery Checklist

- ❑ Review Division/Group Supervisor Responsibilities.
- ❑ Determine resource needs.
- ❑ Establish and implement protocols for collection and logging of impacted wildlife.
- ❑ Coordinate transportation of wildlife to processing station(s).

Wildlife Rehab Group

The Wildlife Rehabilitation Group is responsible for the oversight of facility operations, including: receiving oiled wildlife at the processing center, recording essential information, collecting necessary samples, and conducting triage, stabilization, treatment, transport and rehabilitation of oiled wildlife. The Wildlife Rehabilitation Center Manager is responsible for assuring appropriate transportation to appropriate treatment centers for oiled animals requiring extended care and treatment.

Wildlife Rehab Checklist

- ❑ Review Common Responsibilities.
- ❑ Determine resource needs and establish a processing station for impacted wildlife.
- ❑ Process impacted wildlife and maintain logs.
- ❑ Collect numbers/types/status of impacted wildlife and brief the Wildlife Branch Operations Director.
- ❑ Coordinate the transport of wildlife to other facilities.
- ❑ Coordinate release of recovered wildlife.
- ❑ Implement Incident Demobilization Plan.

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Operations Section Roles Air Ops 2.4.1.5e

OPERATIONS SECTION CHIEF
Manages operations directly applicable to the primary objectives

OPERATIONS SECTION DEPUTY OR ON-SCENE COMMANDER
Support Operations Section Chief

STAGING AREA DIRECTOR
Supervises staging area managers and coordinates their activities

STAGING AREA MANAGER
Receives, maintains, checks-in/out, stores and distributes resources

RECOVERY & PROTECTION BRANCH DIRECTOR
Oversee & implement containment & cleanup

- **PROTECTION GROUP** — *Deploy containment*
- **ON WATER GROUP** — *Manage water recovery*
- **DISPOSAL GROUP** — *Coordinate on-site activities*
- **DECON GROUP** — *Decontamination*
- **SHORESIDE RECOVERY GROUP** — *Shoreside cleanup*

WILDLIFE BRANCH DIRECTOR
Minimize wildlife injuries

- **WILDLIFE RECOVERY GROUP** — *Search & tag wildlife*
- **WILDLIFE REHAB GROUP** — *Oversight facility ops*

AIR OPS BRANCH DIRECTOR
Logistical support to aircraft

AIR SUPPORT GROUP
Coordinate support to aircraft

EMERGENCY RESPONSE BRANCH DIRECTOR
Implement emergency measures

- **PUBLIC SAFETY LEADER** — *Coordinate public protection*
- **FIRE SUPPRESSION GROUP** — *Suppression & resources*
- **EMS/RESCUE GROUP** — *Coordinate response*
- **LAW ENFORCEMENT GROUP** — *Directing law enforcement activities and manage public protection action*

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All activities must be documented at all Levels of Emergency

Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual Log (ICS 214a).

Air Ops Branch

The AOBD is ground-based and is primarily responsible for preparing the air operations portion (ICS 220) of the IAP and for providing logistical support to incident aircraft. The AOBD will ensure that agency directives, to include COMDTINST M3710.1e, flight manuals, unit restrictions, and other agency directives will not be violated by incident aircraft, e.g., flight hours, hoist limitations, night flying, etc. After the IAP is approved, the AOBD is responsible for overseeing the tactical and logistical assignments of the Air Operations Branch. In coordination with the Logistics Section, the AOBD is responsible for providing logistical support to aircraft operating on the incident.

Air Ops Branch Checklist

- ❑ Review Common Responsibilities.
- ❑ Organize preliminary air operations.
- ❑ Coordinate airspace use with the FAA. Request declaration (or cancellation) of Temporary Flight Restriction (TFR) IAW FAR 91.173 and post Notice to Airmen (NOTAM) as required.
- ❑ Attend the tactics meeting and planning meeting to obtain information for completing ICS 220.
- ❑ Participate in preparation of the IAP through the OSC/DOSC. Insure that the air operations portion of the IAP takes into consideration the Air Traffic Control requirements of assigned aircraft.
- ❑ Coordinate with the COML to designate air tactical and support frequencies.
- ❑ Perform operational planning for air operations.
- ❑ Prepare and provide Air Operations Summary Worksheet (ICS 220) to the Air Support Group and Fixed-Wing Bases.
- ❑ Supervise all air operations activities associated with the incident.
- ❑ Evaluate helibase and helispot locations.
- ❑ Establish procedures for emergency reassignment of aircraft.
- ❑ Coordinate approved flights of non-incident aircraft in the TFR.
- ❑ Coordinate Coast Guard air assets with the appropriate Command Center(s) through normal channels on incident air operations activities.
- ❑ Consider requests for logistical use of incident aircraft.
- ❑ Report to the OSC/DOSC on air operations activities.
- ❑ Report special incidents/accidents.
- ❑ Develop Aviation Site Safety Plan in concert with SOFR.
- ❑ Arrange for an accident investigation team when warranted.
- ❑ Debrief with OSC/DOSC as directed at the end of each shift.

Air Support Group

Air Tactical Group Supervisor

The ATGS tasks for oil spills are: coordination and scheduling of aircraft operations to locate, observe, track, survey, support dispersant applications or open water skimming operations, and others. Coordination activities may be performed by the ATGS while airborne.

- ❑ Review Air Tactical Group Supervisor Responsibilities.
- ❑ Obtain a briefing from the Air Operations Branch Director or the OPS.
- ❑ Coordinate dispersant, in-situ burning, and bioremediation application through the Air Operations Branch Director.
- ❑ Coordinate air surveillance mission scheduling and observer assignments with the SUL.
- ❑ Identify remote sensing technology that may enhance surveillance capabilities.
- ❑ Coordinate air surveillance observations and provide reports by the most direct methods available.
- ❑ Report on air surveillance and operations activities to the Air Operations Branch Director.
- ❑ Coordinate application-monitoring requirements with the Helicopter and Fixed Wing Coordinators and the Situation Unit.
- ❑ Report on air application activities to the Air Operations Branch Director.

Air Support Group Supervisor

The ASGS is primarily responsible for supporting aircraft and aircrews. This includes: 1) providing fuel and other supplies; 2) providing maintenance and repair of aircraft; 3) keeping records of aircraft activity, and 4) providing enforcement of safety regulations. The ASGS reports to the AOBD

- ❑ Review Common Responsibilities.
- ❑ Obtain a copy of the IAP from the AOBD, including Air Operations Summary Worksheet (ICS 220).
- ❑ Participate in AOBD planning activities.
- ❑ Inform AOBD of group activities.
- ❑ Identify resources/supplies dispatched for the Air Support Group.
- ❑ Request special air support items from appropriate sources through Logistics.
- ❑ Determine need for assignment of personnel and equipment at each airbase.
- ❑ Coordinate activities with AOBD.
- ❑ Obtain assigned ground-to-air frequency for airbase operations from the Communications Unit Leader (COML) or Communications Plan (ICS 205).
- ❑ Inform AOBD of capability to provide night flying service.
- ❑ Ensure compliance with each agency's operations checklist for day and night operations.
- ❑ Ensure dust abatement procedures are implemented at helibases and helispots.
- ❑ Provide crash-rescue service for helibases and helispots.
- ❑ Debrief as directed at the end of each shift.

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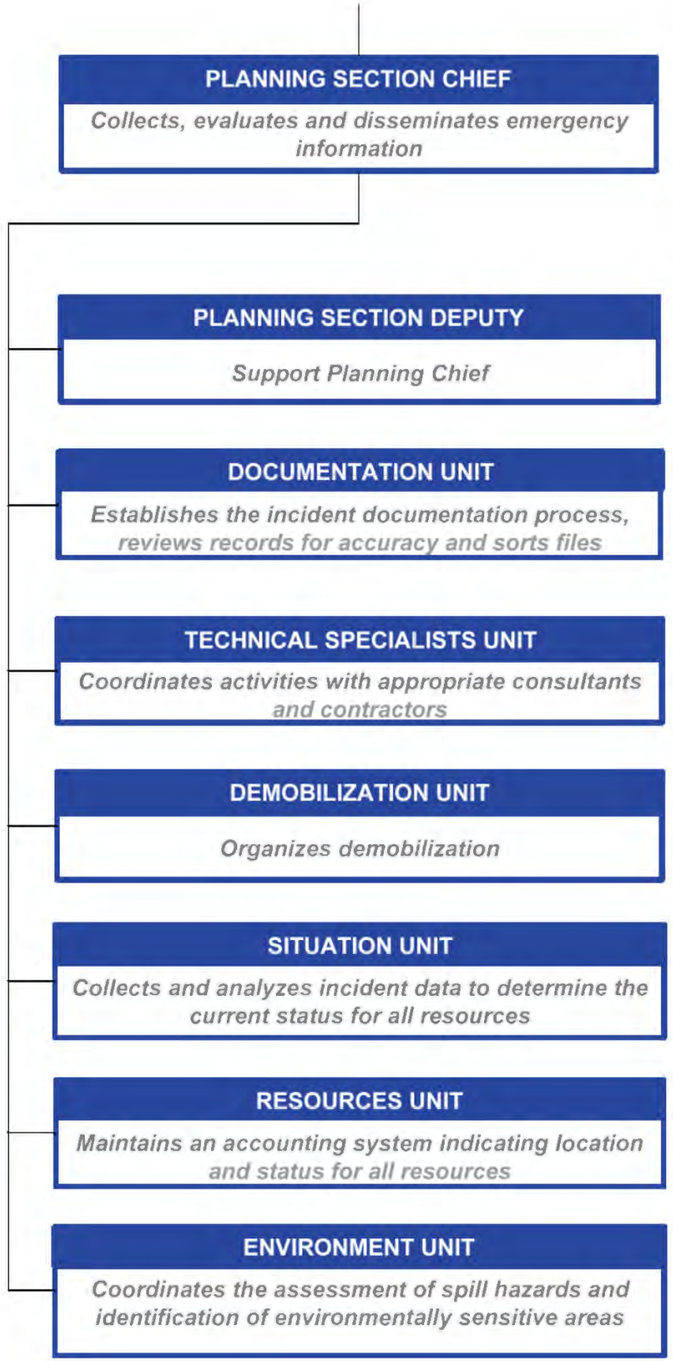

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Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual/Activity Log (ICS 214a).

Planning Section Chief

The PSC, a member of the General Staff, is responsible for the collection, evaluation, dissemination, and use of incident information and maintaining status of assigned resources.

Information is needed to:
1) understand the current situation;
2) predict the probable course of incident events;
3) prepare alternative strategies for the incident; and
4) submit required incident status reports.

The PSC may have a Deputy PSC, who may be from an assisting governmental agency.

Planning Section Chief Checklist

- ❑ Review common responsibilities.
- ❑ Collect, process, and display incident information.
- ❑ Assist OSC in the development of response strategies.
- ❑ Supervise preparation of the IAP.
- ❑ Develop Situation Report (ICS 209)
- ❑ Facilitate planning meetings and briefings.
- ❑ Assign personnel already on-site to ICS/UC organizational positions as appropriate.
- ❑ Establish information requirements and reporting schedules for Planning Section Units (e.g., Resources, Situation).
- ❑ Determine the need for any specialized resources in support of the incident.
- ❑ Establish special information collection activities as necessary (e.g., weather, environmental, toxics, etc.).
- ❑ Assemble information on alternative strategies.
- ❑ Provide periodic predictions on incident potential.
- ❑ Keep IMT apprised of any significant changes in incident status.
- ❑ Compile and display incident status information.
- ❑ Oversee preparation and implementation of the Incident Demobilization Plan.
- ❑ Incorporate plans (e.g., Traffic, Medical, Communications, and Site Safety) into the IAP.
- ❑ Develop other incident supporting plans (e.g., salvage, transition, security).
- ❑ Assist Operations with development of the ICS 234 Work Analysis Matrix.

Planning Section Deputy

The Planning Section Deputy may assume responsibility for a specific portion of the primary position (listed below) , work as relief, or be assigned other tasks. The Deputy should always be as qualified to make decisions and manage the incident as the Planning Section Chief.

- ❑ Review common responsibilities.
- ❑ Collect, process, and display incident information.
- ❑ Assist OSC in the development of response strategies.
- ❑ Supervise preparation of the IAP.
- ❑ Develop Situation Report (ICS 209)
- ❑ Facilitate planning meetings and briefings.
- ❑ Assign personnel already on-site to ICS/UC organizational positions as appropriate.
- ❑ Establish information requirements and reporting schedules for Planning Section Units (e.g., Resources, Situation).
- ❑ Determine the need for any specialized resources in support of the incident.
- ❑ Establish special information collection activities as necessary (e.g., weather, environmental, toxics, etc.).
- ❑ Assemble information on alternative strategies.
- ❑ Provide periodic predictions on incident potential.
- ❑ Keep IMT apprised of any significant changes in incident status.
- ❑ Compile and display incident status information.
- ❑ Oversee preparation and implementation of the Incident Demobilization Plan.
- ❑ Incorporate plans (e.g., Traffic, Medical, Communications, and Site Safety) into the IAP.
- ❑ Develop other incident supporting plans (e.g., salvage, transition, security).
- ❑ Assist Operations with development of the ICS 234 Work Analysis Matrix.

Demobilization Unit

Responsible for developing the Incident Demobilization Plan.

Demobilization Unit Checklist

- ❑ Review common responsibilities.
- ❑ Review incident resources records to determine the likely size and extent of demobilization effort and develop a matrix.
- ❑ Coordinate demobilization with agency/company representatives.
- ❑ Monitor Operations Section resource needs.
- ❑ Identify surplus resources and probable release time.
- ❑ Utilize the demobilization checkout procedures for release of incident resources (ICS 221).
- ❑ Establish communications with off-incident facilities, as necessary.
- ❑ Develop an Incident Demobilization Plan including process by which suppliers inspect condition of released resources and sign off if acceptable prior to moving offsite.
- ❑ Distribute demobilization plan (on and off-site).
- ❑ Provide status reports to appropriate requestors.
- ❑ Develop incident check-out function for all units.
- ❑ Evaluate logistics and transportation capabilities to support demobilization.
- ❑ Ensure that all Sections/Units understand their specific demobilization responsibilities.
- ❑ Supervise execution of the incident demobilization plan.
- ❑ Brief the PSC on demobilization progress.

Resources Unit

Responsible for maintaining the status of all assigned tactical resources and personnel at an incident. Achieved by overseeing check-in of all tactical resources and personnel, maintaining a situation status board to indicate current location and status of resources.

Resources Unit Leader Checklist

- ❑ Review Common Responsibilities.
- ❑ Review Unit Leader Responsibilities.
- ❑ Establish the check-in (ICS 211P) function at command post.
- ❑ Work with Staging Area Manager(s) in the field to ensure they are utilizing the check-in (ICS 211P & E) process to track equipment and personnel arriving and departing the staging area.
- ❑ Prepare Organization Assignment List (ICS 203) and Organization Chart (ICS 207) working with each officer, section chief and unit leader.
- ❑ Ensure appropriate resource tracking process is established and communicated.
- ❑ Maintain master roster of all tactical resources checked in at the incident.
- ❑ Ensure ICS 210 Change Status forms are utilized when resources are reassigned to another location.
- ❑ Work with Operations and Logistics to review ICS 213RR resource requisition and provide input on resources available in staging.
- ❑ Maintain and post the current status and location and assignments of all tactical resources.
- ❑ Work with Operations and Environmental Unit to prepare strategies and tactics (ICS 234 Work Analysis Matrix) to support objectives (ICS 202)
- ❑ Draft ICS 215 Operational Planning Worksheet with Operations, Environment Unit and Safety to determine required resources needed to implement tactics in the field and what additional resources need to be ordered.
- ❑ Prepare appropriate parts of Division Assignment Lists (ICS 204).
- ❑ Attend meetings and briefings as required by the PSC.
- ❑ Provide resources and organization information to SITL for situation status display.

Environment Unit

Ensure that the following specific to the release is recorded:

- ❑ ICS Environmental Unit Leader (including relief activities, timing, etc.);
- ❑ Meetings where environmental issues are discussed (date, time, location, topics, attendees, & action items);
- ❑ Environmental sensitivity/issue information;
- ❑ Environmentally sensitive areas in/adjacent to the release site;
- ❑ Environmental assessment results;
- ❑ Mitigation measures and success of these measures;
- ❑ Agreements on key issues with government, landowners and other stakeholders;
- ❑ Environmental equipment and resources;
- ❑ Impacts on wildlife;
- ❑ Any waste or recovered product removed from a release site or temporary storage site; and
- ❑ Community air quality monitoring results.

Initial Situational Assessment

Upon discovery refer to High Consequence Area (HCA) and Control Point (CP) maps and tables in order to protect environmentally & economically sensitive areas. These maps include:

HCA Maps & Tables

- ❑ Regional Operations maintain maps identifying HCAs along the pipeline, including:
- ❑ High Population Areas (HPA)
- ❑ Other Population Areas (OPA)
- ❑ Commercially Navigable Waterways (CNW)
- ❑ Environmentally Sensitive Areas (ESA)
- ❑ Drinking Water (DW)

Control Point Maps

Regions maintain Control Point Map sets that identify product containment and recovery sites (control points) on high risk water-bodies that could be impacted by a pipeline leak. The impact mechanism could be via direct crossing, overland flow or spray.

Regional management is responsible for ensuring that a field reconnaissance of each control point is carried out at least once in a 3 year period.

Environment Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Predict movement and dispersion of products.
- ❑ Provide clean up expertise.
- ❑ Engage specialists as needed (e.g., shoreline cleanup assessment, trajectory analysis, resources at risk and air monitoring).
- ❑ Develop and review sampling plans, water and air monitoring results.
- ❑ Review and recommend alternative technologies as identified in ACP.
- ❑ Work with LNO to establish advisory meetings as needed.
- ❑ State and Federal Natural Resource Trustees will also assess NRDA impacts, an Enbridge NRDA Manager will want to monitor Trustee activity to determine concerns and document Trustee sample and documentation activities .

Ensure that the following specific to the release is recorded

- ❑ ICS Environmental Unit Leader (including relief activities, timing, etc.);
- ❑ Meetings where environmental issues are discussed (date, time, location, topics, attendees, and action items);
- ❑ Environmental sensitivity/issue information;
- ❑ Environmentally sensitive areas in/adjacent to the release site;
- ❑ Environmental assessment results;
- ❑ Mitigation measures and success of these measures;
- ❑ Agreements on key issues with government, landowners and other stakeholders.
- ❑ Environmental equipment and resources;
- ❑ Impacts on wildlife;
- ❑ Any waste or recovered product removed from a release site or temporary storage site; and
- ❑ Community air quality monitoring results.

Documentation Unit

Responsible for providing incident documentation, reviewing records for accuracy and sorting documentation files. Due to the nature of the legal ramifications, individuals with legal training should be assigned to this particular duty and liaise with the Legal Officer during the entire cleanup scenario.

Documentation Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Set up work area; begin organization of incident files.
- ❑ Establish duplication service, respond to requests.
- ❑ File all official forms and reports. (e.g. Legal Documentation and After Action Report)
- ❑ Review records for accuracy and completeness; inform appropriate units of errors or omissions.
- ❑ Provide incident documents as requested.
- ❑ Retain all documentation for official records.
- ❑ Organize files for submitting final incident documentation package.
- ❑ Prepare meeting summary (ICS 231).

Technical Specialist

Responsible for coordinating activities with appropriate consultants and contractors (e.g., accountants, engineers, oil spill clean-up experts, right-of-way agents, NRDA reps).

Technical Specialists Checklist

- ❑ Review common responsibilities.
- ❑ Provide technical expertise and advice to command and general staff.
- ❑ Attend meetings and briefings to clarify and help resolve technical issues.
- ❑ Provide expertise during the development of the IAP and other support plans.
- ❑ Work with the SOFR to mitigate unsafe practices.
- ❑ Work closely with LNO to help facilitate understanding among stakeholder and special interest groups.
- ❑ Be available to attend press briefings to clarify technical issues.
- ❑ Work closely with Operations Section to monitor compliance and planned actions.
- ❑ Research technical issues and provide findings to decision makers.
- ❑ Provide appropriate modeling and predictions as needed.
- ❑ Troubleshoot technical problems and provide advice on resolution.
- ❑ Review specialized plans and clarify meaning.

Situation Unit

The Situation Unit Leader (SITL) is responsible for collecting, processing and organizing incident information relating to the growth, mitigation or intelligence activities taking place on the incident. The SITL may prepare future projections of incident growth, maps and intelligence information .

Situation Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Begin collection and analysis of incident data as soon as possible.
- ❑ Prepare, post, or disseminate resources and situation status information as required, including special requests.
- ❑ Prepare Incident Status Summary Form (ICS 209).
- ❑ Provide photographic services and maps as required.
- ❑ Conduct situation briefings at the command and general staff meetings, tactics meeting, planning and operations briefing.
- ❑ Develop IAP.
- ❑ Maintain Situation Report Board for incident in the common area of the ICP for all responders to view.

Environment Unit

Responsible for environmental matters associated with the response, including strategic assessment, modeling, surveillance, sensitive area identification, and environmental monitoring and permitting.

Environment Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Predict movement and dispersion of products.
- ❑ Provide clean up expertise.
- ❑ Engage specialists as needed (e.g., shoreline cleanup assessment, trajectory analysis, resources at risk and community air monitoring).
- ❑ Develop and review sampling plans, water and community air monitoring results.
- ❑ Review and recommend alternative technologies as identified in ACP.
- ❑ Work with LNO to establish advisory meetings as needed.
- ❑ State and Federal Natural Resource Trustees will also assess NRDA impacts, an Enbridge NRDA Manager will want to monitor Trustee activity to determine concerns and document Trustee sample and documentation activities .
- ❑ Notify Operations of any potential water intake impacts

Planning Section Roles 2.4.1.5f

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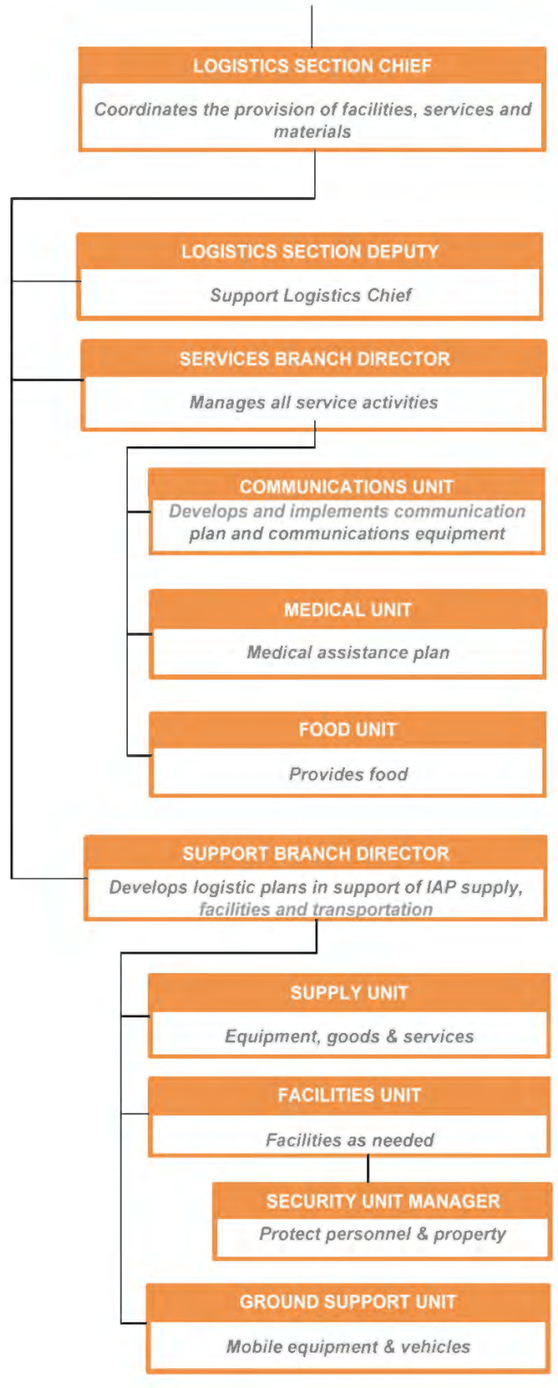

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Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual/Activity Log (ICS 214a).

Logistics Section Chief

The LSC, a member of the General Staff, is responsible for providing personnel, facilities, services, and material in support of the incident. The LSC participates in the development and implementation of the IAP and activates and supervises the Branches and Units within the Logistics Section.

The LSC may have Deputy LSCs. The Deputy LSC must have the same qualifications as the person for whom they work, as they must be ready to take over that position at any time.

- ❑ Review common responsibilities.
- ❑ Plan the organization of the Logistics Section.
- ❑ Assign work locations and preliminary work tasks to section personnel.
- ❑ Notify the Resources Unit of the Logistics Section Units activated, including names and locations of assigned personnel.
- ❑ Assemble and brief Logistics Branch Directors and Unit Leaders.
- ❑ Determine and supply immediate incident resource and facility needs.
- ❑ In conjunction with Command, develop and advise all Sections of the resource approval and requesting process (ICS 213RR).
- ❑ Attend tactics meeting. Review proposed tactics for upcoming operational period for ability to provide resources and logistical support.
- ❑ Identify long-term service and support requirements for planned and expected operations.
- ❑ Advise Command and other Section Chiefs on resource availability to support incident needs.
- ❑ Develop the Communications Plan, Medical Plan and Traffic Plan.
- ❑ Identify resource needs for incident contingencies.
- ❑ Coordinate and process requests for additional resources.
- ❑ Track resource effectiveness and make necessary adjustments.
- ❑ Advise on current service and support capabilities.
- ❑ Develop recommended list of Section resources to be demobilized and initiate recommendation for release when appropriate.
- ❑ Receive and implement applicable portions of the Incident Demobilization Plan.
- ❑ Determine and supply long term incident resources and facility needs.
- ❑ Ensure the general welfare and safety of Logistics Section personnel.

Logistics Section Deputy

The Logistics Section Deputy may assume responsibility for a specific portion of the primary position (listed below) , work as relief, or be assigned other tasks. The Deputy should always be as qualified to make decisions and manage the incident as the Logistics Section Chief.

- ❑ Review common responsibilities.
- ❑ Plan the organization of the Logistics Section.
- ❑ Assign work locations and preliminary work tasks to section personnel.
- ❑ Notify the Resources Unit of the Logistics Section Units activated, including names and locations of assigned personnel.
- ❑ Assemble and brief Logistics Branch Directors and Unit Leaders.
- ❑ Determine and supply immediate incident resource and facility needs.
- ❑ In conjunction with Command, develop and advise all Sections of the resource approval and requesting process (ICS 213RR).
- ❑ Attend tactics meeting. Review proposed tactics for upcoming operational period for ability to provide resources and logistical support.

Logistics Section Deputy *continued*

- ❑ Identify long-term service and support requirements for planned and expected operations.
- ❑ Advise Command and other Section Chiefs on resource availability to support incident needs.
- ❑ Develop the Communications Plan, Medical Plan and Traffic Plan.
- ❑ Identify resource needs for incident contingencies.
- ❑ Coordinate and process requests for additional resources.
- ❑ Track resource effectiveness and make necessary adjustments.
- ❑ Advise on current service and support capabilities.
- ❑ Develop recommended list of Section resources to be demobilized and initiate recommendation for release when appropriate.
- ❑ Receive and implement applicable portions of the Incident Demobilization Plan.
- ❑ Determine and supply long term incident resources and facility needs.
- ❑ Ensure the general welfare and safety of Logistics Section personnel.

Service Branch Director

Responsible for the management of all service activities (Communications, Medical and Food Units) at the incident.

- ❑ Review common responsibilities.
- ❑ Obtain work materials.
- ❑ Determine level of service required to support operations.
- ❑ Participate in planning meetings of Logistics Sections personnel.
- ❑ Review IAP.
- ❑ Organize and prepare assignment for service branch personnel.
- ❑ Coordinate activities of branch units.
- ❑ Inform the LSC of branch activities.
- ❑ Resolve service branch problems.

Communications Unit

The Communications Unit Leader is responsible for developing plans for the effective use of incident communications equipment and facilities; installing and testing of communications equipment; supervision of the Incident Communications Center; distribution of communications equipment to incident personnel; and the maintenance and repair of communications equipment.

- ❑ Review common responsibilities.
- ❑ Review unit lead responsibilities.
- ❑ Determine unit personnel needs.
- ❑ Prepare and implement the radio communication plan (ICS 205).
- ❑ Ensure a communications center is established if needed.
- ❑ Establish appropriate communications distribution/maintenance location at the incident site.
- ❑ Provide technical information as required on:
  - ❑ Adequacy of communication systems currently in operation.
  - ❑ Geographic limitation on communication systems.
  - ❑ Equipment capabilities/limitations.
  - ❑ Amount and types of equipment available.
  - ❑ Anticipated problems in the use of communications equipment.
- ❑ Supervise communications unit services.
- ❑ Maintain records on all communications equipment as appropriate.
- ❑ Ensure equipment is tested and repaired.
- ❑ Recover equipment from units being demobilized.

Medical Unit

The Medical Unit Leader (MEDL) is primarily responsible for; 1) development of the Medical Plan, 2) providing medical care and overseeing health aspects of response personnel, 3) obtaining medical aid and transportation for injured and ill incident personnel, 4) coordinating with other functions to resolve heath and safety issues, and 5) preparation of reports and records

- ❑ Review Common Responsibilities
- ❑ Review Unit Leader Responsibilities.
- ❑ Participate in Logistics Section/Service Branch planning activities.
- ❑ Establish the Medical Unit.
- ❑ Prepare the Medical Plan (ICS 206).
- ❑ Provide any relevant medical input into the planning process for strategy development.
- ❑ Coordinate with Safety Officer, Operations, hazmat specialists, and others on proper personnel protection procedures for incident personnel.
- ❑ Prepare procedures for major medical emergency.
- ❑ Develop transportation routes and methods for injured incident personnel.
- ❑ Ensure incident personnel patients are tracked as they move from origin, care Facility and disposition.
- ❑ Provide continuity of medical care for incident personnel.
- ❑ Declare major medical emergency as appropriate.
- ❑ Provide or oversee medical and rehab care delivered to incident personnel.
- ❑ Monitor health aspects of incident personnel including excessive incident stress.
- ❑ Respond to requests for medical aid, medical transportation and medical supplies.
- ❑ In conjunction with Finance/Admin Section, prepare and submit necessary authorizations, reports and administrative documentation related to injuries, componsation or death of incident personnel.
- ❑ Coordinate personnel and mortuary affairs for incident personnel fatalities.
- ❑ Provide oversight and liaison as necessary for incident victims among emergency medical care, medical examiner and hospital care.
- ❑ Provide for security and proper disposition of incident medical records.

Food Unit

Responsible for supplying the food needs for the entire incident, including all remote locations and providing food for personnel unable to leave their tactical field assignments. Supervises Communications, Medical and Food Units.

- ❑ Determine method of feeding to best fit each facility or situation.
- ❑ Obtain necessary equipment and supplies and establish cooking facilities.
- ❑ Ensure that well-balanced menus are provided.
- ❑ Maintain food service areas, ensuring that all appropriate health and safety measures are being followed.
- ❑ Supervise caterers, cooks, and other Food Unit personnel as appropriate.

Support Branch Director

Responsible for development of logistic plans in support of IAP supply, facilities and transportation.

- ❑ Review common responsibilities.
- ❑ Obtain work materials.
- ❑ Determine initial support operations in coordination with the LSC and service branch.
- ❑ Prepare initial organization and assignments for support operations.
- ❑ Assemble and brief support branch personnel.

Support Branch Director *continued*

- ❑ Prepare Security, Transportation, Traffic routing plans as required by the incident.
- ❑ Determine if assigned branch resources are sufficient.
- ❑ Maintain surveillance of assigned units work progress and inform the LSC of their activities.
- ❑ Resolve problems associated with requests from the Operations Section.

Supply Unit

The Supply Unit Leader (SPUL) is primarily responsible for procuring all resources (personnel, equipment and supplies) for the incident. If not conducted by the Staging Area Manager(s), the SPUL is also responsible for receiving, storing and distributing all supplies; maintaining an inventory of supplies; and storing, disbursing and servicing non-expendable supplies and equipment.

- ❑ Review Common Responsibilities.
- ❑ Review Unit Leader Responsibilities.
- ❑ Participate in Logistics Section/Support Branch planning activities.
- ❑ Determine the type and amount of resources en route to the incident.
- ❑ Review the IAP for information on operations of the Supply Unit.
- ❑ Develop and implement safety and security requirements for equipment/supplies storage areas/facilities.
- ❑ Order, receive, distribute and store supplies and equipment.
- ❑ Receive and respond to requests for personnel, supplies and equipment.
- ❑ Maintain an inventory of supplies and equipment.
- ❑ Prepare ICS 210 Change Status forms if equipment or other significant resources are deployed from storage areas.
- ❑ Service reusable equipment.
- ❑ Submit reports to the SUBD.

Ground Support Unit

The Ground Support Unit Leader (GSUL) is responsible for: 1) maintaining tactical equipment, vehicles, mobile ground support equipment, 2) providing fueling services, 3) transportation of personnel, supplies, food and equipment, 4) recording equipment usage time, including contract equipment assigned to the incident, and 5) implementing the Transportation Plan for the incident.

- ❑ Review Unit Leader Responsibilities
- ❑ Participate in Support Branch/Logistics Section planning activities.
- ❑ Develop and implement the Transportation Plan.
- ❑ Notify the Resource Unit of all status changes (ICS Form 210) on support and transportation vehicles.
- ❑ Arrange for and activate fueling, maintenance and repair of ground resources.
- ❑ Maintain inventory of support and transportation vehicles, establish file to record daily equipment use and communicate to Finance Section Chief.
- ❑ Provide transportation services in association with requests from the Logistics Section Chief.
- ❑ Collect use information on rented equipment.
- ❑ Requisition maintenance and repair supplies, e.g., fuel, spare parts.
- ❑ Maintain incident roads.
- ❑ Submit reports to Support Branch Director as directed.

Facilities Unit

The FACL is primarily responsible for the set up, maintenance and demobilization of incident facilities, e.g., Base, ICP and Staging Areas, as well as security services required to support incident operations. The FACL provides sleeping and sanitation facilities for incident personnel and manages Base operations. Each facility is assigned a manager who reports to the FACL and is responsible for managing the operation of the facility. The FACL reports to the SUBD.

- ❑ Review Unit Leader Responsibilities.
- ❑ Obtain a briefing from the SUBD or the LSC.
- ❑ Receive and review a copy of the IAP.
- ❑ Participate in Logistics Section/Support Branch planning activities.
- ❑ In conjunction with the Finance Section, determine locations suitable for incident support facilities and secure permission to use through appropriate means.
- ❑ Inspect facilities prior to occupation and document conditions and preexisting damage and/or contamination.
- ❑ Determine requirements for each facility, including the ICP.
- ❑ Prepare layouts of incident facilities.
- ❑ Notify Unit Leaders of facility layout.
- ❑ Activate incident facilities.
- ❑ Provide sleeping facilities, security services, food and water service, sanitation and shower service, & facility maintenance services, e.g., sanitation, lighting, clean up, trash removal, etc.
- ❑ Inspect all facilities for damage and potential claims.
- ❑ Demobilize incident facilities.
- ❑ Establish/maintain a file to record daily equipment use and communicate (FSC).

Security Manager

The SECM is responsible for providing safeguards needed to protect personnel and property from loss or damage.

- ❑ Establish contacts with local law enforcement agencies, as required.
- ❑ Contact the Resource Use Specialist for crews or Agency Representatives to discuss any special custodial requirements that may affect operations.
- ❑ Request required personnel support to accomplish work assignments.
- ❑ Ensure security of classified material and/or systems.
- ❑ Ensure that support personnel are qualified to manage security problems.
- ❑ Develop Security Plan for incident facilities and adjust for personnel and equipment changes as necessary.
- ❑ Develop Traffic Plan for safely routing vehicle traffic around incident area, ICP, staging areas, etc. and work with local law enforcement to implement.
- ❑ Provide personnel to perform personnel and equipment check-in duties (ICS Forms 211p & e) at ICP, Staging Areas, Bases, etc. as requested and communicate to RESL.
- ❑ Coordinate security activities with appropriate incident personnel
- ❑ Keep the peace, prevent assaults and settle disputes with response agencies.
- ❑ Prevent theft of all company, contractor, government and personal property.
- ❑ Document all complaints and suspicious occurrences.

Logistics Section Roles 2.4.1.5g

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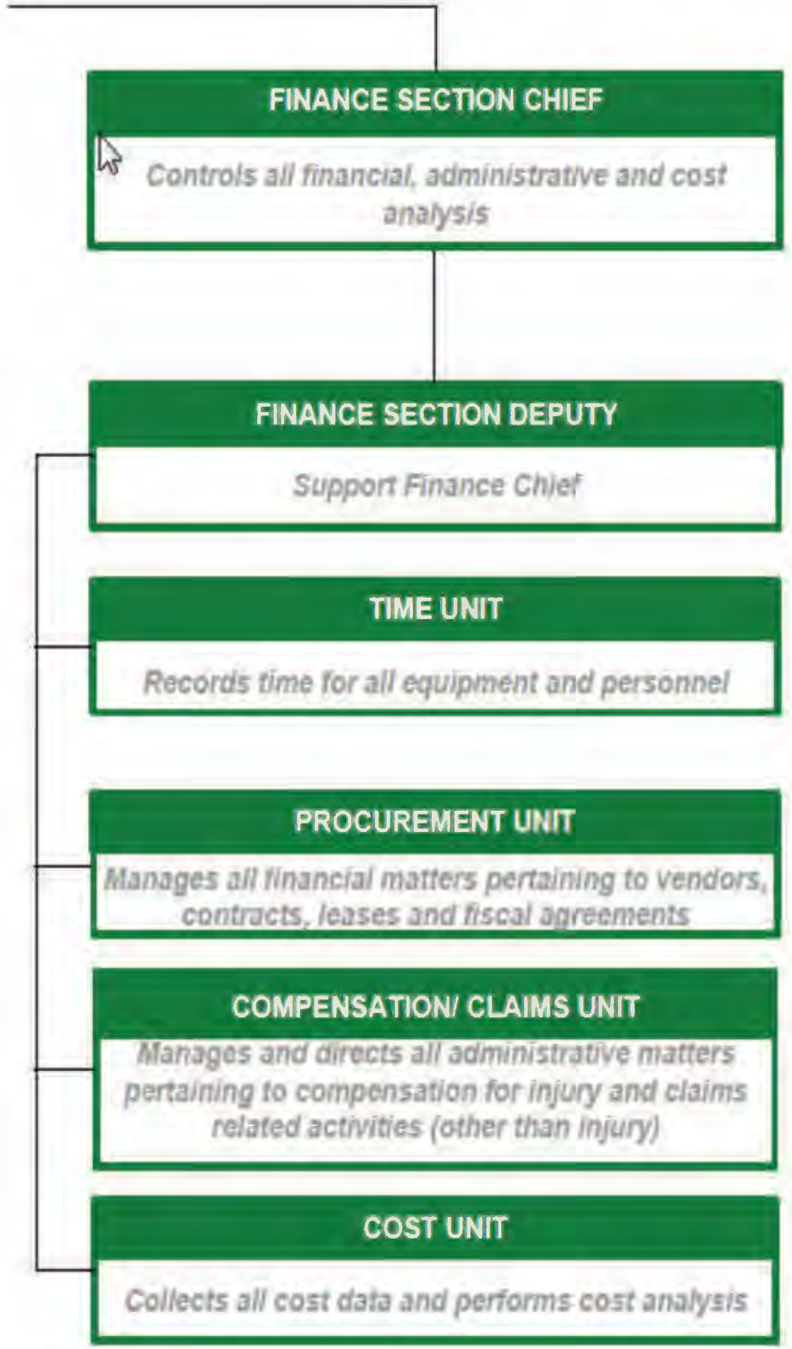

Finance section Roles 2.4.1.5h

Roles Common To All

Common Responsibilities Checklist

After initial notification and receiving your assignment:

- ❑ Review job assignment (e.g., Strike Team designation, position, etc.).
- ❑ Receive brief overview of type and magnitude of incident.
- ❑ Receive resource order number and request number.
- ❑ Receive reporting location & time.
- ❑ Receive travel instructions.
- ❑ Receive any special communications instructions (e.g., travel, radio frequency).
- ❑ Monitor incident related information from media, internet, etc., if available.
- ❑ Assess personal equipment readiness for specific incident and climate (e.g. medications, money, computer, medical record, etc.).
- ❑ Maintain a checklist of items and if possible a personal Go-Kit.
- ❑ Inform others as to where you are going and how to contact you.
- ❑ Review Incident Management Handbook (IMH).
- ❑ Take advantage of available travel to rest prior to arrival. Upon arrival at the incident, check-in at the designated check-in location. Check-in may be found at any of the following locations:
- ❑ Incident Command Post, Base/Camps, Staging Areas, and Heli-bases.
- ❑ If you are instructed to report directly to a line assignment, check-in with the Division/Group Supervisor.
- ❑ Receive briefing from immediate supervisor.
- ❑ Agency Representatives from assisting or cooperating agencies report to the LNO at the Incident Command Post after check-in.
- ❑ Acquire work materials.
- ❑ Abide by organizational code of ethics.
- ❑ Participate in IMT meetings and briefings, as appropriate.
- ❑ Document information and key actions.
- ❑ Ensure compliance with all safety practices and procedures. Report unsafe conditions to the SOFR.
- ❑ Supervisors shall maintain accountability for their assigned personnel with regard as to exact location(s) and personal safety and welfare at all times, especially when working in or around incident operations.
- ❑ Organize and brief subordinates.
- ❑ The Command Staff and General Staff shall ensure branches are identified, set up and allocate divisions and groups within them to stay within the recommended span of control (1 Supervisor per 4-7 people).
- ❑ Know your assigned communication methods and procedures for your area of responsibility and ensure that communication equipment is operating properly.
- ❑ Use clear text and ICS/UC terminology (no codes) in all radio communications.
- ❑ Complete forms and reports required of the assigned position and ensure proper disposition of incident documentation as directed by the Documentation Unit Leader (DOCL).
- ❑ Ensure all equipment is operational prior to each work period.
- ❑ Report any signs/symptoms of extended incident stress, injury, fatigue or illness for yourself or coworkers to your supervisor.
- ❑ Respond to demobilization orders and brief subordinates regarding demobilization.
- ❑ Prepare personal belongings for demobilization.
- ❑ Return all assigned equipment to appropriate location.
- ❑ Complete Demobilization check-out process before returning to home base.
- ❑ Participate in After-Action activities as directed.
- ❑ Carry out all assignments as directed.
- ❑ Maintain Individual/Activity Log (ICS 214a).

Finance Section Chief

The FSC, a member of the General Staff, is responsible for all financial, administrative and cost analysis aspects of the incident and for supervising members of the Finance/Admin Section. The FSC may have a Deputy FSC. The Deputy FSC must have the same qualifications as the person for whom they work, as they must be ready to take over that position at any time.

Finance Section Chief Checklist

- ❑ Review common responsibilities.
- ❑ Participate in incident planning meetings and briefings as required.
- ❑ Review operational plans and provide alternatives where financially appropriate.
- ❑ Manage all financial aspects of an incident.
- ❑ Provide financial and cost analysis information as requested.
- ❑ Gather pertinent information from briefings with responsible agencies.
- ❑ Develop an operating plan for the Finance/Admin Section; fill supply and support needs.
- ❑ Meet with assisting and cooperating Agency Representatives, as needed.
- ❑ Maintain daily contact with agency(s) administrative headquarters on Finance/Admin matters.
- ❑ Ensure that all personnel time records are accurately completed and transmitted to home agencies, according to policy.
- ❑ Provide financial input to demobilization planning.
- ❑ Ensure that all obligation documents initiated at the incident are properly prepared and completed.
- ❑ Brief agency administrative personnel on all incident-related financial issues needing attention or follow-up prior to leaving incident.
- ❑ Develop recommended list of section resources to be demobilized and initial recommendation for release when appropriate.
- ❑ Receive and implement applicable portions of the Incident Demobilization Plan.

Finance Section Deputy

The Finance Section Deputy may assume responsibility for a specific portion of the primary position (listed below) , work as relief, or be assigned other tasks. The Deputy should always be as qualified to make decisions and manage the incident as the Finance Section Chief.

Finance Section Deputy Checklist

- ❑ Review common responsibilities.
- ❑ Participate in incident planning meetings and briefings as required.
- ❑ Review operational plans and provide alternatives where financially appropriate.
- ❑ Manage all financial aspects of an incident.
- ❑ Provide financial and cost analysis information as requested.
- ❑ Gather pertinent information from briefings with responsible agencies.
- ❑ Develop an operating plan for the Finance/Admin Section; fill supply and support needs.
- ❑ Meet with assisting and cooperating Agency Representatives, as needed.
- ❑ Maintain daily contact with agency(s) administrative headquarters on Finance/Admin matters.
- ❑ Ensure that all personnel time records are accurately completed and transmitted to home agencies, according to policy.
- ❑ Provide financial input to demobilization planning.
- ❑ Ensure that all obligation documents initiated at the incident are properly prepared and completed.
- ❑ Brief agency administrative personnel on all incident-related financial issues needing attention or follow-up prior to leaving incident.
- ❑ Develop recommended list of section resources to be demobilized and initial recommendation for release when appropriate.
- ❑ Receive and implement applicable portions of the Incident Demobilization Plan.

Time Unit

The Time Unit is responsible for ensuring the accurate recording of daily personnel time, compliance with specific agency time recording policies and managing commissary operations if established at the incident.

- ❑ Record daily personnel time, ensure compliance with specific agency time recording policies, and manage commissary operations if established at the incident.
- ❑ Submit cost estimate data forms to Cost Unit as required.
- ❑ Ensure that all records are current and complete prior to demobilization.

Time Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Track the time of all personnel on site. (ICS 211P)

Procurement Unit

Responsible for managing all financial matters pertaining to vendors, contracts, leases and fiscal agreements.

Procurement Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Review incident needs and any special procedures with unit leaders, as needed.
- ❑ Coordinate with local jurisdiction on plans and supply sources.
- ❑ Develop a procurement plan.
- ❑ Prepare and authorize contracts and agreements with supply vendors.
- ❑ Interpret contracts and agreements.
- ❑ Coordinate with the compensation claims unit for processing claims.
- ❑ Coordinate cost data in contracts with the cost unit leader.
- ❑ Brief the FSC on current problems and recommendations, outstanding issues and follow-up requirements.

Compensation/Claims Unit

Responsible for the overall management and direction of all administrative matters pertaining to compensation for injury and claims related activities (other than injury) for an incident.

Compensation/Claims Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Review Unit Leader Responsibilities.
- ❑ Obtain briefing from Finance Section Chief.
- ❑ Establish contact with the Incident Medical Unit, Safety Officer and Liaison officer (or Agency Representatives if no LNO is assigned).
- ❑ Determine the need for compensation for injury and claims specialists and order personnel as needed.
- ❑ Review medical plan (ICS 206).
- ❑ Ensure that compensation/claims specialists have adequate workspace and supplies.
- ❑ Brief the Claims Specialists on incident activity.
- ❑ Review and coordinate procedures for handing claims with the procurement unit.
- ❑ Periodically review logs and forms produced by specialists to ensure that they are complete.
- ❑ If applicable, ensure that all compensation for injury and claims logs and forms are completed.
- ❑ Develop process for managing community claims.
- ❑ Brief FSC on unit status and activity.
- ❑ Demobilization unit in accordance the plan.

Cost Unit

The Cost Unit provides all incident cost analysis. It ensures the proper identification of all equipment and personnel requiring payment; records all cost data; analyzes and prepares estimates of incident costs; and maintains accurate records of incident costs.

- ❑ Collect and evaluate cost data to establish an accurate picture of the incident costs.
- ❑ Create cost summaries, cost estimates, and cost saving recommendations.
- ❑ Prepare resources-use cost estimates for the Planning Section.
- ❑ Identify all equipment and personnel requiring payment.

Cost Unit Leader Checklist

- ❑ Review common responsibilities.
- ❑ Obtain a briefing from the FSC.
- ❑ Coordinate with FSC on cost reporting procedures.
- ❑ Collect and record all cost data.
- ❑ Develop incident cost summaries.
- ❑ Prepare resources- use cost estimates for the planning section.
- ❑ Ensure all cost documents are accurately prepared.
- ❑ Complete all records prior to demobilizations.
- ❑ Provide reports to the FSC.

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2.4.1.6 Command Posts

Centralize communications between Company emergency response personnel and external response agencies at the Command Post.

The Operations Section Chief and IC are responsible for selecting the location of the Command Post based on factors such as wind direction, areas of high ground and site access. The potential for plume development/migration, explosion and toxic effects of a spill must be taken into account.

Locate the Command Post:

- In the cold zone, e.g. a minimum of 90 m from a product release site or 800 m from a Natural Gas Liquids ("NGL") release site, or
- As determined by the IC

Check wind direction frequently to ensure wind shifts do not compromise the safety of the Command Post site.

If a vapor cloud is present or imminent, adapt the location of the Command Post to the specific circumstances of the emergency. For example:

- In isolated areas, it may be more appropriate to locate the Command Post several miles from the emergency site.
- In populated areas, it may be more appropriate to locate the Command Post close to the emergency site.

For evolving incidents, the Command Post may need to be moved to allow for expanding activities. This may include moving to a community center, hotel conference room or other location at the decision of the IC.

The Command Post must be clearly illuminated and identified by signage at the emergency site entrance (or just inside), visible to all entering the site. The Command Post must be attended at all times.

Command Post personnel must maintain periodic contact with anyone entering the site alone (e.g., to shut off valves, survey the area, evacuate the public).

The ICS 208 Site Safety Plan must be posted on the situation status board at the Command Post that identifies alert procedures, protective zones, evacuation routes and assembly.
Facilities required for oil spill response typically include:

- Staging sites;
- Decontamination and temporary waste handling sites;
- Accommodations; and
- Incident Command Post.

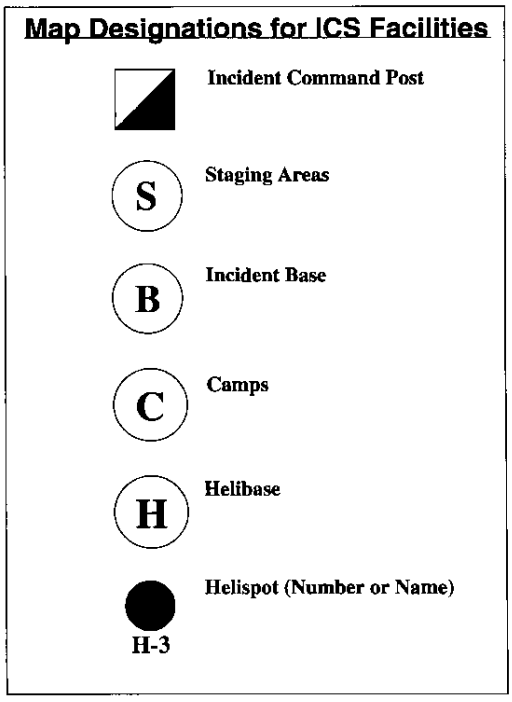
The Incident Command Post will be the initial spill response management command post for assessing the incident and communicating with the FRT and the IMT. Each operational plan (pipeline, terminal, marine) will identify pre-designated primary incident command post facilities and their locations, and options for other field incident command posts.

Each primary Incident Command Post will have the following minimum materials:

- Maps (sensitivity and operational atlases, Control Point tactical plans, geographical response plans;
- Situation status boards;
- Spill response plans (the operational General Oil Spill Response Plan and corresponding operational plan); and
- Communications systems, including radio, internet and telephone.

Depending on the complexity of response and the amount of resources, personnel and management required, multiple or expanded facilities may be required.

During a major incident, the FRT, IMT and participating government agencies would require a formal external communications plan and team. The joint information center would provide the venue for all key representatives in the response to prepare messages and communications for external parties jointly. The joint information center is generally located away from the command post but sufficiently near the center of activity. External affairs and press officers will be appointed to the joint information center, so that all messages will be approved by the command post before being issued.



2.4.1.7 Expanding Incidents / Unified Command

When an emergency crosses geographic areas, political boundaries or government departments, the IC may establish a unified command group that includes a representative from each jurisdiction (Federal, Provincial/State and local).

Depending upon the response situation and needs, the IMT may add specialized personnel, contractors and consultants to:

- Provide advice on operations and technical issues.
- Help in planning meetings.
- Interface with provincial and federal authorities, as needed.

The IMT will be responsible for:

- Safety
- Spill source control
- Community interface
- Wildlife activities
- Recovered material disposal
- Contract variations and business controls
- The overall management of the clean-up
- Corporate communications.

In the U.S., Federal and State agencies have the authority to exercise overall responsibility during a response. The designated federal monitoring officer monitors response operations undertaken by the IMT.

The environmental authority may recommend environmental priorities and provides expert environmental advice and services to the federal monitoring officer for review. The federal monitoring officer then passes this advice to the IC. The advice may cover a broad range of environmental matters, including:

- Weather conditions
- Spill fate and effects
- Sensitive areas.

Joint command may be established with a representative for the province/state working with the IC to establish response objectives and to approve incident action plans.

In the U.S., a Federal On-Scene Coordinator ("FOSC") designated by the Environmental Protection Agency or by the United States Coast Guard may support an emergency.

When federal and/or state agencies arrive on-scene to participate in managing a response action, the agencies and Enbridge will utilize a Unified Command structure to jointly manage the spill incident. In the Unified Command, decisions with regard to the response will be made by consensus and documented through a single IAP for each operational period. When a consensus cannot be reached, the FOSC has the ultimate decision-making authority under the National Contingency Plan ("NCP"). If in the rare occurrence this happens, the circumstances surrounding this action will be clearly documented in the IAP.

2.4.2 Site Security and Control

Security is necessary to protect the public and responders, prevent any additional damage due to sabotage, protect the equipment, and eliminate congestion at the work site due to unauthorized personnel. If there is a security incident, the Regional Emergency Response and Security Coordinator should be notified.

The priority of all Enbridge personnel in any emergency is protecting the public and responders. The public will be prevented access to an emergency site while there is any danger of explosion, fire, hazardous vapors, or other hazardous condition.

For example:

- Routes into the emergency site will be sealed off and a security perimeter established.
- Local police will be contacted to set up road blocks at all access points as applicable.
- Employees/contractors, police and/or security personnel can be used as well as physical barriers (e.g. barricades and reflective tape) to control access to hazardous areas.

Security measures need to be established early in the incident to provide the following:	
✓	Protect personnel from loss or damage and assets
✓	Ensure the safety of the general public
✓	Establish a perimeter (zone of safety) around the spill area
✓	Ensure the general public does not interfere with the spill response and clean-up operations
✓	Ensure access for personnel and equipment to the access point, staging area and Command Post

[redacted]

[redacted]

2.4.3 Hazard-Specific Field Response Team Considerations

Enbridge uses an all hazards approach to mitigate and respond to a variety of hazards and threats. General procedures for response considerations listed below should still be applied where required.

2.4.3.1 Objectives

We will prudently over respond to any incident with priorities in the following order:

People
- Ensure safety of employees & contractors located in the field
- Ensure safety of staff located inside regional buildings

Environment
- Take mitigative action to prevent impacts of an incident

Assets
- Where possible protect company assets located on regional property; tanks, pipelines, equipment, vehicles, etc.

Reputation

2.4.3.2 Safety

- Conduct hazard assessment
- Ensure proper documentation has been completed (Safe Work Permit, Field Level Hazard Assessment, etc.)
- Your safety first and then the safety of others
- Stay out of hazard zone
- If performing Recon approach up wind, uphill, up stream
- Determine the immediate hot zone
- Ensure proper levels of PPE
- Ensure PPE is in line with Site Safety and Health Plans (SSHP)
- Establish site control (hot zone, warm zone, cold zone and security).

2.4.3.3 Notifications

- Follow Notification Procedures (Notification section of this plan A2)

2.4.3.4 Isolate And Deny Entry

- Evacuate the immediate area
- Deny entry to the immediate area
- Ask others to help deny entry into the area
- If on the scene, ask agency resources to help deny entry into immediate area

2.4.3.5 Command Management

- First Responders assumes the role of the Incident Commander until transfer of command occurs
- Make an announcement to everyone on scene that you have assumed Command
- Set up mobile Incident Command Post (ICP) trailer up wind, uphill and upstream of the incident in the cold zone
- Establish a Staging Area up wind, uphill and upstream of the incident in the cold zone
- Begin assigning ICS positions as per Regional Incident Management Team
- Meet, greet and brief responding Agencies as they arrive at the ICP trailer
- Ensure Safety Officer begins and completes a Site Safety Plan

See section 2.4 for information on Enbridge's Response Management System

2.4.4 Hazard Specific Response Actions

Specific actions to mitigate and respond to following hazards are listed below:

2.4.4.1 Medical Emergencies

The three basic steps to follow in a medical emergency are as follows:

CHECK the person

- Does the person want your help? If the person is unable to answer, assume you have consent to give first aid
- Check the person's ABCs

CALL for assistance/additional resources

- If the person responds, find out if there is a need to call for additional help (e.g. 911, EMS)
- If the person does not respond, call for help.

CARE for life-threatening conditions first

- Reduce the risk of disease transmission by using protective equipment such as disposable gloves and a barrier device

2.4.4.2 Pipeline Release

In the event of a pipeline release carry out the following actions:

- Shut off flow
- Isolate leaking section of piping
- Notify Terminal Supervisor, Manager or designee
- Place a container under the leak and attempt to temporarily plug the hole
- Initiate spill containment (if outside containment area)
- Evacuate contents of line with suction pump or flush with water to remove remaining oil
- Block and purge affected equipment
- Initiate recovery/clean-up actions

2.4.4.3 Tank Failure

In the event of a tank failure carry out the following actions:

- Immediately stop work activity
- If safe, ensure dike drains are closed
- Notify Terminal Supervisor, Manager or designee
- Secure area
- Initiate response actions
- Shut off flow to tank
- Begin transfer of contents to other tankage.

2.4.4.4 Equipment Failure

In the event of equipment failure carry out the following actions:

- Shut off the flow and transfer pumps. Close header & tank valves
- Notify Terminal Operations/Manager
- Evacuate the area as necessary
- Drain remaining contents to containment tanks
- Secure area if safe to do so
- Tighten leaky valve or fitting, if safe
- Initiate response actions

On-Water Spill Surveillance Guidelines

- Spill surveillance should begin as soon as possible to aid response personnel with assessing spill size, movement and potential impact locations.
- Cloud shadows, sediment, floating organic matter, submerged sand banks, or wind-induced patterns on the water may resemble an oil slick if viewed from a distance.
- It is difficult to adequately observe oil on the water from a boat, dock or shoreline.
- Spill surveillance is best accomplished using helicopters or small planes. Helicopters are preferred due to their superior visibility and maneuverability characteristics.
- If fixed-wing planes are used, high wing types provide better visibility than low-wing types.
- Document all observations in writing and with photographs and/or videotapes.
- Describe the approximate oil slick dimensions based on available reference points (i.e. vessel, shoreline features, facilities, etc.). Use aircraft or vessel (if safe to do so) to traverse the length and width of the slick while timing each pass. Calculate the approximate size and area of the slick by multiplying speed and time.
- Record aerial observations on detailed maps.
- In the event of reduced visibility, such as dense fog or cloud cover, boats may be used for patrols and documenting the location and movements of the spill. Boats will only be used if safe conditions are present, including on-scene weather and product characteristics.
- Surveillance is also required during spill response operations in order to gauge effectiveness of response operations, to assist in locating skimmers and to continually assess size, movement and impact of spill.

Spill Volume Estimation & Methods

Early in a spill response, estimation of spill volume is required in order to:

- Report to agencies.
- Determine liquid recovery requirements.
- Assess manpower and equipment requirements.
- Determine disposal and interim storage requirements.
- In the event that actual spill volumes are not available, it may be necessary to estimate this volume (see flowchart)

Initial Estimates:

If available, information provided from the control center can be used to provide an initial estimate of the spill volume. The volume released should match the change in a cutoff inventory measurement.

Tanks:

If the leak source can be isolated to a tank, an initial leak volume estimate can be determined as:

Volume = the change in height of the tank x the volume per inch as found on the tank strapping table

Mainline Releases - An initial release volume can be calculated as:

Volume = (the mainline flow rate x the time to isolate) + the volume of drain-up from the release site to the next high point in the line

The volume release estimate can be verified by the mismatch in injection and delivery flow meters or tank volume change. In systems where ATMOS pipe is used for leak detection (i.e. gathering system), the estimated leak size is available in the user screen.

Land:

The following is a list of possible tools that can assist with determining a spill volume on land.

Transportation Spill to Land Estimation Tool
SCADA (Control Center calculation)
Tank Data Program

Leak on Land - Field Measurement:

To estimate the volume of a spill in a field location, the spill is segmented to a summation of area calculations. The volume of each area is calculated as the length x the width x the depth.

Conversions:

1 m3 = 6.29 bbls 1 ft3 = 0.178 bbls

1 in = 0.0254 meters 1inch = 0.0833 ft.

Water

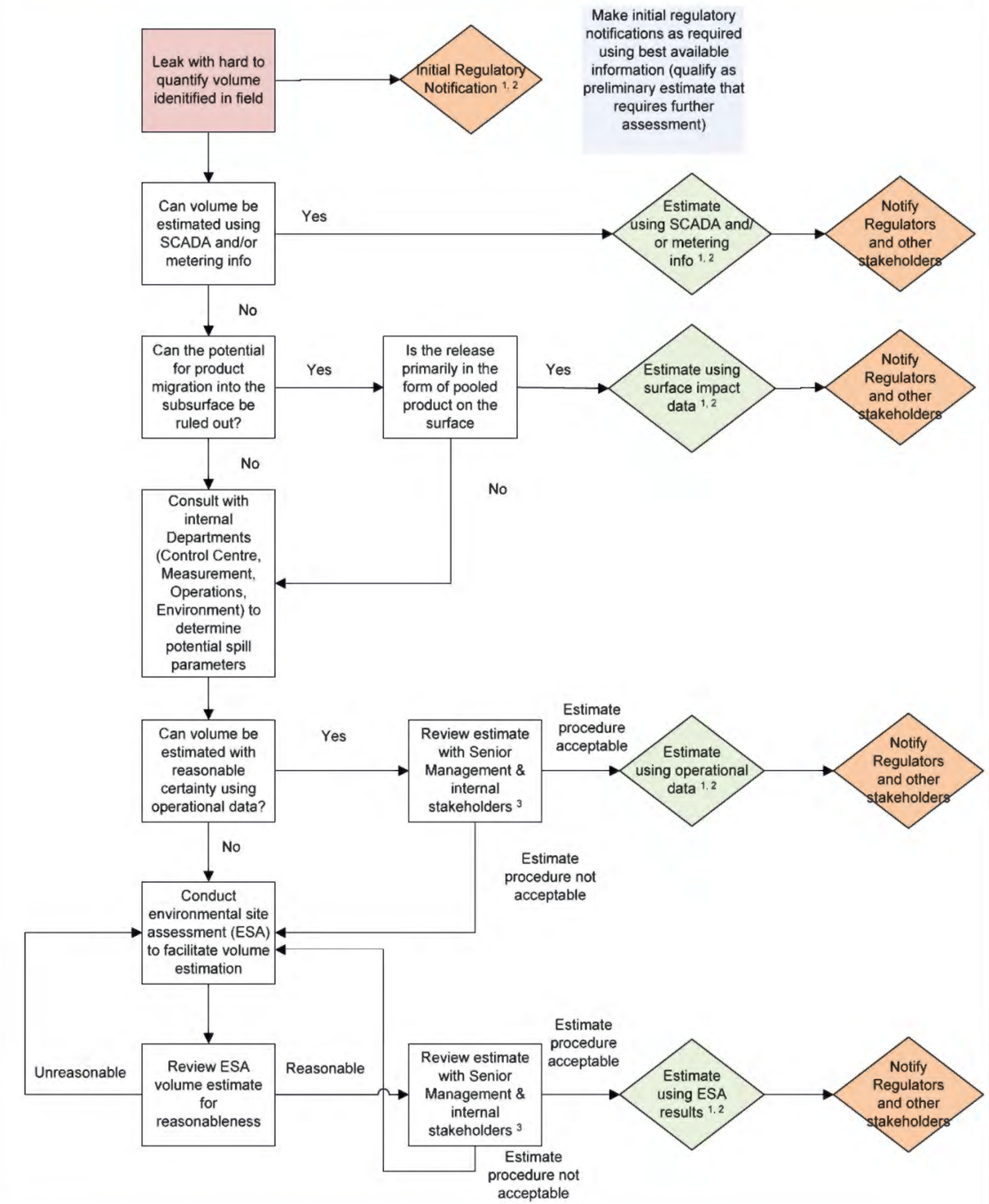
Visual observation and calibration with the A.P.I. Task Force on Oil Spill Cleanup, Committee for Air and Water Conservation's Spill Size Estimation Matrix Table. Methods which can be used to determine size and volume of a spill include, but are not limited to:

Vessel / line capacity formulas
Infra-red thermal imaging

Leak on Water - Visual Observation:

Using only visual observation to obtain an accurate volume estimate for a product on water is improbable. When possible, the estimate should be based on one of the above methods (i.e. tank or mainline release calculations with Control Center input). The National Oceanic and Atmospheric Administration (NOAA) does provide a job aid to assist with visually estimating the volume of a release on water, but it is more suitably used to subjectively characterize and describe the spill. It may be found at: http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/open-water-oil-identification-job-aid.html

Volume Estimates Flowchart



Notes:

1. Estimates must take uncertainties (such as extent of subsurface contamination, duration of leak, etc) into account.
2. In situations where there are significant uncertanties, it is preferable to estimate using a range (low case, likely case, and high case).
3. Internal stakeholders typically include Operations, Public & Government Affairs, Environment and Law.

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Estimating Spill Trajectories

Oil spill/NGL trajectories may initially be estimated in order to predict direction and speed of the slick movement. Trajectory calculations provide an estimate of where oil slicks may impact shorelines and other sensitive areas and provide an estimate of the most likely locations for protection, containment and recovery.

The following method may be used to predict spill movement:

- Computer trajectory modeling programs (including but not limited to):
  - World Oil Spill Model (WOSM)
  - OilMap
  - General NOAA Oil Modeling Environment (GNOME)

The Company will utilize internal subject matter leads (SML) with consultants as necessary to perform trajectory analysis and fate & effect modeling.

Input variables for proper modeling include, but are not limited to:

- Spill location, volume, and time of spill.
- Nature of the spill - continuous or single incident
- Wind speed & direction.
- Water movement (current) speed & direction.
- Water temperature.
- Atmospheric temperature.
- Characteristics of spilled material

This information can be obtained from many sources, including but not limited to:

- Reports from personnel at the spill site.
- Commercial weather services.
- NOAA.
- Internal company databases.
- Oil Map software.

Product Volume Tracking

An estimate of the amount of product recovered. In order to provide relevant information, a uniform procedure for sampling, analyzing and calculating the amount of product recovered from remediation activities at the release location should be established for the site.

Product volume tracking requires identification of each waste stream. Examples of typical waste streams from an oil release include:

- Soil and/or sediment impacted by the hydrocarbon product (hazardous and non-hazardous)
- Debris (e.g., impacted sorbents, boom, pads, plastic, PPE, vegetation)
- Water (hazardous and non-hazardous)

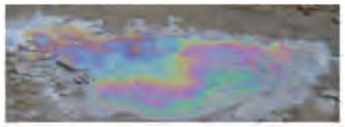
A sampling protocol will be established for each waste stream and will include:

- Number of samples required per volume of waste generated
- Laboratory analysis required
- Data reporting requirements

In the case of a crude oil release, the data provided by the waste stream disposal contractors (e.g. volumes converted to mass) and the validated analytical results (Oil and Grease in mg/kg) may be used as a basis to calculate the amount of crude oil recovered per waste load. These calculations will be maintained in a "Daily Waste Load Summary" spreadsheet.

Oil Volume Calculation Table

Visual Color

	Sheen (Silver/Gray)	Dark (or True)	Rainbow	Metallic	Transitional
					

	Sheen (Silver/Gray)	Rainbow	Metallic	Transitional	Dark (or True) Color
Approximate Thickness	0.04 to 0.3 μm	0.3 to 5.0 μm	5.0 to 50 μm	50 to 200 μm	>200 μm
Area	**Volume (liters)**				
100 m^2	0.004 to 0.03	0.03 to 0.5	0.5 to 5	5 to 20	>20
500 m^2	0.02 to 0.15	0.15 to 2.5	2.5 to 25	25 to 100	>100
1,000 m^2	0.04 to 0.3	0.3 to 5	5 to 50	50 to 200	>200
1,500 m^2	0.06 to 0.45	0.45 to 7.5	7.5 to 75	75 to 300	>300
2,000 m^2	0.08 to 0.6	0.6 to 10	10 to 100	100 to 400	>400
3,000 m^2	0.12 to 0.9	0.9 to 15	15 to 150	150 to 600	>600
5,000 m^2	0.2 to 1.5	1.5 to 25	25 to 250	250 to 1000	>1000
10,000 m^2	0.4 to 3	3 to 50	50 to 500	500 to 2000	>2000
50,000 m^2	2 to 15	15 to 250	250 to 2500	2500 to 10,000	>10,000
100,000 m^2	4 to 30	30 to 500	500 to 5000	5000 to 20,000	>20,000
150,000 m^2	6 to 45	45 to 750	750 to 7500	7500 to 30,000	>30,000
200,000 m^2	8 to 60	60 to 1000	1000 to 10,000	10,000 to 40,000	>40,000
400,000 m^2	16 to 120	120 to 2000	2000 to 20,000	20,000 to 80,000	>80,000
600,000 m^2	24 to 180	180 to 3000	3000 to 30,000	30,000 to 120,000	>120,000
800,000 m^2	32 to 240	240 to 4000	4000 to 40,000	40,000 to 160,000	>160,000
1,000,000 m^2	40 to 300	300 to 5000	5000 to 50,000	50,000 to 200,000	>200,000

	Sheen (Silver/Gray)	Rainbow	Metallic	Transitional	Dark (or True) Color
Approximate Thickness	1.6 x 10^{-6} to 1.2 x 10^{-5} inches	1.2 x 10^{-5} to 2.0 x 10^{-4} inches	2.0 x 10^{-4} to 2.0 x 10^{-3} inches	2.0 x 10^{-3} to 8 x 10^{-3} inches	>8 x 10^{-3} inches
Area	**Volume (gallons)**				
100 yd^2	0.003 to 0.007	0.007 to 0.11	0.11 to 1.1	1.1 to 4.4	>4.4
500 yd^2	0.013 to 0.03	0.03 to 0.56	0.56 to 5.6	5.6 to 22	>22
1,000 yd^2	0.026 to 0.07	0.07 to 1.1	1.1 to 11.1	11.1 to 44	>44
1,500 yd^2	0.039 to 0.10	0.10 to 1.67	1.67 to 16.7	16.7 to 66	>66
2,000 yd^2	0.052 to 0.14	0.14 to 2.2	2.2 to 22.2	22.2 to 88	>88
3,000 yd^2	0.078 to 0.20	0.20 to 3.3	3.3 to 33.3	33.3 to 132	>132
5,000 yd^2	0.13 to 0.34	0.34 to 5.6	5.6 to 55.5	55.5 to 220	>220
10,000 yd^2	0.26 to 0.68	0.68 to 11.1	11.1 to 111	111 to 440	>440
50,000 yd^2	1.3 to 3.4	3.4 to 55.5	55.5 to 555	555 to 2,200	>2,200
100,000 yd^2	2.6 to 6.8	6.8 to 111	111 to 1,110	1,110 to 4,400	>4,400
150,000 yd^2	3.9 to 10.2	10.2 to 167	167 to 1,665	1,665 to 6,600	>6,600
200,000 yd^2	5.2 to 13.6	13.6 to 222	222 to 2,220	2,220 to 8,800	>8,800
400,000 yd^2	10.4 to 27.2	27.2 to 444	444 to 4,440	4,440 to 17,600	>17,600
600,000 yd^2	15.6 to 40.8	40.8 to 666	666 to 6,660	6,660 to 26,400	>26,400
800,000 yd^2	20.8 to 54.4	54.4 to 888	888 to 8,880	8,880 to 35,200	>35,200
1,000,000 yd^2	26 to 68	68 to 1,110	1,110 to 11,100	11,100 to 44,000	>44,000

Table is based off of information in NOAA's *Open Water Oil Identification Job Aid for Aerial Observation*.

Discovery / Investigation

The Enbridge Responder will take action to mitigate the situation and prevent escalation if safe to do so. For the initial action it is important to remember:

- Don't try to control more area than can be effectively isolated and controlled ;
- The more time, distance and shielding between the Enbridge Responder and the released product, the lower the risk;
- Designate an emergency evacuation signal and identify muster points if emergency evacuation is necessary;
- Ensure appropriate PPE;
- Ensure compliance to safety and health policies for working alone
- Never permit response personnel to perform activities in areas where un-ignited gasses or vapors may accumulate; and
- Assess the hazards posed by the release (health, physical, chemical, other).

Immediately inform the Control Center and contact the QI/IC and provide a situation report. Assess the emergency level and activate the ICS based on need.
The most qualified Enbridge Responder on scene will assume the role of IC and direct on-scene response activities until otherwise relieved.

Identifying NGL Releases

Indications of an NGL release include:

- Cloud of steam or mist (caused by condensation and freezing moisture);
- Ice buildup on exposed pipe, or frozen ground around an underground pipe;
- Brown vegetation (indicates soil saturation);
- Yellow-stained snow (may indicate NGL accumulation under the snow); and/or
- Odor (which is the condensate fraction of NGL).

Standard Safety Precautions

- Ensure proper documentation has been completed (Safe Work Permit, Field Level Hazard Assessment, etc.)

- Determine the wind direction and approach cautiously from upwind.
- Park vehicles upwind in vapor-free areas and on high ground, if possible.
- Shut down vehicles when not in use.
- Eliminate or shut off all potential ignition sources in the immediate area.
- Explore the suspected release area only when wearing appropriate PPE; explore on foot, using the buddy system if possible.
- Do not carry ignition sources.
- Do not attempt to walk in product releases or vapors.
- Maintain constant or scheduled communication "buddy" or back-up personnel.
- Use intrinsically safe equipment (e.g., flashlights, two-way radios, gas detectors with audible alarms).

Assess the site for potential impacts, for example:

- Electrical lines down or overhead.
- Unidentified visible liquid or solid products.
- Visible vapors.
- Odors or breathing hazards.
- Fire, sparks or other ignition sources.
- Holes, caverns, deep ditches, fast water or steep slopes nearby.
- Local traffic.
- Ground conditions (dry, wet or icy).

Standard Safety Precautions, cont.

There is no one single barrier that will effectively combine both chemical and thermal protection. Also any type and level of impermeable protective clothing creates the potential for heat stress injuries. Remember that PPE is the LAST line of defense. Enbridge responders have been seriously burned and injured because they did not use their protective clothing and equipment.

Flammable liquids and gases give off a tremendous amount of radiant heat. Responders need to be aware and protect exposed areas as appropriate. No attempt should be made to extinguish a flammable gas fire. Always control or isolate the source of the leak as best as possible. If the source can't be isolated, then attempt to reduce the operating pressure of the pipeline. Try and permit the fire to self-extinguish, if possible and consume any residual fuel that may remain inside or outside the pipeline.

In addition to the standard safety precautions, when exploring outdoors use a gas detector to determine the presence of vapors. Natural gas is odorless and colorless. However, even if there is no odor present or there is an odor, a dangerous concentration may be present.

A combustible gas indicator (CGI) or a gas flame ionization detector (FID) could be used to determine the flammability hazards. Most CGIs and flammable gas detectors are set to alarm at 10% of the LEL of the gas upon which the sensor is calibrated (approximately 4000 ppm). In the natural gas industry, virtually all CGIs and flammable gas sensors are calibrated on pentane.

Natural gas may follow disturbed soil and enter grade areas around the pipe or other venues. The flammability range of natural gas is 4% to 15% in air by volume. Controlling ignition sources is a priority. Some examples you may not have thought about are:

- Doorbells
- Flashlights
- Telephones
- Burglar Alarms
- Heating Systems
- Vehicles and Trucks
- Pagers
- Light Switches
- Garage Door Openers

Since natural gas is extremely flammable the following should be considered:

- With any leak, always anticipate and expect that ignition will occur;
- Natural gas released inside buildings presents one of the greatest flammable hazards to emergency responders. Buildings full of natural gas should only be approached when needed with extreme caution and with a minimum number of personnel;
- Natural Gas / Methane (UN1971) is lighter than air and will rise;
- Do not close main valves or any other large transmission or distribution valves. This can lead to serious problems elsewhere in the natural gas pipeline system;
- Upon ignition, vapors may burn back to the source of gas; therefore make sure source is controlled;
- Vapors may cause dizziness or asphyxiation;
- Establish an effective and safe perimeter;
- Position all response support out of danger zone;
- Secure the scene and deny entry;
- If necessary, evacuate the public to a safe distance;
- Monitor the atmosphere, using multiple monitors where possible;
- Monitor for gas traveling away from source toward exposures;
- Control ignition sources (smoking, open flames, vehicles, internal combustion engines and motors);
- Do not operate electric devices such as switches, etc. Sparks could cause ignition; and
- If safely possible, ventilate the area, keeping in mind that during this process, if the flammable atmosphere is above the UEL the gas may pass back through the flammable range of 4% to 15% gas to air.

Prevent and Effective Management of Release

Small Release

If the released NGL is creating a local safety hazard, the NGL may then be ignited following the procedure for igniting NGL (see below). Where available, water fog may be used to break up and disperse small vapor clouds. Air movers are also an effective method of providing air circulation in confined areas or in buildings. Ensure they are safe (intrinsically safe) to use in that environment.

Large Release

If the NGL release is large or the NGL batch cannot be pumped past the release site, ignite the NGL following the standard procedure.

If the vapor plume is moving toward a populated area the area will be evacuated. If the vapor cloud cannot be ignited and repair procedures must begin, all equipment and vehicles will be located a minimum of 0.5 mi (0.8 km) upwind of the leak site. Continuously monitor the perimeter of the vapor cloud to detect any shift in the vapor cloud.

Isolating the Pipeline Section

When NGL is escaping uncontrolled, the affected pipe section will be immediately isolated by closing the appropriate sectionalizing valves.

Relieving Pressure

Use one of the following methods to relieve pressure at a pipeline section releasing NGL:

- If NGL is present at the blowdown valve, install a pipe discharge line and flare the NGL
- Transfer the product to a properly rated pressure containment vessel
- Install a pump complete with a discharge check valve to pump across the downstream sectionalizing valve
- If elevation does not provide a standing head in the isolated section, a transfer pump connected to the blowdown valve will be needed to fill a properly rated pressure containment vessel

Evacuation/Site Security

Due to the high flammability of NGL and the possibility of a vapor plume forming, it may be necessary to evacuate workers and visitors from the area, and to secure the site to protect the public and property.

Digging out a Release Site

Repair operations involving NGL are difficult, slow and hazardous. Pockets of gas may be trapped in the ground. In addition, if NGL has been leaking for some time, the condensate portion may have saturated the soil for a considerable distance around the site. Before beginning excavation or line repairs, active NGL releases are ignited or left burning.

When digging out an NGL release site, the following methods will be used:

- Ensure liquid has replaced the NGL at the release site;
- Follow appropriate Company standards on pipeline excavation;
- Ensure fire extinguishing equipment is immediately at hand;
- Consider obtaining external firefighting services and equipment;
- If no wind is blowing, use air movers to keep air moving across the worksite and away from workers;
- Continuously monitor air using a gas detector; and
- Constantly monitor wind direction

Igniting an NGL Plume

Before ignition of an NGL plume:

- Ensure the area where people are congregating is and remains a Cold Zone by the use of gas detectors;
- Ensure proper permits for firearm and ignition if applicable;
- The area of the vapor plume is maintained clear of people and vehicles and people are prevented from going near the area;
- The potential impact on adjacent facilities is evaluated;
- Every attempt to obtain clearance from Regional Management and the municipal fire chief has been made;
- Stage fire extinguishers nearby;
- Review flare pistol safe handling procedures (jurisdictional firearm rules apply); and
- Confirm that the available pistol is in working order, verify the number of flares available and ensure that they are the correct type for the firearm.

If contact with the QI/IC cannot be obtained quickly (e.g. no cell phone communication in area or no definite answer given) and there is an immediate risk to the public, the Enbridge Responder or a designee trained in NGL ignition may proceed with ignition.

If applicable have local fire department on-scene prior to any attempt at ignition. Review the Ignition Decision Flowchart on the next page.

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Ignition Decision Flowchart

Consider the Impact of Ignition on People, the Environment and Property.

Assess as follows:

If the plume remains un-ignited or the wind direction changes:

- Are responders or the public at risk?
- Is there a greater potential for property and/or environmental damage due to accidental ignition or explosion?

No →

Continuously review:

- Employee and public safety considerations.
- Existing site conditions and changes.
- Site control procedures.
- Monitoring of the Emergency Hazard Area.

Yes ↓

Review pre-ignition considerations:

- Consider safer alternatives (i.e. close valves, ventilate, etc.)
- Assess the area/perimeter of impact
- Proximity to residences, public facilities, towns or urban centers.
- Status of evacuations.
- Wind conditions and general topography.
- The potential for changes in weather and its implications.
- Transition from daylight to night darkness.
- Fire hazard after ignition in relation to adjacent area.
- Safety of all personnel in the Hazard Area.
- The presence of other underground or overhead utilities.De-energize if possible
- Will the situation worsen by burning seals out of adjacent valves or by starting pumps on fire?
- Controlled depressurization at other locations in the damaged section will reduce down time.

IS IGNITION THE MOST FAVORABLE CONTROL OPTION TO MINIMIZE THE HAZARDS?

No →

- Continue with release control procedures onsite.
- Review alternative control procedures.

Yes ↓

- Is there time to discuss the ignition decision with Regional QI/IC, Regional On-Call or People Leader?

No → Go to Ignition Procedures Flowchart.

Yes ↓

- Review decision to Ignite with Regional QI/IC, On Call or People Leader
- Determine post-ignition emergency service requirements.
- Assemble and brief Ignition Team.
- Go to Figure 2: Ignition Procedure Flowchart.

Ignition Procedure Flowchart

Onsite personnel will coordinate and lead the safe ignition of gas release.

PREPLANNING

Prior to ignition the Enbridge Responder will:

- Consider the path of the flair projectable
- Confirm that the area has been checked for habitation and that a complete evacuation of non-essential personnel has been completed.
- Isolate the Warm Zone / Hot Zone using manned roadblocks.
- Assemble ignition Team (2 people when possible).
- Ensure Ignition Team is protected with appropriate personal protective equipment.
- Review wind conditions (direction and speed), and erect windsock and streamer (if time permits).
- Monitor the area for combustible gas.
- Fully discuss ignition procedures.
- Check radio communications.
- Confirm whether overhead wires and electrical sub-stations have been de-energized.

APPROACH

Select position to attempt safe ignition that will:

- Allow for safe retreat.
- Provide cover from the initial flash.
- Be upwind of the gas leak 250m (820 ft) minimum from the edge of identified vapor plume for first attempt – this may be reduced in subsequent attempts as long as it is safe to move forward).
- Be in an area where no combustible gas is detected.
- Shoot for the outer edge of the cloud

ATTEMPT IGNITION

- Aim for the outer edge of plume. The center of the plume is too rich to ignite. Arcing shots or bounce shots can be used.
- Turn away from target to avoid heat flash.

Is the Plume ignited?

No ←

REPEAT IGNITION

- Continue approaching inwards using short distances and repeat (as long as safe to do so) until successful. Do not go closer than 100m (330 ft) from plume.

Yes →

POST IGNITION

- Advise Regional Management.
- Continue to monitor downwind for gas accumulations.
- Maintain security around immediate area.
- Assist emergency service crews with any fire control measures needed.

2.4.4.7 Enbridge Field Response Team Guide - Fire and Explosion

***Under no circumstances are Enbridge employees to engage in offensive fire-fighting tactics unless they are trained, certified, and have the correct PPE and firefighting equipment**

FIRE RESPONSE STANDARD FIRES

1. Look or call for help.
2. Notify fire department.
3. Activate fire alarm, if one is available.
4. Implement Emergency Procedures and Evacuation Plan.
5. If safe to do so, shut off sources of fuel to fire and facility electricity and eliminate ignition sources.
6. Shut down pumping only if essential to fight or control the fire to stop a leak.
7. Report fire to the control center and initiate reporting.

FOAM SYSTEMS COMPRESSOR BUILDINGS

If one of the UV/IR fire detection sensors in the compressor building detects a fire:

1. An emergency shutdown (ESD) condition is triggered, which automatically shuts down any operating units, isolates the station from the mainline, and vents all gas from the station.
2. A warning horn sounds.
3. The fire pump starts, drawing water from the concrete tanks and mixing it with the liquid foaming agent.
4. Foam is pumped from the control building to the compressor building, where it is ejected through the foam heads in the ceiling, and continues until it runs out or the foam system is deactivated. Do not use water to extinguish fires in or close to

FACILITIES WITH CO2 FIXED SYSTEMS

When a fixed system is triggered, an audible pre-discharge signal sounds as a warning that the system will activate within 30 seconds. In compressor unit enclosures, where there is no delay or audible alarm, there is a visual indication that the CO2 system is
activated.

1. As soon as fire is detected or audible pre-discharge signal sounds, evacuate protected area.
2. If extinguishing system does not trigger automatically, manually activate

MAINLINE FIRES

1. Assess fire.
2. Initiate fire response:
   - if fire is small and in early stages, and it is safe to do so, attempt to extinguish it using multiple portable extinguishers simultaneously, including 150lb or 350lb wheeled unit.
   - if fire is large or fully involved:
     - follow standard fire response procedure
     - notify nearby tenants, landowners and businesses
     - build a fire break around perimeter of fire if possible
   - if fire is beside a pipeline and pipeline is not leaking, continue pumping to keep pipeline cool.

STATION YARD PIPING OR MANIFOLD FIRES

1. Follow standard fire response procedure.
2. Attempt to contain fire with earth dikes, water fog or foam blanket.
3. Ensure all ignition sources (e.g., electrical short circuits) have been isolated or
   eliminated.
4. Extinguish fire with foam or dry chemical extinguishers.
5. Cool hot pipes and tanks with water, if possible.

SUMP FIRES

1. Assess fire.
2. Initiate fire response:
   - if fire is small and in early stages, and it is safe to do so, attempt to extinguish it using dry chemical extinguishers
   - to keep fire from spreading or reigniting, use available water to cool adjacent facilities or sump metal
   - if fire is large or fully involved, follow standard fire response procedure
3. Isolate sump and close lid if possible.

NATURAL GAS FIRES

1. Follow standard fire response procedure.
2. Close appropriate valves to isolate pipe section.
3. Consider blowing down pressure at a safe location.
4. Let fire burn down.
5. Do not extinguish a fire involving natural gas until fire burns down, flow of gas can be stopped and there is no chance of re-ignition.

PCB FIRES

1. Evacuate and secure area.
2. Call fire department or HAZMAT representative.
3. Ensure power is off to equipment containing PCB (e.g., transformer or capacitor).
4. If fire is within an enclosed building, close air inlets/outlets and access to building ventilation system.
5. Assist fire fighters and/or HAZMAT officials in extinguishing fire.

DIESEL STORAGE TANK FIRES

1. If possible and safe to do so, isolate diesel tank by closing remote or manually operated valves.
2. Remove any combustible materials (e.g., timber, rags) located near fire.
3. Allow tank to burn itself out.
4. Keep other installations in the vicinity cool with water spray if possible.

TANK FIRES

1. Activate Alarm
2. Evacuate area.
3. Notify the control center.
4. Notify fire department, if applicable.
5. From a safe distance, assess type of fire.
6. Implement emergency procedures and evacuation plan.
7. Activate terminal Pre-Fire Plan for:
   - First Responder actions
   - local fire department contacts and equipment list
   - Safety Data Sheets (SDS)
   - tank fire and tank datasheets

VEHICLE FIRES

1. Sound facility alarm (if applicable).
2. Assess situation.
3. If fire is small and in early stages, and it is safe to do so, attempt to extinguish using dry chemical extinguishers. Otherwise, withdraw and secure area.
4. Call emergency services.

Flash Fire, Vapour Cloud Explosion, Pool Fire

HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames
CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient. For mixtures containing alcohol or polar solvent, alcohol- resistant foam may be more effective

1. Do not extinguish fire unless flow can be stopped and it is safe to do so
2. Keep unauthorized personnel away.
3. Use water in flooding quantities as fog. Solid streams of water may spread fire.
4. Cool all affected containers with flooding quantities of water.
5. Apply water from as far a distance as poss ble.
6. If fire becomes uncontrollable or container is exposed to direct flame - consider evacuation

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Wildfire 2.4.4.8

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Actions Before/During a Wildfire:

- Follow FireSmart principals, continuously manage vegetation in and around facilities
- Identify evacuation staging areas in evacuation plans for use during a wildfire event
- Set up triggers for evacuation
- Establish air monitoring at all manned facilities impacted
- Ensure personnel are aware of evacuation alerts, evacuation routes and evacuation staging areas away from the wildfire.
- Identify methods of transportation for evacuation (air, ground, water)
- Obtain and maintain emergency contact lists
- Decrease the number of personnel onsite during a wildfire event
- Stay tuned to local media for updates on the wildfire conditions

Release Mitigation Actions

Actions that can be taken during a wild fire to mitigate a release include:

- Shutting down the lines, etc.
- Isolation of energized systems
- Reassess the need to further manage vegetation in and around the facilities and cut it back further if required
- Gain situational awareness of fire behavior, monitor fuel spread and wind direction to predict the how the hazard area may change
- Conduct fly-over patrol for fire behavior impact in coordination with local authorities and respecting any NOTAMs (notice to airmen)

Additional Notifications

- Safety Coordinator/Officer
- State/Provincial Wildfire and/or Forestry officials

Additional References

www.ready.gov/wildfires
www.firewise.org/wildfire-preparedness.aspx
www.redcross.org/prepare/disaster/wildfire
www.wildfire.alberta.ca/fire-smart-industry (see oil and gas)

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Earthquake 2.4.4.9

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Actions During an Earthquake

If outside:

- Stay outside, do not enter a building
- Stay away from buildings, utility wires and fuel and gas lines
- If outside, stay away from the exterior walls of a building
- Once on the open, get down low (to avoid being knocked down by strong shaking) and stay there until the shaking stops

If in an vehicle:

- Stop as quickly and safely as possible
- Move your vehicle to the shoulder or curb, away from utility wires and under or overpasses
- Stay in the car and set the parking brake
- Turn on the radio for emergency broadcast information
- Watch for hazards created by the earthquake

If inside:

- Do not evacuate outside, stay where you are until the shaking stops
- "Drop, Cover and Hold On"
    - DROP down onto your hands and knees
    - COVER your head and neck
    - HOLD ON to your shelter
- Do not get in a doorway as this doesn't provide protection from falling debris
- Stay away from glass and windows

Actions After an Earthquake

- Check for injuries, administer first aid if required and call for assistance
- Check for secondary hazards that may have resulted after the earthquake, keeping in mind aftershocks may strike at any time
- Extinguish small fires, shut of the water supply if broke pipes are leaking, shut off the electricity when damaged wiring threatens to spark fires, shut of the off the gas if you suspect a leak
- Assess Damage (establish a Damage Assessment Team). Access to buildings that have sustained structural damage should be prohibited until they can be assessed by a structural engineer.
- Evacuate building(s) when any of the above hazards are present or if there is structural damage

Release Mitigation Actions

The following actions could be taken during an earthquake to mitigate further damage:

- Isolate and/or shut down energized systems to anticipate aftershock and/or additional tremors
- **….others from Geohazard group…**

Additional Notifications

- Enbridge Geohazard Department
- Safety Coordinator/Officer

Additional References

- Earthquake Monitoring System, USGS: www.earthquake.usgs.gov/monitoring/
- www.getprepared.gc.ca/cnt/hzd/rthqks-en.aspx
- www.fema.gov/earthquake-safety-home

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2.4.4.10 Enbridge Field Response Team Guide - Flooding

Personnel Protective Actions

Prevent and mitigate damage to pipeline facilities and ensure public and environmental safety in areas affected by flooding:

Actions to Consider Before a Flood:

- Utilize experts in river flow, such as hydrologists or fluvial geomorphologists, to evaluate a river's potential for scour or channel migration at each pipeline river crossing
- Evaluate each pipeline crossing a river to determine the pipeline's installation method and determine if that method (and the pipeline's current condition) is sufficient to withstand the risks posed by anticipated flood conditions, river scour, or river channel migration. In areas prone to these conditions and risks, consider installing pipelines using horizontal directional drilling to help place pipelines below elevations of maximum scour and outside the limits of lateral channel migration.
- Determine the maximum flow or flooding conditions at rivers where pipeline integrity is at risk in the event of flooding (e.g., where scour can occur) and have contingency plans to shut down and isolate those pipelines when those conditions occur
- Evaluate the accessibility of pipeline facilities and components that may be in jeopardy, such as valve settings, which are needed to isolate water crossings or other sections of pipelines
- Preposition personnel and equipment in the event that emergency action is required including, shutdown, isolations or containment
- Extend regulator vents and relief stacks above the level of anticipated flooding as appropriate
- Coordinate with emergency and spill responders on pipeline locations, crossing conditions, and the commodities transported. Provide maps and other relevant information to such responders so they can develop appropriate response strategies

Actions to Consider During a Flood:

- Coordinate with other pipeline operators in flood areas and establish emergency response centers to act as a liaison for pipeline problems and solutions
- Deploy personnel so that they will be in position to shut down, isolate, contain, or perform any other emergency action on an affected pipeline
- Determine if facilities that are normally above ground (e.g., valves, regulators, relief sets, etc.) have become submerged and are in danger of being struck by vessels or debris and, if possible, mark such facilities with U.S. Coast Guard approval and an appropriate buoy
- Perform frequent patrols, including appropriate overflights, to evaluate right- of-way conditions at water crossings during flooding and after waters subside. Report any flooding, either localized or systemic, to integrity staff to determine if pipeline crossings may have been damaged or would be in imminent jeopardy from future flooding
- Have open communications with local and state officials to address their concerns regarding observed pipeline exposures, localized flooding, ice dams, debris dams, and extensive bank erosion that may affect the integrity of pipeline crossings

Personnel Protective Actions

Actions to Consider After a Flood:

- Following floods, and when safe river access is first available, determine if flooding has exposed or undermined pipelines because of new river channel profiles. This is best done by a depth of cover survey
- Where appropriate, surveys of underwater pipe should include the use of visual inspection by divers or instrumented detection. Pipelines in recently flooded lands adjacent to rivers should also be evaluated to determine the remaining depth of cover. You should share information gathered by these surveys with affected landowners. Agricultural agencies may help to inform farmers of potential hazards from reduced cover over pipelines
- Ensure that line markers are still in place or are replaced in a timely manner. Notify contractors, highway departments, and others involved in post-flood restoration activities of the presence of pipelines and the risks posed by reduced cover

Site Control & Safety

ADDITIONAL FLODDING SAFETY

- Watch for high water, be aware of sudden changing water conditions and/or increased flow rates

Asset Mitigation Actions

Actions that can be taken during a flooding event to mitigate a release include:

- Shutting down the lines, etc.
- Isolation of energized systems

Notifications

Notifications in addition to standard emergency notification procedure:

- Safety Coordinator/Officer
- GeoHazards Program representative

Additional References

www.getprepared.gc.ca/cnt/hzd/flds-en.aspx
www.ready.gov/floods
PHMSA Advisory Bulletin Volume 81, Number 11 issued Jan 18, 2016

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Actions Before/During a Tornado

- All employees must proceed immediately to the closest storm shelter. See building site maps and terminal evacuation map for shelter locations.
- If you are accompanied by visitors, bring them to your designated shelter.
- If you are caught outside with no shelter:
  * Lie flat in a nearby ditch or depression and cover your head with your hands. Be aware of the potential for flooding.
  * Do not get under an overpass or bridge. You are safer in a low, flat location.
  * Never try to outrun a tornado in urban or congested areas in a car or truck. Instead, leave the vehicle immediately for safe shelter.
  * Watch out for flying debris. Flying debris from tornados cause most fatalities and injuries.

Actions After a Tornado

- Check for injuries, administer first aid if required and call for assistance
- Check for secondary hazards that may have resulted after the tornado
- Extinguish small fires, shut of the water supply if broke pipes are leaking, shut off the electricity when damage wiring threaten to spark fires, shut of the off the gas if you suspect a leak
- Evacuate the building when any of the above hazards are present or if there is structural damage

Additional Notifications

- Enbridge Geohazard Department
- Safety Coordinator/Officer

Asset Mitigation Actions

Actions that can be taken during a tornado to mitigate a release include:

- Shutting down the lines, etc.
- Isolation of energized systems

Additional References

www.ready.gov/tornados
www.redcross.org/prepare/disaster/tornado
www.getprepared.gc.ca/cnt/hzd/trnfs-en.aspx

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2.4.4.12 Bomb and Security Threats

Security Classification

Security information is received from multiple sources. They include employees, industry, public, local policing, provincial/state, federal organizations, This intelligence, normally delivered via phone, email, mail and/or media channels is to be assessed by the Enterprise Security. Once information is examined, subsequent advisories or notifications are issued globally or to the regions affected.

Level 1 Security provides guidelines on minimum requirements for facilities. These include access control, fencing, gates, security guards, employee awareness, communications, facility lighting, intrusion detection, closed-circuit video and general policies/practices.

Level 2 Security provides direction in the event security measures require elevating. Changes typically include tighter perimeter control, visitor restrictions and increased perimeter checks.

Level 3 Security provides direction in the event that security measures require elevation based on a credible, imminent threat. Changes typically include Level 2 Security plus further personnel and vehicle restrictions, the use of security guards, more frequent and random perimeter checks, work restrictions and potentially operational restrictions.

Although most anonymous security threats are hoaxes intended to create an atmosphere of anxiety and panic in order to interrupt normal operational activities, all threats must be taken seriously.

Suspicious Activities

If any of the following are observed at company facilities, immediately notify the regional management/on-call person:

- Unknown personnel;
- Unidentified vehicles or vehicles operated out of the ordinary;
- Abandoned parcels or packages; and/or
- Suspicious activities (e.g., loitering).

[redacted]

[redacted]

Initial Response

Based on the threat assessment, consider the following initial response options:

- General facility evacuation (i.e., if the threat is confirmed or is considered credible and serious).
- Do not evacuate (i.e., if the threat is considered a hoax and not credible).

Bomb Explosion, Confirmed or Credible Threat

If (a) there is a bomb explosion, or (b) a security threat is confirmed or considered credible and serious, the regional management/on-call person is responsible to:

- Be pro-active and activate ICS.
- Evacuate workers and visitors from the area according to the regional Emergency Procedures and Evacuation Plan.
- Secure the area to ensure the safety of workers, visitors, and the public.
- If firefighting or other medical response becomes necessary, activate the ICS and mobilize response personnel and equipment.

The Company has developed procedures to be used in responding to bomb threats, identifying strangers in the work place, or other suspicious communications, some of which may be related to acts of terrorism or abductions.

Bomb Threat Call Procedures

Bomb threats or warnings will usually be given by telephone; anyone on site could receive such a call. [redacted] The use of the Bomb Threat Information Form is highly recommended. (See Section 4 – Forms)

- [redacted]
- Remain calm; [redacted]
- The supervisor will notify local authorities and company management. Police will want to speak with the person who received the call directly, thus should remain available to provide details to police.
- Secure access and evacuate the facility until the local authorities have cleared the facility for re-entry.
- A complete written record of each incident shall be retained by the supervisor and any photographs or physical evidence shall be preserved until further disposition of the incident by the company.
- The supervisor should ensure that a follow up investigation into the incident has been conducted and appropriate additional security measures, if any, have been established and any identified issues have been resolved.

Bomb Explosion, Confirmed or Credible Threat cont.

Bomb Threat Received by Hand Written Note (In addition to above procedures)

- Contact Supervisor immediately
- Handle note as minimally as possible.

Bomb Threat Received by E-Mail (In addition to above procedures)

- Contact Supervisor immediately
- Do not delete the message.

Unconfirmed Threat

If unable to confirm a security threat, the Regional Management/on-call person is responsible to advise employees, the police and the Control Center, and return to normal operations.

Suspicious Package

If a threat is received in the mail, (a) place all leffers and envelopes associated with the mail in a bag or large envelope, and (b) immediately notify the management/on-call person and local law enforcement.

Indicators of suspicious mail/packages might include:

- No return address, or a return address that does not make sense;
- Unusual rigidity, bulk, or irregularity;
- Handwritten or poorly typed addresses or labels;
- Peculiar odors, especially sweet smells;
- Excessive binding, taping, or tying material;
- Excess postage, lack of postage, or un-canceled postage;
- Mismatching postmark and return address;
- Foreign writing, address, or postage;
- Incorrect spelling of common names, titles, or places;
- Leaks or stains; and/or
- Protruding wires, string, or tape.

If suspicious mail/package is received in the mail or observed at company facilities:

- Immediately notify management/on-call person who in turn should notify local law enforcement.
- Leave the suspicious package in its present location.
- Do not open or physically handle the package, or allow anyone to touch or move the package.
- Do not use two-way radios and cellular telephones within 300 feet of the package.
- Do not cover the package.

Threat Assessment

Upon notification of a bomb threat or other security threat, the Regional Management/on-call person is responsible for:

- Assessing the seriousness of the threat;
- Determining the appropriate level of response;
- Ensuring the police have been alerted;
- To assess the seriousness of a threat, consider:
  - Is the information credible (e.g., identity of the caller, likelihood of facility access to place the explosive device)?
  - Is the information corroborated (e.g., were suspicious activities or personnel observed)?
  - Is the threat specific (e.g., detonation time, location, type of explosive device, intended target)?
  - What are the potential consequences?

Procedures

- Person in Charge – Call 911 and activate fire alarm.
- Eliminate all ignition sources.
- Begin Emergency Shut-Down if necessary.
- If person(s) down, refer to Medical Emergency Checklist.
- When fire is noticed at any facility, secure the source if safe to do so.
- Account for all personnel in the unit or area where the fire occurred.
- Evacuate all non-essential personnel, if necessary.
- Establish communications. Contact PIC.
- Search for and rescue missing or injured personnel as directed by appropriate authority.
- Use the buddy system.
- Ensure the Facility Operators control the process.
- Conduct air monitoring to ensure safety of personnel and appropriate PPE is required to respond. (For additional information, see the Site Safety and Health Plan and/or the Safety Coordinator.)
- Conduct initial firefighting by personnel (trained in the use of firefighting equipment and PPE), which may include use of monitors, deluge systems, and portable fire extinguishers.
- Coordinate evacuation of nearby residents with local responders.

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2.4.4.13 Radioactive Source Emergencies

In the event of an accident (e.g. fire, explosion), damage or any other incident that may affect the integrity of a radiation source (e.g. nuclear densitometers, either portable or fixed):

- Stop all activity in the immediate area
- Evacuate the immediate vicinity of the source head and clear personnel within a 6 meter radius perimeter around the source head
- Notify local Operations personnel and/or call the 24-hour emergency number shown on the warning sign
- Do not allow workers to re-enter the area until a radiation survey is completed by a radiation specialist
- If the device has sustained physical damage, contact a radiation specialist to leak test the device
- Follow company procedures for required initial notifications
- Notify the CNSC 24 hour Duty Officer and inform them of the incident at 613-996-0479.

2.4.5 Volunteer Plan

Normally, the Company will not hire and/or train volunteers for work on an oil spill response incident. Consequently, the Company will refer volunteers to appropriate provincial/state and/or local agencies or organizations that are set up to handle volunteers.

If the scale of the incident requires, the Company will confirm status of volunteer use under provincial/states legislation as some jurisdictions afford the same protections and regulations to volunteers as workers under Labour codes and regulations as volunteers are the responsibility of the company and as such are to be afforded the same level of health and safety training, tools and protective equipment in accordance with provincial/states legislation.

2.4.6 Environmental Response

This section provides key information related to environmental response activities associated with an emergency response to a release. The discovery of a historical release (i.e. a release that occurred in the past that is not considered to be a new or ongoing release) may result in the need to initiate some or all of the activities described in the following sections of this Environmental Response section.

As a precaution, the Company's Environment Unit should ensure the Federal and Provincial/State Environmental Regulatory Agencies have been contacted.

In the event of a release that requires an environmental response, the Environment Unit Leader ("ENVL") will immediately mobilize a preferred environmental consultant or consultants if necessary. The Company's Environment Department will staff the Environment Unit within the ICS organizational structure and at a minimum manage the following environmental related response activities:

- Spills to groundwater
- Monitoring / sampling activities
- Wildlife management
- Natural Resource Damage Assessment
- Environmental compliance
- Environmental documentation
- Site investigation and remediation
- Waste management.

2.4.6.1 Spills to Groundwater

Spills to bare ground may initially spread laterally on the surface and then begin migrating downward through the soil and, depending on a variety of factors and circumstances, could reach groundwater. During vertical migration the spill may spread laterally to some degree and a portion of the oil may be absorbed by the soil particles or become trapped in small pores eventually immobilizing the spill.

In general, oil may continue migrating downward until:	
✓	Residual saturation is reached (all of the oil is absorbed by the soil)
✓	Impenetrable layer (silt, clay, sandstone, rock) is encountered
✓	Groundwater is reached.

If a spill does reach groundwater, the oil may begin to spread radially but preferentially in the direction of groundwater flow. In general the following behaviors may occur:

- For higher groundwater velocities, a narrow plume elongated in the direction of groundwater flow may form; and/or
- For lower groundwater velocities the plume may broaden and assume a more circular pattern.

The timeline for this process may be days to months to years, depending on the circumstances of the spill, site specific hydrogeology, and remedial action taken.

The thickness of the plume or layer of oil may decrease with distance from the source. As with vertical migration, a portion of the oil may adhere to soil particles and become trapped in small or water filled pores eventually becoming immobilized.

Response Actions

In the event of a spill to bare ground, there are a number of actions that should be taken to assess the spill and, if groundwater is impacted, initiate recovery and limit the extent of impact.

Containment and Recovery

Rapid and efficient containment and recovery of free product reduces the potential for impacts to groundwater or other environmental receptors.

Initial Assessment

As for any spill, the initial response actions for spills to bare ground should include the assessment of health and safety hazards. See the SSHP as well as the following parameters.

Initial Assessment :	
✓	Spill Size and Product Accumulation (pooled oil) Depth
✓	Product Type (viscosity)
✓	Soil Type / Permeability
✓	Depth to Groundwater
✓	Estimated Response Time to Initiation of Recovery Actions.

Groundwater Impact Potential

Once the initial assessment is completed, the potential for the spill to impact underlying groundwater should be determined and generally requires some knowledge of the local hydrogeology including soil type/permeability and depth to groundwater, and groundwater flow direction. The common factors, along with selected examples, that contribute to a spill having a higher potential to impact groundwater are:

Higher Potential	
✓	Shallow Groundwater (generally <20 ft/6 m)
✓	Low Viscosity Oil (gasoline)
✓	Dry Soil with Low Oil Retention Capacity
✓	Highly Permeable Soils (sand, gravel, coarse grained mixed sediment)
✓	Large Volume of Groundwater
✓	Pooled Oil (creates hydraulic head that enhances penetration)
✓	Response Time (several hours before pooled oil recovery begins).

Supplemental Assessment

If the potential exists for a spill to reach groundwater, additional assessment activities should be conducted to confirm if groundwater has been impacted and, if so, assess the extent of impacts. The Company's Environment Unit will work with third party Environmental Consultants to conduct subsequent assessment activities and characterize any impacts.

These activities commonly include:	
✓	**Backhoes or Excavators** – excavate pits/trenches to determine penetration depth/groundwater impacts (limited to depths of 10–20 ft / 3-6 m)
✓	**Hand or Power Augers** – install borings to collect soil/water samples and which can also be used to install temporary wells (often limited to 15-30 ft / 4-9 m)
✓	**Direct Push Drilling Rigs** – install borings to collect soil/water samples and which can also be used to install temporary wells (often limited to 50-100 ft / 15-30 m)
✓	**Hollow Stem Auger ("HAS") or rotary drill rigs** - install borings to collect soil samples and wells for groundwater samples (limited to 100-500 ft / 30-150 m .).

The method used often depends on equipment availability, depth to groundwater and access to the spill area. For areas with shallow groundwater and good access, backhoes or excavators are often the most expedient means of determining penetration depth and groundwater impacts. If access is limited, such as in many tank farms, hand or power augers can be used to advance borings and collect samples. Direct push (Geo-probe) rigs can get into many areas but are generally truck mounted and will need road access. For areas with good access and where groundwater is deeper, hollow stem augers or rotary drill rigs are often the best equipment for subsequent assessment.

If groundwater impacts are confirmed or expected, additional sample points or wells should be installed by stepping out laterally from the spill area until the groundwater impact area is delineated.

It is important to note that if intrusive activities (excavation, drilling, hand augers, etc.) are necessary, additional air monitoring of the excavation and breathing zone around the activities should be conducted to ensure additional hazards are not created by the activities. In addition, if excavation activities are conducted and it is necessary for workers to enter the excavation, confined space permitting and/or shoring regulations may apply.

Care must be taken during the groundwater assessment not to create additional pathways for impact movement. The Environment Unit and third party Environmental Consultants will determine appropriate assessment methods and locations.

Recovery/Remediation

In the event a spill does reach groundwater, recovery or remediation activities may need to be conducted to mitigate the impacts. The impacts could be limited to low concentrations of hydrocarbons that have dissolved into the groundwater or, for larger spills, involve a layer of oil/product floating (separate, or non-aqueous, phase hydrocarbons) on the groundwater surface accompanied by elevated concentrations of dissolved (aqueous phase) hydrocarbons in the groundwater.

Common groundwater remediation techniques include:	
✓	Pump and Treat
✓	Excavation
✓	Bio-remediation
✓	Air Sparging/Vapor Extraction
✓	In-Situ Oxidation
✓	Monitoring Natural Attenuation

Selection of the most appropriate remediation technique will depend on a number of factors including product type, soil type, depth to groundwater, access, extent of impacts, current groundwater use, etc. The Company will utilize experienced remediation contractors to select and implement the most appropriate remediation technique(s)

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2.4.6.2 Monitoring/Sampling Activities

Air Monitoring & Groundwater

In defining an acceptable response to a spill incident, it is necessary to know certain physical and chemical characteristics of the spill material. If positive identification of the spilled material can be made without testing, product data may be obtained from a SDS found in Section 2.11.10, product specification information, and/or records of product physical and chemical properties.

Occasionally a spill may occur in which the spilled material is not readily identifiable. Typically, laboratory analytical data for spill event samples will not be instantaneously available during an emergency. Therefore, it is necessary and desirable to field-categorize oils as the product reacts and changes in the environment. Although varying widely in physical and chemical properties, oil products have common basic features that permit their grouping for predictive evaluation of environmental effects and determination of control actions. In addition, as petroleum products react and change (e.g., weather) when exposed to the environment, the laboratory data may not be representative of "real-time" conditions; rather the data may instead reflect the chemical characteristics of the spilled material(s) at the time of sample collection.

Monitoring of the following media may be required, depending on the nature and location of the release:

- Air
- Surface water
- Groundwater
- Sediment
- Soil.

Air Monitoring

Air monitoring will assess real-time hydrocarbon related compound concentrations and background air quality conditions as needed.

- A site action level will trigger the collection of confirmation analytical testing.
- Grab analytical air samples will determine air quality for general public and site workers

Groundwater

Groundwater samples will be collected as necessary from onsite public and private wells (residential, public utility, commercial and industrial) within a specified potential receptor zone around the site.

- State, province or county databases will be used to identify wells.
- Ground survey may also be conducted to ensure all area wells are identified.
- Groundwater samples will be analyzed for laboratory and field parameters that will be determined on a site specific basis.

Surface Water and Sediment

Surface Water

Surface water sampling and monitoring procedures will be utilized to assess visible product and/or hydrocarbon sheen that may affect navigable waterways as well as to document background conditions within the waterways.

- Surface water samples will be collected periodically at each sample location to establish concentration changes over time.
- Surface water samples will be collected at various depths within the water column periodically at each sample location to establish concentration changes over time.
- GPS coordinates will be collected for sample locations to assist in re-sampling.
- Location and frequency of the sample collection activities will be determined on a site-specific basis.
- Surface water samples will be analyzed for laboratory and field parameters that will be determined on a site specific basis.

Sediment

Sediment samples will be collected periodically to provide a baseline evaluation of current conditions and confirm the presence or absence of hydrocarbon impacts.

- Sample locations will be selected in the field based on topography, erosion features, water depth, water velocity and other indicators of sediment deposition.
- GPS coordinates will be collected for sample locations to assist in re-sampling.
- Shallow sediment samples (e.g. 0 to 2", approximately 50-mm depth) will generally be collected from areas of low potential for sediment deposition (i.e. straight, narrow and/or swiftly moving waterways).
- Deeper sediment samples (e.g. 0 to 6", approximately 150 mm depth) would generally be collected at locations with a high potential for sediment deposition (i.e. meandering, broad, and/or slowly moving waterways).
- Sediment samples will be analyzed for laboratory and field parameters that will be determined on a site specific basis.

Oil Sampling Procedures

Oil Sampling Procedures

The following is a list of procedures to follow when obtaining an oil sample:

- Always wear latex or rubber gloves when taking samples. This protects the sample from your hands and your hands from the sample.
- Use a laboratory supplied clear glass jar for sampling. Four or six-ounce jars are sufficient. Dip or lower the jar (using string if necessary) into the oil or oily water at about a 30° angle. This may allow more oil and less water to flow over the lip of the jar. Do not fill the jar more than 2/3 full.
- If sampling a small amount of light oil, such as a sheen, the oil can be collected more easily using a Teflon strip or sorbent pad that is transferred to a sample jar. Do not use anything containing organic fibers such as rag, cotton, cheesecloth, etc.; these may contaminate the sample, thus, giving improper analysis results.
- Decanting the water may be necessary to get enough oil for analysis. To decant, fasten the lid on securely and turn the jar over allowing the water to settle towards the lid. Then unscrew the lid just enough to allow the excess water to slowly escape.
- Fasten the lid after lining it with aluminum foil or Teflon to obtain a good seal.
- Affix the documentation label to the jar after wiping it clean and dry for the label to adhere. The label should identify the following information:
  - Date and time of sampling
  - Source/location of sample (be specific and include GPS coordinates)
  - Name of person who took the sample
  - Sample designation using a sequential numbering or lettering system
- Samples should be delivered to a laboratory immediately for analysis. If samples cannot be delivered immediately, they should be temporarily stored in a refrigerator or a cool dark place since exposure to heat and light could affect the analysis. Samples should be transported in waterproof containers or wrapped in enough sorbent material to soak up the entire contents of the jar in case of leakage or breakage.

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2.4.6.3 Wildlife Management

In the event of a release where impacts to wildlife are present or expected, the Environment Unit will immediately mobilize a preferred wildlife response consultant or consultants.

The following actions should be taken to minimize or prevent additional damages to wildlife:

- Immediately secure the release area and install appropriate wildlife deterrence measures to discourage wildlife access to the site;
- Conduct an initial assessment of wildlife and wildlife habitat in the area of the release to establish the potential for wildlife impacts;
- Avoid collecting any dead or injured wildlife in the impacted (oiled) areas until the wildlife response team arrives unless it impedes operations or is a threat to human health and safety. However, if there is concern that injured or deceased wildlife might attract scavenging or predatory wildlife to the impacted areas, consult with the Environmental Unit for a proper and authorized course of action.; and
- Contact the appropriate regulating authority. Wildlife rescue and rehabilitation can only be conducted with appropriate permits and under the direction of the ENVL.

A site specific wildlife management and response plan may be developed for the site. The plan may include, but is not limited to:

- Additional wildlife deterrence strategies.
- Wildlife response permitting and approval requirements.
- Wildlife assessment procedures.
- Wildlife capture and collection procedures.
- Wildlife cleaning and rehabilitation procedures.
- Documentation protocols.

Dead and injured wildlife found during response operations must be collected by trained and authorized personnel and properly documented. An inventory of dead, injured, rehabilitated and released wildlife needs to be maintained as a component of the Natural Resources Damage Assessment in the U.S.

2.4.6.4 Natural Resource Damage Assessment

Under the provision of CERCLA, the Oil Pollution Act of 1990, and numerous state statutes, cost recovery can be obtained from industry for natural resource damage caused by the release of oil or hazardous substances to the environment. Natural resources are defined as land, air, biota, groundwater, and surface water. A Federal or State government entity, an Indian tribe or another nation acting as a public trustee of a natural resource may file claims for damages to natural resources.

An assessment is often conducted by a third party used to determine damages for residual natural resource injuries. This assessment is often conducted by the public Trustee, the potential responsible party or both. During the assessment, the injured natural resources are

identified, the extent of the injury is quantified and the extent of the economic damage resulting from the loss of services provided by the resources is determined. In addition, the assessment also determines the cost of restoration or replacement of the injured natural resource.

The assessment contains injury to natural resources and the loss of "services" (i.e., physical and biological functions provided by the resources) as a result of the petroleum release. If issues are anticipated, the type and condition of the natural resources before being impacted by the release will be determined by collecting soil and water samples as soon after the release as possible. These samples should be collected from areas that are threatened by spreading product, areas recently impacted by the product, and in the area of the release. Listed below, in descending order of importance, are locations typically sampled after a hydrocarbon release:

- River reaches immediately downstream (ahead) of the product plume (water and sediment samples).
- Wetlands and backwaters adjacent to and downstream of the product plume.
- Areas freshly affected by the release.
- The area adjacent to the release location (source area samples).
- Upstream areas unaffected by the release.

Over the course of the response actions, the above locations may be re-sampled to evaluate the following:

- Changing extent and severity of impacts.
- Fate and degradation of the hydrocarbon product over time.
- Changing site conditions.

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2.4.6.5 Environmental Compliance

Environmental compliance includes, but is not limited to, preparing and submitting permit applications and completing associated field inspections. Permits and other compliance requirements that may be required during a release response may include but are not limited to:

- Permit applications to discharge treated water, trench dewatering, stormwater impacted by construction activities in some states, and/or hydro-test water.
- Applicable Wetland plans and permits.
- Joint Permit Application for wetland disturbances.
- Air Emissions Inventory and Air Permit.
- Local Authority Soil Erosion and Sediment Control Permit and associated inspections.
- Local Authority - Road and Drain Permits.
- Wildlife Research and Collection Permit.
- Wildlife Rehabilitation Permit.
- Application of the "Recovered Oil" vs. "Recovered Fuel" exemptions or exclusions.
- Clean Water Act emergency response actions.
- Permits for disturbance of areas outside of existing ROW.
- Other permits or approvals as necessary based on event circumstances.

Additional permitting or regulatory compliance requirements will be determined based on the regulatory jurisdiction and specific circumstances of the release.

2.4.6.6 Environmental Documentation

In addition to the general documentation activities listed in Section 2.0, Environmental documentation activities also include: collecting and retaining site records; initial site survey; preparation of site figures; and preliminary reporting. Site Records include:

- Field notebooks;
- Daily weather conditions (include wind direction and speed); and
- Initial release information including initial site survey:
    - Incident characteristics, product properties, extent of impacts, and site conditions
    - Protection Priorities for natural resources
    - Natural Resources that are affected or threatened by the release Wildlife injury and impacts
    - Sample locations and access areas

Regulatory Communication

- Records of all notifications should include: time, date, agency, telephone number, individual contacted, and a summary of the conversation.
- Establish and distribute a general Enbridge email account to be copied on all emails to Federal, State/provincial and local regulators.
- Maintain a log of on-site agency personnel.

Photos

- Include a description of the site and the cardinal direction the photographer is facing when the photograph was taken. Photographs taken with a camera equipped with or synchronized to a GPS are preferred.

Laboratory Data

- Establish a standard protocol for sample naming at the onset of the response (e.g. Sampling and Analysis Plan).
- Establish quality assurance (“QA”) and quality control (“QC”) objectives.
- Includes Chain of Custody and laboratory reports.
- Collect and maintain post-processed GPS data of sample locations.

Site information to produce early in the project may include:

- Site/Release Location and Site Access (i.e. release location, extent of visual impacts, access roads, boat launches, boom deployment areas, safety zones, sign-in and security gates).
- Receptor Survey (may include: residential, commercial and industrial wells, residences, surface water intakes, and threatened and endangered species).

Preliminary reporting activities may include:

- Estimated volume of release
- Response activities
- Data presentation.

2.4.6.7 Site Investigation and Remediation

Site investigations will generally include determining the horizontal and vertical extent of the impacts. Equipment used to complete site investigation activities may include hand tools, drilling equipment and earth-moving equipment. Soil sampling for field screening and laboratory analysis may also be required.

Based on the results of the site investigation, a site specific remedial action plan may be prepared to address the impacts. The remedial action plan may include:

- Description of impacted areas
- Remediation criteria and end points
- Remediation methodology
- Approvals and permits required for remediation
- Site reclamation methodology.

2.4.7 Waste and Disposal

The management of the wastes generated in clean-up and recovery activities must be conducted with the following overall objectives:

Overall Objectives	
✓	Worker Safety
✓	Waste Minimization
✓	Minimization of Environmental Impacts
✓	Proper Disposal
✓	Minimization of present and future environmental liability

2.4.7.1 Waste Management and Disposal Plan

The ENVL may develop a site specific waste management and disposal plan including procedures for the proper storage, characterization, treatment, disposal, and record-keeping of hydrocarbon impacted soil, water and investigation-derived waste.

Standard Operating Procedures ("SOPs") should be established within the site specific waste management and disposal plan and may include, but are not limited to:

- Maintaining a waste management hotline to provide a resource for contractors for larger releases that have multiple staging or waste accumulation areas.
- Establishing uniform procedures for segregation of waste and proper disposal of non-regulated and regulated solid waste.
- Providing guidance on waste sampling activities.
- Staging areas and temporary storage requirements.
- Waste manifesting and record keeping requirements.
- Site specific disposal plan for each waste stream.
- Handling and personnel safety requirements for different waste streams

To minimize handling of waste materials suitable and sufficient containers will be used.. Waste streams will be segregated based on their physical characteristics and disposal requirements. New waste will not be combined with waste previously characterized and designated for disposal unless directed to do so by the ENVL. Waste suitable for product recovery or remediation will be kept separate from other waste.

Wastes will be transported from the collection site to designated secure areas (lined, bermed temporary storage areas, lined pits, or tanks) for storage, segregation, characterization, permitting, and packaging. Once this process is complete, the waste will be transported to an approved facility for required disposal or recycling.

Oil will be recovered and processed for re-use or disposal as appropriate. Water recovered may be disposed of or treated as per local requirements.

Transportation of waste from the release site will comply with applicable government regulations. Any waste or recovered product removed from a release site will be properly documented The ENVL, in consultation with the IC, will establish appropriate procedures for waste tracking and transportation.

The following steps will be taken prior to transporting wastes for disposal:

- Waste characterization is complete and accurate;
- Waste manifests are complete;
- Procedures for tracking waste volumes and product recovery are in place;
- Regulations are being met for transportation (e.g., placards are available and in place and carrier is registered, manifest completed, etc.); and
- Transport equipment is suitable for materials being transported (e.g., sealed bins/end gates, adequate tarps, tank trucks suitable for liquids, and drivers have adequate training).

Waste disposal methods vary depending on the type of waste, release location, regulatory requirements, etc. These disposal options will be dependent upon laboratory analysis per current Federal, Provincial, State and local regulation.

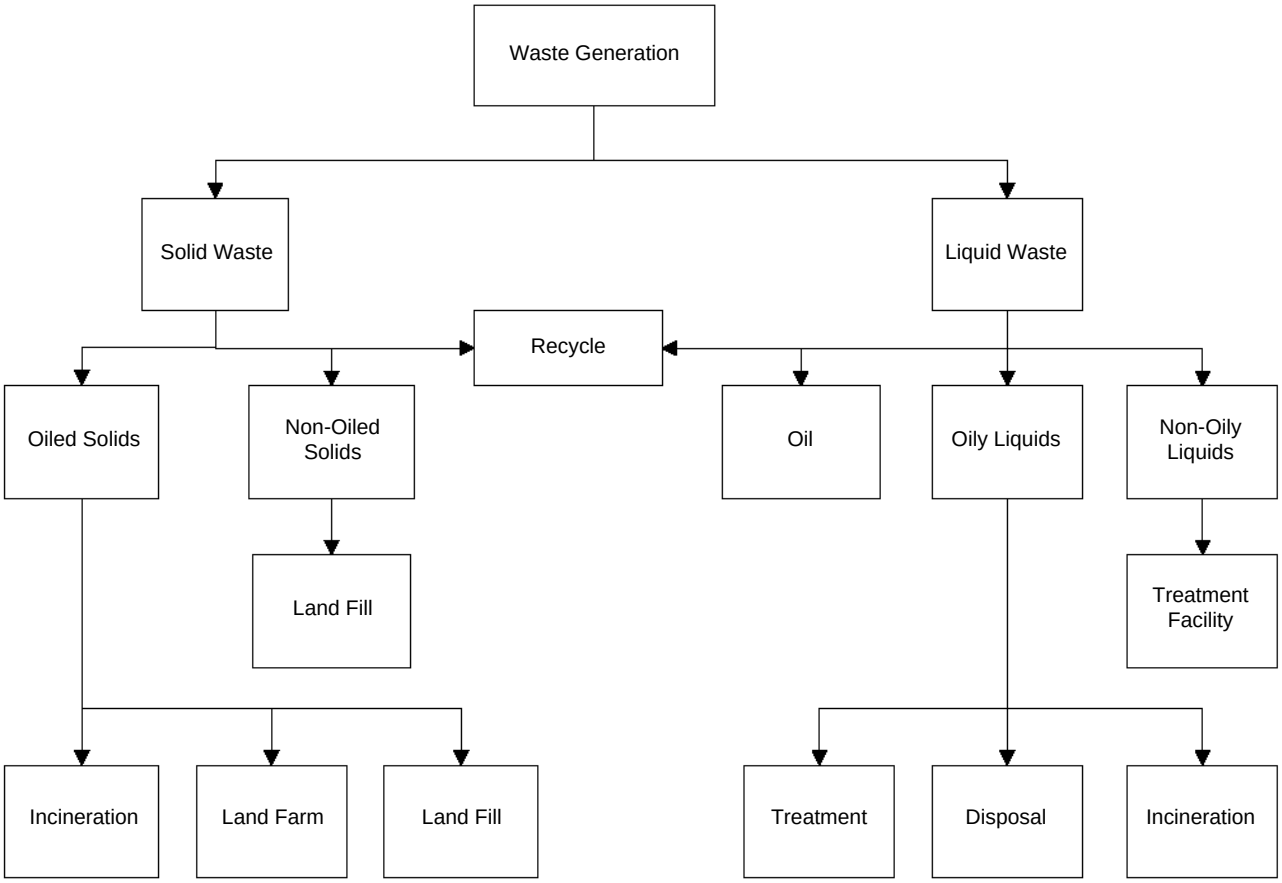
Disposal options may consider remediation techniques such as the following to help minimize waste volumes and recover resources (soil, water, oil):

- Phase separation (gravity, centrifuge)
- Bioremediation
- Thermal desorption
- In-situ burning
- Chemical oxidation
- Water treatment (chemical treatment, filtering).

In the U.S. the Company has contracted with USCG Certified third party contractors for each ICP Geographical Response Zone (or Region). In Canada the Company would use the services of a spill cooperative. Contact information and response capability for each third party contractor can be found in that particular ICP Geographical *Annex 2*.

The third party contractors that Enbridge has signed contracts with in each Geographical Response Zone are capable of being on site and ensuring planned temporary storage and waste disposal activities are accomplished within the appropriate response times. They will provide sufficient temporary storage to ensure sufficient capacity is available to respond to a significant release, or a Worst Case Discharge (“WCD”) in the U.S.

General flowchart for Waste Management Guidelines



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Temporary Storage Methods

PRODUCT								
Containment	OIL	OIL/WATER	OIL/SOIL	OIL/DEBRIS (Small)	OIL/DEBRIS (Medium)	OIL/DEBRIS (Large)	Capacity (Imperial)	Capacity (Metric)
Drums		X	X	X			.2-.5 yd^3	0.15 - .38 m^3
Bags			X	X	X		1-2 yd^3	0.76 – 1.52 m^3
Boxes			X	X	X		1-5 yd^3	0.76 –3.82 m^3
Open Top Rolloff	X	X	X	X	X	X	8-40 yd^3	6.11- 30.58 m3
Roll Top Rolloff	X	X	X		X	X	15-25 yd^3	11.47 – 19.11 m3
Vacuum Box	X	X					15-25 yd^3	11.47 – 19.11 m3
Frac Tank	X	X					500-20,000 gal	1892.7 – 75708 litres
Poly Tank	X	X					200-4,000 gal	757.08 – 15142 litres
Vacuum Truck	X	X	X				2,000-5,000 gal	7570.8 – 18927 litres
Tank Trailer	X	X					2,000-4,000 gal	7570.8 - 15142 litres
Barge	X	X					3,000+ gal	11356+litres
Berm, 4 ft	X	X	X	X	X	X	1yd^3	0.76 m3
Bladders	X	X					25-1,500 gal	94.63 – 56778.1 litres

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2.4.8 Site Safety and Health Plan

The Site Safety and Health Plan (ICS 201-5) and the individual Site Safety Plan (ICS 208) are designed to comply with regulations. This form is intended to describe the health and safety guidelines developed for the Response Operations to protect personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes. The procedures and guidelines contained herein are based upon the best available information at the time of the form's preparation. Specific requirements will be reviewed and revised when new information is received and/or conditions change.

Enbridge staff and contractors must also complete a Safe Work Permit and Field Level Hazard Assessment. Specifically, this plan provides procedures and information for program administration, safety and health considerations, PPE, medical surveillance, training, site control, industrial hygiene monitoring programs, personal hygiene, sanitation, housekeeping, and the decontamination of both PPE and equipment utilized during the response.

The ICS Forms for the SSHP (ICS 201-5) and the individual Site Safety Plan (ICS 208) are located in *Section 4 - Forms*.

Scope

All spill response and remedial activities will be conducted in accordance with established SSHP guidelines. These guidelines will cover all personnel, including Company employees, contractors, subcontractors, government employees, and visitors. The SSHP guidelines will be modified as necessary and where applicable will address multiple work environments. A copy of this program will be posted at all command operations and field centers for the duration of the clean-up activity. It is the responsibility of each manager, supervisor, and crew foremen to be familiar with these guidelines and to assist in their implementation.

The SOFR will develop and administer a SSHP during an emergency response. The SOFR will be available to answer questions regarding effective implementation of the Plan. The SOFR is supported by other staff personnel advisors in Safety, Industrial Hygiene, Occupational Medicine, Environment, Operations and Legal.

It is the responsibility of the SOFR to monitor the effectiveness of the SSHP and to contact the appropriate support staff for guidance if changes to the plan are necessary.

All employees who may be directly involved in any clean-up activities are required to be trained and briefed on the contents of this SSHP. All employers and employees will be responsible for adhering to all Federal, Provincial/State, Territorial, and local regulations for clean-up activities.

The SOFR will enforce compliance with the SSHP and all other requirements. Any deviations from the stipulated requirements, which are noted, will be communicated to the responsible contractor. The contractor will take immediate actions to correct the deviations and prepare a written corrective action report to be submitted to the SOFR.

Daily Safety Briefings

Site safety meetings/briefings are the first step in maintaining site safety. Daily meetings will be held at the start of each shift to ensure that all personnel understand site conditions and operating procedures, to ensure that PPE is being used correctly, to address worker health and safety concerns and to communicate any changes or revisions to the SSHP.

Briefing Attendance Forms shall be used to document that individuals working in the Response Operation recognize the hazards present and the policies and procedures required to minimize exposure or adverse effects of these hazards.

Visitor Policy

All visitors must provide all required training documentation prior to arrival on-site, if applicable. The IC and/or OSC and the PIO must approve the site visit and shall coordinate visitor tours with the Operations Section. The SSHP shall designate a safe route through the site and away from the on-going operations, and provide for visitor escorts. The OSC and applicable Branch or Group Supervisors must be notified when the visitor approaches. The OSC and applicable Branch or Group Supervisor shall acknowledge visitor arrival onsite and communicate approval of the visit and acceptable duration for the visitor onsite.

Visitors are expected to dress appropriately for a field visit and when required, shall wear PPE consistent with that used by workers at the Response Site.	
✓	All visitors shall be approved prior to arrival at the Incident Site
✓	All visitors are to be escorted.

Site Safety During Initial Response

During the initial response phase the ICS 201-5 form is used to ensure hazards are identified, evaluated and managed, and this form would also typically be used for a Tier 1 response. The ICS 201-5 form can be supported by attachments such as the released product SDS and other topics at the SOFR's discretion. In a Tier 1 response the SOFR transitions to the ICS 208 form at their discretion.

A Tier 2 response would typically use the SDS, ICS 208 Site Safety Plan and Medical Plan forms. The ICS 201-5 form would be in place until the Tier 2 Safety team transitions from the Tier 1 team. The ICS 208 form can also be supported with attachments of SDS and Medical Plan, at the SOFR's discretion. SDSs are located in *Annex 1*. When a response has transitioned to the "project phase" the project is usually turned over to a remediation project group. At that time a SSHP will be developed based on Company safety and health procedures.

Site Name:	Date / Time:
A. Monitoring Plan	
✓	Air monitoring at the spill site and surrounding areas will be done to ensure site worker and community safety
✓	Air monitoring will be done during work shift site characterization and on each work shift during clean-up activities until results indicate no further monitoring is required
✓	All monitoring done at the clean-up site will be documented and the data maintained by qualified personnel on site
✓	Monitoring will be done: ❒ During initial site entry and characterization ❒ If a new potential inhalation hazard is introduced into the work area ❒ During clean-up activities, on each work shift ❒ If a new task is begun that may involve potential inhalation exposure.
✓	Noise monitoring and radiation monitoring will be conducted as needed.
B. Initial Site Monitoring	
✓	Instruments will be calibrated prior to and following use
✓	Monitoring will be done during initial site entry. The monitoring will include checking for: ❒ Oxygen (O_2) deficiency using a direct reading oxygen meter; ❒ Flammable atmospheres (%LEL) using a combustible gas indicator; ❒ Benzene, hydrogen sulfide, hydrocarbons, and combustion by-products (SO_2, CO), as needed, using direct-reading instruments, colorimetric indicator tubes, and/or other valid methods
✓	All monitoring will be documented (*Section 4 – Forms, ICP 006: Site Monitoring Template).*
C. Post-Emergency Monitoring (On-Going)	
✓	Monitoring for benzene, hydrogen sulfide, hydrocarbons and combustion by-products will be done during each work shift on an on-going basis, as needed. Repeat initial site monitoring if any significant changes occur (i.e., temperature increases, more material released, wind direction changes, etc.)
✓	Checks for oxygen deficiency and flammable atmospheres will be made if confined spaces are encountered, or as required
✓	Exposure monitoring shall be done as necessary. Personnel samples will be collected under the direction of the industrial hygiene personnel. Samples will be analyzed by an accredited laboratory
✓	Results of site monitoring will be made available to site workers' supervisors for informing all affected employees. Results will be made available to the Command Center for review by regulatory agencies.

Site Safety and Health Plan Evaluation Checklist

See *Section 4 - Forms* for the SSHP Evaluation Checklist

2.4.9 Protection, Containment and Recovery

Containment and recovery refers to the techniques or methods that can be employed to contain and recover petroleum spills on water or the containment of petroleum spills flowing overland. Recovery of terrestrial spills is often very similar, or uses the same techniques as shoreline clean-up.

The following considerations should be taken into account when planning or implementing containment and recovery operations:	
✓	Containment is most effective when conducted near the source of the spill where the oil has not spread over a large area and the contained oil is of sufficient thickness to allow effective recovery and/or clean-up
✓	Feasibility of containment is generally dependent on the size of the spill, available logistical resources, implementation time, environmental conditions and the nature of the terrain in the spill area
✓	Aquatic (water) containment is primarily conducted through the use of oil spill containment booms (this is a key tactic to control the water discharged from upstream impoundments)
✓	Skimmers are usually the most efficient means of recovery of aquatic spills, although pumps, vacuum systems, and sorbents can also be effective, particularly in smaller waterways
✓	Terrestrial (land) containment typically involves berms or other physical barriers
✓	Recovery of free petroleum from the ground surface is best achieved by using pumps, vacuum sources, and/or sorbents.

2.4.9.1 Inland Spill Response Tactics Guide

The Inland Spill Response Tactics Guide is a Company document that can be used as a quick reference by Enbridge first-on-scene responders to select and implement containment and recovery tactics with Enbridge-owned oil spill response equipment during the first 72 hours of the response. It illustrates a collection of inland spill tactics that can be applied using obtainable resources to a liquid products release until additional resources and personnel arrive on site.

2.4.9.2 Isolation Protection Technique Selection *(Conversion table located in Section 1: Plan Introduction Elements)*

Technique	Description	Logistical Requirement Examples	Use Limitations[1]	Potential Environmental Effects
Techniques on Land				
A. Containment / Diversion Berms (3.1.1 in Tactics Guide)	Construct berm (clay, bales, rocks, logs, etc.) ahead of advancing surface spill to contain spill or divert it to a containment area.	Typical Equipment Backhoe, bulldozer, front- end loader, or set of hand tools, plastic sheeting	• Steep Slopes • Porous substrate	• Disturbance to environmental sensitivities, surface soils and vegetation • Increased oil penetration
B. Interceptor Trench (3.1.2 in Tactics Guide)	Excavate ahead of advancing surface/ near-surface spill to contain product. Cover bottom and down gradient side with plastic.	Typical Equipment* Backhoe or set of hand, tools, misc. plastic sheeting	• Slope • Depth to near-surface flow	• Increased oil penetration • Disturbance to environmental sensitivities, surface soils and vegetation • Potential to impact groundwater
C. Trench and Berm (3.1.3 in Tactics Guide)	Construct berm with soil from the trench to stop the advancing surface spill and allow for recovery.	Typical Equipment* Backhoe, bulldozer, front- end loader, or set of hand tools, plastic sheeting	• Steep Slopes • Porous substrate	• Increased oil penetration • Disturbance to environmental sensitivities, surface soils and vegetation • Potential to impact groundwater
Techniques on Small Watercourses				
D. Stream Dam, Board Weir, Siphon Dam (3.2.1, 3.2.2 and 3.2.5 in Tactics Guide)	Construct dam in drainage course/stream bed to block and contain flowing oil. Cover with plastic sheeting. If water is flowing, install inclined pipes during dam construction to pass water underneath.	Typical Equipment* Backhoe, bulldozer, front- end loader, or set of hand tools, plastic sheeting roll, Aqua Dam, PVC Pipe, Water Gate, Tiger Dam, Water Bag	• Upstream storage capacity	• Increased oil penetration • May increase suspended sediment • Downstream water flow may be restricted

2.4.9.2 Cont. Isolation Protection Technique Selection *(See Conversion table located in Section 1: Plan Introduction Elements)*

Technique	Description	Logistical Requirement Examples	Use Limitations[1]	Potential Environmental Effects
E. Culvert Block (3.2.3 in Tactics Guide)	Block culvert opening with plywood, sediments, sandbags, etc. to prevent oil from entering culvert	Typical Equipment* Misc. hand tools, misc. plywood, sandbags, etc.	• Upstream storage capacity	• Increased oil penetration • Downstream water flow may be restricted
F. Filter Fence - Debris Exclusion (3.2.4 in Tactics Guide)	Install fence barrier upstream of containment site to exclude debris/ice	Typical Equipment* Misc. hand tool, fence posts, fence, fasteners, chicken wire, support lines, bales, sorbent materials etc.	• Soft substrate	• Minor substrate disturbance at post an anchor points
G. Sorbent Barriers / Filter Fence (3.2.4 in Tactics Guide)	A barrier is constructed by installing two parallel lines of stakes across a channel, fastening wire mesh to the stakes, and filling the space between stakes with sorbents.	Typical Equipment* Misc. hand tools, boats, fence posts, wire mesh, sorbents, misc. fasteners, support lines, stakes, etc.	• Soft substrate	• Minor substrate disturbance at post and shoreline anchor points • High substrate disturbance if boat is not used

2.4.9.2 Cont. Isolation Protection Technique Selection *(See Conversion table located in Section 1: Plan Introduction Elements)*

Technique	Description	Logistical Requirement Examples	Use Limitations[1]	Potential Environmental Effects
Techniques on Larger Watercourses				
H. Diversion Booming (3.3.3.3 in Tactics Guide)	Boom is deployed from the shoreline at an angle towards the approaching slick and anchored or held in place with a work boat. Oil is diverted towards the shoreline for recovery.	Typical Equipment* Hard boom, ground tackle, rope, shoreline anchors, boats, winches.	• Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy oiling at shoreline anchor point
I. Narrow Channel Containment Booming (3.3.3.3 in Tactics Guide)	Boom is deployed across entire river channel at an angle to contain floating oil passing through channel.	Typical Equipment* Hard boom, ground tackle, rope, shoreline anchors, boats, winches.	• Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy shoreline oiling at downstream anchor point
J. Exclusion Booming (3.3.3.1 and 3.3.3.2 in Tactics Guide)	Boom is deployed across or around sensitive areas and anchored in place. Approaching oil is excluded from area.	Typical Equipment* Hard boom, ground tackle, rope, shoreline anchors, boats, winches.		• Minor substrate disturbance at anchor points

2.4.9.2 Cont. Isolation Protection Technique Selection *(See Conversion table located in Section 1: Plan Introduction Elements)*

Technique	Description	Logistical Requirement Examples	Use Limitations[1]	Potential Environmental Effects
Spills on Water (Cont'd)				
K. Deflection Booming (3.3.3.1 and 3.3.3.2 in Tactics Guide)	Boom is deployed from the shoreline away from the approaching slick and anchored or held in place with a work boat. Oil is deflected away from shoreline.	Typical Equipment* Hard boom, ground tackle, rope, shoreline anchors, boats, winches.	• Onshore winds	• Minor substrate disturbance at anchor points • Oil is not contained and may contact other shorelines
L. Boomvane Deploying Containment / Recovery / Deflection modes (3.3.3.4 in Tactics Guide	BoomVanes can be used in place of ground tackle when deploying deflection and diversion booms.	Typical Equipment* Hard boom, BoomVane(s), control line, mooring line,boom/shore anchor line, tow bridles, shore anchor pins.	• Requires access to multiple shoreline locations (if mooring line is to be used) • Requires a current (not for still water use)	• Minor disturbance of trees if using as an anchor point.

[1] In addition to implementation and accessibility.
* Need to establish a safe perimeter and follow safety precautions as appropriate before work begins.

2.4.9.3 Technique Selection - Terrestrial Containment and Recovery

The primary factors influencing terrestrial containment and recovery are:	
✓	**Size** - Most containment techniques provide limited storage capacity
✓	**Slope** - Berms and barriers are generally less effective on steeper slopes and accessibility may be limited
✓	**Surface texture** - Rough surfaces with natural ridges and depressions enhance containment and should be taken advantage of whenever possible
✓	**Substrate permeability** - Highly permeable sediments will allow rapid penetration of oil into the substrate, thus complicating containment and recovery
✓	**Topographical Low Areas**- Oil is more easily contained and recovered if it is flowing within, or can be diverted to, existing natural or manmade topographical ow areas
✓	**Stormwater runoff** - Runoff generally requires the containment of larger quantities of liquids and complicates oil recovery.

2.4.9.4 Technique Selection - Aquatic Containment and Recovery

Selection of an appropriate aquatic containment, protection and recovery technique depends on a number of factors including:	
✓	**Current speed** - Surface currents greater than 1 knot may cause boom failure or entrapment of oil beneath the boom when the boom is deployed perpendicular to the current. Boom can be deployed at varying angles as the current increases.
✓	**Water depth** - Depths greater than 50 ft. (approximately 15 meters) can complicate hard boom anchor placement within the watercourse. Shorelines anchors or systems such as the Boom Vane may be more applicable. Depths less than 2 feet (approximately 0.5 meters) can preclude effective hard boom use. Sorbents booms, dams and filter fences may prove more effective.
✓	**Channel width** - The width of a watercourse will determine if multiple sections of boom need to be installed. One method is cascading boom. Single boom deployments across wider channels have a greater change of failing as current ncreases.
✓	**Slick thickness** - Recovery effectiveness with pumps/vacuum systems and skimmers decreases as slick thicknesses decline, becoming relatively ineffective for very thin slicks or sheens
✓	**Shoreline access** - Obstacles (rocks, debris, man- made structures, etc.) in the water or steep or densely vegetated shorelines could restrict access and present safety and operational problems
✓	**Anchor points** - Soft bottom substrates can complicate boom anchor placement
✓	**Safety** - High currents and winds, large obstacles, and other dangerous conditions could present safety hazards and preclude certain techniques.

The objective of mechanical recovery is to collect contained and concentrated oil and to transfer the oil to temporary storage for subsequent disposal. Spills that have been contained by a boom, a berm or in slots cut into the ice can be skimmed and pumped into storage containers.

Three basic types of skimmers are used to recover oil:

- Advancing systems
- Stationary skimmers
- Vacuum units.

There are a wide variety of collection principles and varieties of stationary skimmers on the market than can be used to recover hydrocarbons from the water's surface. Operational factors such as oil viscosity, oil thickness, debris and temperature all play an important role in the selection of skimmers. At temperatures below freezing, some skimmers may become difficult to operate; however, the additions of steam, hot water and pressure, or heating elements are sometimes considered for skimmers in cold conditions.

Vacuum systems can include portable vacuum units or a conventional vacuum truck with skimmer head. Vacuum systems can provide a quick and effective method for recovering large volumes of oil and are capable of handling a wide range of fluid viscosities and a variety of small debris.

The third party contractor(s) contracted to respond in each ICP Geographical Annex is capable of being on site and ensuring spill containment activities are accomplished within the appropriate response times. They will provide sufficient containment equipment to ensure enough capacity is available to respond to a WCD.

Submerged Oil Content

Enbridge's tariff restricts products on the system to those with a density of no greater than 940 kg/m^3. All products shipped on the Enbridge system are floating oils, including dilbits and synbits.

Enbridge acknowledges that, under certain environmental conditions, some fraction of oil released into a water body may become entrained in the water column, submerge or sink, in freshwater environments. This is the case irrespective of whether the product is diluted bitumen, synthetic crude, or conventional crude oil. This is not an issue that is limited to diluted bitumen.

The primary mechanisms that may lead to submergence of petroleum products are:

- Product weathering – Note that products shipped on the Enbridge system are not expected to weather to a point whereby their density would be greater than the density of water;
- Interactions and agglomeration onto sediment, which can cause oil particles to submerge or sink; and
- Emulsification due to the dynamic properties of the water body.

Practically, for products shipped on Enbridge's system, it is the combination of these processes, under specified environmental conditions, that can lead to the submergence and sinking of a percentage of released products.

Unless the released product has a density (specific gravity) > 1.0 (typical for freshwater), it will not sink en-mass.
Enbridge considers the potential for sinking and submerged oil as part of our Emergency Response

plans and in the execution of such plans. In the unlikely event of a spill, Enbridge would work with regulatory agencies to determine the appropriate response and remedial actions given the specific circumstances of the event. This would include decisions regarding the short term emergency response as well as subsequent clean-up of residual amounts of submerged oil.

2.4.9.5 Shoreline and Terrestrial Operations

In the event that terrestrial sediments do become oiled or that petroleum contacts and becomes stranded on a shoreline, clean-up operations should be undertaken to minimize the environmental effects of the petroleum. In most instances, clean-up efforts are not subject to the same time constraints as containment, recovery and protection operations. As a result, better planning and greater attention to detail is possible. The exception is where there is a high probability of stranded oil becoming remobilized and migrating to previously unaffected areas. In this case, clean-up operations should be implemented immediately.

The following items should be considered in detail:	
✓	Documentation of the location, degree and/or extent of oil conditions
✓	Evaluation of all environmental, cultural, economic, and political factors
✓	Clean-up technique selection
✓	Mitigation of physical and environmental damage associated with clean-up technique implementation
✓	Cost-effectiveness.

The shoreline or terrestrial area that has been impacted by the oil conditions can range from those that require immediate and thorough clean-up to lightly oiled areas where no action may be the most environmentally sound option. The amount and type of oil, shoreline sensitivity, substrate or shoreline type, intrusive nature of the direction flow, and shoreline exposure are all factors that influence technique selection in spill clean-up operations.

Clean-up Technique Selection – Shoreline

The selection of an appropriate shoreline clean-up technique is primarily dependent on the following factors:	
✓	**Substrate type** - Finer-grained sediments typically require different techniques than coarse- grained sediments
✓	**Oil conditions** - Heavier oil conditions and larger areas may require more intrusive or mechanical methods, whereas lighter conditions may not require clean-up. For example, removing lighter oils in a marsh area or wetland may cause more harm to the environment than allowing for natural attenuation and biodegrading
✓	**Shoreline slope** - Heavy equipment may not be usable on steeper shorelines
✓	**Shoreline sensitivity** - Intrusive techniques may create a greater impact than the oil itself
✓	**Oil penetration depth** - Significant penetration can reduce the effectiveness of several techniques.

Clean-up Technique Selection - Terrestrial

The selection of an appropriate terrestrial clean-up technique is primarily dependent on the following factors:	
✓	**Size** - Larger areas will generally require the use of mechanical methods, whereas manual techniques can be used for smaller areas
✓	**Slope** - The use of heavy equipment is often restricted to gradually sloped areas, and manual techniques may be considered unsafe if used on steep terrain
✓	**Soil type** - Softer soils may reduce traffic ability for heavy equipment and the presence of coarser sediments and bedrock could also restrict the use of certain types of heavy equipment
✓	**Oil penetration depth** - Significant penetration may require the use of heavy equipment or special subsurface remediation techniques
✓	**Impacted groundwater** - Special subsurface remediation techniques would likely be required.

The third party contractor(s) contracted to respond are located in each ICP Geographical, *Annex 1* **Facility and Locality Information**. Contractors are capable of being on site and ensuring spill recovery activities are accomplished within the appropriate tiered response times. They will provide sufficient recovery equipment to ensure enough capacity is available to respond to a WCD.

Non-Mechanical Response Options

Non-mechanical response options that could be used in responding to a spill include:	
✓	Chemical treatment
✓	Bioremediation
✓	In-situ Burning

Although the physical control and recovery of spilled oil is advocated and generally preferable, such actions are not always possible or practical because of factors including safety hazards, remote spill sites, or weather. When non-mechanical methods can result in reduced human hazard or environmental damage, consideration of their use is appropriate, but will require regulatory approval. In Canada, chemical treatments / dispersants are not a commonly used tactic on inland waters and would only be considered after consultation and approval from the Department of Fisheries and Oceans and other applicable regulatory stakeholders.

2.4.9.6 - In-Situ Burning*

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In-Situ Burning

When mechanical recovery (the preferred cleanup method) of spilled oil is not feasible, in-situ burning may be considered. Since burning presents a potential safety and air pollution hazard to the surrounding area, approval from appropriate regulatory agencies is required.

In-situ burning alters the composition of the spilled oil by eliminating anywhere from 90 to 99 percent of the original volume of oil provided it is controlled within a fire resistant boom or other containment system. A portion of the original oil is released into the atmosphere as soot and gaseous emissions. Solid or semi-solid residues typically remain following a burn, but are relatively easy to retrieve. They can be further reduced in volume through repeated burns, and ultimately are collected and removed from the environment.

Evaluation

The potential for implementing a successful burn depends upon the knowledge and experience of those responsible for the assessment of the spill situation. Review of the spill conditions, together with the spill checklist below, will ensure that the safety issues, the benefits, and the environmental impacts will have been examined carefully. While steps may be taken to move critical equipment into position for a possible burn, there should be no attempt to ignite spilled oil without prior authorization from federal, provincial, state and local authorities.

Decisions to burn or not to burn oil in areas considered case-by-case are made on the basis of the potential for humans to be exposed to the smoke plume, and pollutants associated with it.

Before a spill is ignited, consider:

- Regulatory permits and approvals specific to the jurisdiction.
- Appropriate monitoring is in place to limit particulate matter (PM-10) exposure to 150 micrograms per cubic meter.
- Smoke plume modeling is done to predict which areas might be adversely affected.
- Aerial surveys are also conducted prior to initiating a burn to minimize the chance that concentrations of mammals, turtles and birds are in the operational area and affected by the response.
- Sampling should be conducted for particulates at sensitive downwind sites prior to the burn (to gather background data) and after the burn has been initiated. Data on particulate levels are recorded and the data and recommendations are forwarded to the Incident Commander (IC).
- Oil type, amount and condition
- Environmental conditions
- Availability of personnel and equipment
- Timing
- Human safety
- Danger of fire spreading
- Presence of explosive vapors
- Damage to nearby habitats that may prolong natural recovery

Request Process

When a request for an in-situ burn is made:

- Complete In-Situ Burn Plan Template Form ISP 009 in *ICP Core Section 4* or similar plan required by federal, state/provincial, or local authorities.
- The burn must be outside the corporate city limits, except as deemed necessary by the local fire department.
- Wind direction should move the smoke away from the city and/or populated areas.
- Burning must be at least 300 feet (91.44 meters) from any adjacent properties.
- Burning should commence during daylight, typically between the hours of 9:00 am and 5:00 pm
- Wind speed should be between 5 mph (8.052 km/h) and 20 mph (32.19 km/h) (IAW SMART recommendations) during the burn period.
- Burn should not be conducted during persistent atmospheric thermal inversions.

Approval Procedure

Approval for the burn must be obtained from regulatory bodies and other stakeholders. The approval required to conduct a burn will vary in each jurisdiction.
The following steps outline the approval process for in-situ burning as a tactic:

- The need to carry out an in-situ burn is documented in the Incident Action Plan (IAP) during the Planning Cycle process
- Incident Commander (IC) reviews and approves the request
- The request is then presented to the Federal On Scene Coordinator (FOSC) for approval

The FOSC will submit a burn plan to Federal, State and local regulatory entities/ stakeholders for review and approval.

National Response Center (NRC) 1-800-424-8802

Plume Dispersion Modeling

It may be necessary to conduct a plume trajectory assessment to determine public health safe distances for the following reasons:

- Regulatory requirements to obtain approval to burn;
- Local terrain not (relatively) flat;
- Winds exceed 18 km/hr (11 mph);
- Close proximity of populated areas (for safety or perception considerations); and
- The presence of unusual meteorological conditions (e.g., temperature inversions)

The wind speed of 35 km/hr (21 mph) is the established upper limit at which fire behavior can be predictably managed.

The Planning Section will be responsible for leading the assessment. The Incident Commander must be made aware of the assessment results and the results should be included in the In-Situ Burn Plan.

Monitoring

In-situ burning generates a thick black smoke that contains primarily particulates, soot, and various gases (carbon dioxide, carbon monoxides, water vapor, nitrous oxides and Polycyclic Aromatic Hydrocarbons (PAHs). The components of the smoke are similar to those of car exhaust. Of these smoke constituents, small particulates less than 10 microns in diameter, known as PM-10, are considered to pose the greatest risk to humans and nearby wildlife. Due to these potential affects monitoring before, during and after a burn may be required.

In general, SMART* is conducted when there is a concern that the general public may be exposed to smoke from the burning oil. It follows that monitoring should be conducted when the predicted trajectory of the smoke plume indicates that the smoke may reach population centers, and the concentrations of smoke particulates at ground level may exceed safe levels. When impacts are not anticipated, monitoring levels will be decided by the federal, provincial, state and local authorities.

The Planning Section will be responsible for developing and monitoring plan for the burn.

Execution of in-situ burning has a narrow window of opportunity. It is imperative that the monitoring teams are alerted of possible in-situ burning as soon as burning is being considered, even if implementation is not certain. This increases the likelihood of a timely and orderly burn process.

The monitoring teams are deployed at designated areas of concern to determine ambient concentrations of particulates before the burn starts. During the burn, sampling and continues readings are recorded both in the data logger of the instrument and manually in the recorder data log.

After the burn has ended and the smoke plume has dissipated, the teams remain in place for some time (15-30 minutes) and again sample for and record ambient particulate concentrations. During the course of the sampling, it is expected that the instantaneous readings will vary widely. However, the calculated time-weighted average readings are less variable, since they represent the average of the readings collected over the sampling duration, and hence are a better indicator of particulate concentration trend. When the time-weighted average readings approach or exceed the Level of Concern (LOC), the team leader conveys this information to the IC.

Monitoring activities should be directed by the Operations Section Chief in the Incident Command System. It is recommended that a "group" be formed under the Operations Section that directs the monitoring effort. (e.g. Monitoring Group Supervisor.) Under each group there are monitoring teams, at a minimum, a monitor and assistant monitor. An additional team member could be used to assist with sampling and recording. The teams report to the Monitoring Group Supervisor who directs and coordinates team operations, under the control of the OSC.

Communication of monitoring results should flow from the field (Monitoring Group Supervisor) to those persons in the ICS/UC who can interpret the results and use the data. Typically, this falls under the responsibility of a Technical Specialist on in-situ burning in the Planning Section of the command structure. The Technical Specialist or his/her representative reviews the data and, most importantly, formulates recommendations based on the data. The Technical Specialist communicates these recommendations to the ICS/UC. Quality assurance and control should be applied to the data at all levels. The Technical Specialist is the custodian of the data during the operation, but ultimately the data belongs to the ICS/UC incident files. This will ensure that the data is properly archived, presentable, and accessible for the benefit of future monitoring operations.

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* *These procedures reflect Special Monitoring for Applied Response Technologies (SMART) protocols developed by NOAA, US Coast Guard. Full procedures for reference can be found online at http://response.restoration.noaa.gov/sites/default/files/SMART_protocol.pdf*

Product Characteristics

- Refined product or light to medium crude will burn more efficiently and leave less residue to recover compared to heavier product.
- Heavy oil requires longer heating times and a hotter flame to ignite than lighter oils.
- Product that is relatively fresh (less than 3 days of exposure to the elements) will burn more efficiently than weathered product.
- Burn duration can be estimated based on known burn rates for different product types (e.g., 2.54 mm [1/10 in.] of depth per minute for medium crude).

Soil and Vegetation

Saturated or frozen soil reduces the extent of damage to vegetation root systems and the soil itself in the containment area and in adjacent areas. Optimally, the containment and adjacent areas are mostly un-vegetated (e.g., dry roads, ditches, dry streambeds or idle cropland).

Herbaceous vegetation (grasses) are generally more fire tolerant to an adjacent burn than woody vegetation (shrubs and trees), although some woody species are also fire tolerant. In highly vegetated areas, fire behavior and forestry specialists will be consulted.

Dormant vegetation (not during the growing season) is generally more resilient in response to fire damage than actively growing vegetation. Dense wetland vegetation can slow evaporation and prolong the opportunity for conducting an efficient in-situ burn.

Wetlands

A layer of water at least 2.5 mm to 10 mm (1 in. to 4 in.) under the burning product will provide protection to vegetation root systems from heat stress.

Burned areas should not be flooded with high water levels shortly after the burn. The remaining root systems require oxygen from the air or soil until new vegetation emerges.

On Water (Open or in Broken Ice)

Adequate containment (fire boom, ice or bank) is necessary and must result in the minimum product depth of 2 - 3 mm (1/10 in.) to sustain ignition. Wave conditions that exceed 3 ft. can result in higher emulsion rates and splash-over, and make containment difficult. A sustained burn is more likely if the oil has not significantly emulsified (<25%).

In broken ice, ice coverage of 30% to 65% will slow slick movement and may allow for a slow moving semi-contained burn attempt. Ice coverage of 65% or higher may provide natural containment via floes touching. Currents higher than 1.4 km/hr (0.9 mph) may result in the escape of product under the ice.

Ignition Considerations and Procedures

After completing all the pre-burn requirements, the in-situ burning program should be implemented, taking the following into consideration:

- every in-situ burn is unique.
- ignition procedures vary with prevailing conditions and available equipment, manpower and emergency resources.
- on-going monitoring of local weather conditions and long range forecasts are essential to permit a safe and effective burn.

Determine the appropriate time and conditions for igniting the spill .

- Use experienced personnel to oversee the burning activities and monitor the burn plan.
- The area around the spill site should be monitored using an explosive / toxic gas meter to determine any explosive / toxicity hazards.

The spill should be approached from upwind during all phases of the operation by personnel who are properly equipped and trained to monitor the conditions.

- Continually monitor weather conditions.
  - burning should occur only when wind conditions are low
  - weather should be stable
- Ignition should not occur until entire area is secured.
- Ensure there is a sufficient supply of the following on-site (actual numbers will be determined based on the individual spill conditions)
  - fire-fighting equipment
  - personnel (workers and emergency staff)
  - water supplies
- If potential exists for secondary fires, ignition should take place during low burning period (i.e. 1800 to 1000 hrs).
- If the product is heavy oil, or it is severely weathered, it may be advantageous to burn during the heat of the day in order to assist with ignition, if safe to do so.

Determine what method of ignition will work the best while still allowing for safe implementation

- Ignition procedures should be designed to allow the response team to be well back of the site when the spill is ignited. Individual companies may have their own ignition procedures based on the type of product and ignition devices available.
- Ensure the oil at point of ignition is between 2-3 mm thick to create a sustained burn. Ignition source should generate sufficient heat long enough to cause the oil to ignite.
- Spills that contain light ends will probably ignite without the assistance of an auxiliary fuel source. A flare shell propelled from a safe distance should be adequate**.**
- Spills that contain a high percentage of heavy ends may require the use of an auxiliary fuel or ignition promoter
- Auxiliary fuel usually consists of diesel, kerosene and gasoline but can also be in the form of dry straw, etc.
- Diesel and kerosene are considered to be the best ignition promoters as the flame temperature is higher
- Lighter products, such as gasoline, evaporate much faster than diesel which results in faster cooling of the slick
- Dry straw can be effective but application must be able to be done in a safe manner
- Ignite the outer edge of the spill and allow the fire to burn from the outside in (helps to reduce chances of fluid migration).

Ignition Considerations and Procedures *continued*

Determine what method of ignition will work the best while still allowing for safe implementation, *continued*

- Use multiple ignition points, where possible, to encourage the spreading of flames throughout the spill area and improve burn efficiencies.
- Ignition devices may include:
  - flare shells
  - gelled gasoline
  - diesel or kerosene
  - mixtures of gasoline and diesel fuel
  - crude oil
  - organic matter such as peat moss or straw
  - canister igniters
  - aerial ignition devices
  - dry straw
  - propane torches.

Ignite the spill.

- Determine flammability / toxicity around the spill using an explosive / toxic gas meter.
- Apply the auxiliary fuel agents (if necessary) to the determined ignition areas.
- Approach the ignition points from upwind.
- Ensure ignition workers are in a safe zone by continuously monitoring for explosive / toxic mixtures.
- Ignite all sites of the spill at the same time, using the selected method.
- Allow initial burn to complete without adding any additional fuel.

Monitor the spill site during the burn period to ensure that no hazards exist.

- Monitor the weather conditions on a regular basis.
- Be prepared to implement the emergency plan should the conditions change for the worse.
- Ensure the workers are in a safe area.
- Monitor the success of the burning procedures as they are implemented and at completion of the burn.
- For larger spills, burning may continue over an extended period of time, involving night-time conditions.
- Maintain security until the hazards have been totally eliminated.
- Utilize a fire guard crew on the entire perimeter to ensure no secondary fires occur.
- Monitor the site for black smoke.
- Ensure that regulatory agencies, land owner(s), stakeholders, the public, and media are kept informed.
- Ambient air monitoring programs should be implemented as required.

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2.4.9.7 Bioremediation

Bioremediation and would be considered when mechanical disturbance is not warranted or would cause additional damage based on a Net Environmental Benefits Analysis.

Bioremediation is the process of applying nutrients (fertilizer containing nitrogen and phosphorus) or genetically engineered bacteria to oiled terrestrial or shoreline areas to accelerate the natural biodegradation process. During this process, micro-organisms (bacteria) oxidize hydrocarbons, ultimately converting them to carbon dioxide and water. Biodegradation occurs primarily at the oil/water or oil/air interface and is limited by oxygen, moisture, and nutrient availability. It is also sensitive to temperature; the lower the ambient temperature, the lower the rate. If nutrients are used, they must be supplied in such a way that they will not be washed away by tides or any water runoff.

Bioremediation Evaluation

The decision to use bioremediation treatment should be based on the type of spill, the character of the area impacted. In some cases, other forms of clean-up may be required in conjunction with nutrient addition to achieve the desired enhancement rate. As in the case of other oil spill response chemicals, approval must be obtained from the U.S. FOSC and U.S. State On-Scene Commander ("SOSC ") or applicable Canadian regulatory stakeholders before the nutrients are applied and the products must be listed on government product schedules where required. An expert should be consulted.

Under the U.S. Regional ACP and NCP, options for the authorization of biological agents are outlined for use under certain conditions and in certain locations. Consultation with the FOSC should take place to determine authorization/preauthorization requirements for approval.

The IC will be responsible for providing incident specific information needed to approve the use of bioremediation operations.

Bioremediation Approval

The physical containment and recovery of oil is the preferred clean-up technique.

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Biological Disinfection

Biological disinfection is the systematic reduction in the probability of spreading invasive biological organisms between freshwater environments.
Applying the practices in the procedure will reduce the probability of spreading invasive biological organisms between freshwater environments by way of Enbridge Pipelines Inc., Enbridge Energy Partners, L.P. (Enbridge) or contractor equipment, material or operations used during a response or exercise. The procedure incorporates the requirements of the jurisdictions (state, province, territory and country) in which Enbridge operates.

The disinfection procedures included in this document may not be suitable in all situations or for all potential biological organisms. If more information is required regarding which disinfection procedure should be used, an appropriate environmental professional or environmental regulator should be contacted.

If required, the ENVL is responsible for development of the detailed Biological Disinfection Plan.

- Once items are disinfected, they should not come into contact with infected waters or other materials.
- Avoid touching absorbent materials with other absorbent materials during disinfection.

INSPECTION

To help determine if equipment need to undergo disinfection, either prior or post deployment, a full inspection of the equipment is needed. The inspection should be focused on any attached mud, plants, and other organisms. If debris is found, the equipment must undergo disinfection procedures. All inspections should be documented on the *Enbridge Invasive Species Inspection and Certification Form*. Further information on how inspection should be conducted can be found in the *Emergency Response Aquatic Invasive Species Inspection Procedures*.

General Guidelines

General guidelines that will assist in implementation of this SOP follow:

- Use a tagging system to identify infected from disinfected equipment.
- Look in cracks/crevices that may otherwise go unnoticed and hide unwanted organisms.
- Use rubber waders, gloves and boots where possible, as neoprene waders and gloves as well as felt soled boots retain moisture and organism such as Rock Snot and whirling disease. Neoprene and felt soles are also harder to disinfect.
- Allow equipment to dry completely and for the recommended times between uses.
- To help prevent transfer of aquatic invasive species, in addition to the above mentioned disinfection methods, where possible efforts should be made to designate equipment and personal gear to a single waterbody

The following should be considered when setting up disinfection stations:

- Weather conditions
- Proximity to water bodies or means by which water and cleaning solutions could enter water bodies.
- Disinfection stations will be constructed with secondary containment to collect wash water. Wash water will be collected and disposed of as per the site-specific waste management plan.
- Wherever possible, draining water from equipment (e.g. bilge water) should be done in the waterbody in which work was conducted.
- Type and quantity of PPE, clothing, heavy equipment and vehicles to be disinfected.

Equipment

WORKERS AND PERSONAL PROTECTIVE EQUIPMENT

When using chemicals, the appropriate PPE is to be used (e.g., appropriate gloves, safety glasses and clothing) and the SDS are to be reviewed and available.

Recommended cleaning supplies and equipment for disinfecting workers and their PPE will depend on the method of disinfection that is determined to be appropriate and may include:

- Heavy gauge plastic drop cloths for larger pieces of equipment, personal clothing/ technical equipment (i.e., waders, wader boots, rubber boots, motors, etc.).
- Assorted long and short handles soft bristled brushes to scrub equipment, parts and boots.
- Buckets for wash and rinse solutions.
- Tubs, stock tanks, or containers large enough and sturdy enough to contain water above 60°C (140°F).
- Plastic tubs for workers to submerge equipment and clothing.
- Methods for containing waste water.
- Methods for disposing of waste water (e.g. bilge water etc.).
- Bleach solutions:
  - 2% bleach solution (200 mL and water added to make 10 liters) for general disinfection
  - if targeting whirling disease specifically, a 10% solution should be used
  - if Viral Hemorrhagic Septicemia (VHS) is targeted a 20% chlorine bleach solution should be used.

Bleach can be corrosive to aluminum and hot water can delaminate Gore-Tex® fabric and other sensitive clothing or fabrics.

- 5% salt solution.
- 5% antiseptic hand solution.
- Full strength cleaning agents with quaternary ammonium compound alkyl dimethyl benzyl ammonium chloride (ex Parvasol ® and Kennelsol ® or Formula 409® and Fantastic ®).
- A 5% Household detergent (dishwashing detergent) solution.

Disinfection of workers and PPE must be completed in one of the on-site disinfection stations. These stations are to be separate from the on-site decontamination stations.

The following is recommended for disinfecting heavy equipment and vehicles. These should be used in addition to the previously listed materials and solutions.

- Pressure washer with at least 250 psi strength.
- Pumps for collecting wash solutions and emptying boats and other vessels
- Brooms and brushes for cleaning operator areas inside vehicles and equipment.
- Disposal receptacles for disposable cleaning materials and for any biological materials removed from equipment (e.g., plants, bait fish, paper towels or other disposable cleaning materials used).
- Methods for containing waste water.
- Methods for disposing of waste water (e.g. bilge water etc.).

Disinfection of heavy equipment and vehicles must be completed in one of the on-site disinfection stations. These stations are to be separate from the on-site decontamination stations. Decontamination is to occur prior to disinfection. If heavy equipment and vehicles require disinfection following decontamination, the equipment is to be brought directly from the decontamination station and is not to be re-used until disinfection has been completed.

Where possible, potentially infected equipment should be disinfected in one of the on-site disinfection station, rather than transported off-site for disinfection.

If on-site disinfection is not feasible, PPE and clothing should be removed as per the site-specific decontamination plan, bagged and not used on other sites before being disinfected off-site.

Disinfection Procedures

Disinfection methods should be matched to best suit the type of equipment being used. Refer to Spill Response Freshwater Biological Disinfection Procedures for detailed disinfection procedures.

It is illegal to transport live fish, bait or other organisms from one body of water to another. If none of the disinfection procedures are plausible for certain equipment, restrict use of equipment to a single water body.

DISINFECTION

Disinfection procedures may vary depending on whether particular organisms are being targeted, as well as what may be most suitable, based on what the equipment is made of, how readily some supplies are, and the feasibility of obtaining large enough quantities of cleaning solutions in the field.

DRYING

Drying can be used as a disinfection process if the following procedure can be followed:

- Some aquatic invasive species can survive out of water for more than two weeks. It is important to know potential species to which equipment may have been exposed. Equipment should be dried before transporting to another body of water, according to the site-specific species of concern.
- If targeting adult zebra mussels, 10 days may be required to kill organisms in cool or humid weather.
- If targeting *Didymosphenia geminate* (commonly referred to as Didymo or Rock Snot), equipment must be dried completely inside and out, and then for an additional 48 hours. Freezing items solid will also kill Didymo cells. Freezing overnight should work in most instances.
- Porous materials should be soaked in cleaning solutions for longer than non-porous materials and dried for longer periods of time than non-porous materials. Materials should be dry to the touch both inside and out, and allowed to dry for at least an additional 48 hours prior to entering a different waterway.

ACTIVE CLEANING

If drying cannot be implemented, an active cleaning method of disinfection will be required to limit the potential of transporting biological organisms from one fresh water environment to another.

Non Absorbent Items

Soak and scrub non-absorbent items for at least one minute (unless otherwise specified below) in one of the following solutions:

- 5% solution of dishwashing liquid (500 mL or 2 cups and water added to make 10 liters).
- 2% solution of bleach (200 mL and water added to make 10 liters).
- 5% solution of salt (500 ml or 2 cups and water added to make 10 liters).
- 5% antiseptic hand cleaner (500 mL or 2 cups and water added to make 10 liters).
- A dilute solution of 7% hydrogen peroxide mixed in a 64 ml (hydrogen peroxide):1litre (water) ratio. Can be applied using spray equipment. Infected equipment should be completely covered with the solution and allowed to sit for approximately 60 minutes before rinsing with clean water.
- Iodophor solution of 100 mg/L for moving equipment out of Viral Hemorrhagic Septicemia (VHS) management zones.
- Vinegar Dip (100% vinegar for 20 minutes).
- 1% salt solution in place of the vinegar dip for 24 hours.
- Full strength cleaning agents with quaternary ammonium compound alkyl dimethyl benzyl ammonium chloride (ex Parvasol ®and Kennelsol ®or Formula 409® and Fantastic ®)
- These can also be used in a 2:1 water to disinfectant ratio
- Soak all equipment for a minimum of 10 minutes

When deciding on the appropriate active cleaning methodology for non-absorbent items, the following should be considered:

- Disinfection with chemicals is not effective against killing spiny water fleas resting eggs.
- Disinfection with chlorine or iodophor must be used if fieldwork is conducted within and outside of the VHS management zones.
- Water-based solutions should be at least 60°C (140°F) and soaked for at least 20 minutes in hot water kept above 45°C (113°F).
- For equipment that cannot be submerged, solutions may be applied by either washing with a pressure washer, or with a pressurized garden hose. Pressure washers should reach at least 250 pounds per square inch (psi). Pressure washers may not be appropriate for all equipment and may damage some equipment.

ABSORBENT ITEMS

Absorbent items (e.g. felt-soled waders and diving suits) will require longer soaking times than non-absorbent items, to allow thorough saturation.

Soak absorbent items in the following solutions:

- At least 40 minutes in hot water kept above 45°C
- At least 30 minutes in hot water kept above 45°C containing a 5% dishwashing detergent solution
- For SCUBA gear, the following solution and soak times may also be used:
- Submerge and wash the suit and equipment (including inside of buoyancy compensator with hot water that is at least 40°C (or 104°F);
- Submerge/wash suit and equipment in a tub/tote with a salt solution (1/2 cup salt dissolved in 3.4 liters of water), then rinse with clean water

DISPOSAL

- Materials and solutions used in the disinfection process will be contained, and managed as outlined in the site-specific Waste Management Plan.

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Decontamination

Decontamination is the systematic removal of residual chemicals from personnel and equipment after exposure to toxic, flammable and/or hazardous products.

The SOFR is responsible to establish work areas which will be divided and identified (i.e. signs and/or barrier tape) into three zones as stated in the ICS 208- Site Safety Plan.

Each time clean-up workers exit the Hot Zone they will undergo decontamination (decon) procedures at stations within the Warm Zone. The SOFR will determine the decon level, measures and set-up of the decon corridor as part of the Site Safety Plan. If required, the ENVL is responsible for development of the detailed Decontamination Plan.

To determine the scope of decontamination stations needed, consider:

- Weather conditions
- Site conditions (e.g., access to utilities, space)
- Size of the emergency
- Quantity of PPE (e.g., boots, gloves, coats, coveralls, headwear, air monitoring devices, respiratory protective equipment)
- Amount of tools and equipment (e.g., shovels, axes, picks, pumps, chainsaws, compressors, light plants, backhoes, dozers, cranes, vacuum trucks, welding and boom trucks)
- Sensitive areas (natural areas, wildlife habitat)
- Natural drainage pattern
- Logistics of decontamination waste disposal

Non-Emergency/Routine vs. Emergency Decontamination

Routine decontamination is designed to reduce the amount of residual product on the clothing until safe and acceptable levels are achieved.

Emergency decontamination is designed to remove the patient from the hazardous area, remove contaminated clothing and flush the product off the patient. This will be accomplished taking into account any medical considerations. Water should be used to perform the emergency decontamination of the patient. There is less regard for runoff retention, and the emphasis is to expedite emergency medical treatment.

Factors Influencing Methodology

Product(s) involved
Hazards associated with the product(s)
Degree or extent of contamination
Physical and chemical properties of the product(s)

Decontamination Procedures

- All emergency response personnel will be briefed on decon procedures before entering the decon corridor.
- The decon corridor will be clearly identified by yellow tape or other highly visible method with clearly identifiable entry and exit points.
- The decon corridor will be established upwind of the Hot Zone or in a location where vapors from the Hot Zone will not significantly impact the corridor.
- If possible, the decon corridor will be set up close to services (water, electricity, road access, etc.).
- The floor of each station will be covered with PVC sheets/10 mil poly to prevent contamination of the soil. The rest of the decon corridor will be lined with non-slip sorbent surface and bordered with sorbent rolls, pylons and barrier tape.
- Decon corridor entry and exit will be identified and located within the Warm Zone.
- Runoff water will be contained and removed either by portable pump or buckets into drums or other suitable containers for subsequent hazardous waste removal.
- Tents or plastic barriers will be set up for protection from inclement weather and also for privacy during disrobing. If emergency response personnel include men and women, establish separate disrobing tent/barrier stations per gender.
- Chairs will be set up where needed to assist in PPE removal and boots/booties.
- Decon pools for primary wash/rinse and wading pools for secondary wash/rinse will be established.
- A tool drop will be set up just outside the decon corridor entry point (wading pool and/ or other suitable containment).
- All water used in the Hot Zone will be treated as hazardous waste (minimize water use as much as possible).
- Heavily contaminated PPE, clothing/equipment considered to be a hazardous waste may be disposed of without decontamination as required.
- Cleaning solutions must have adequate grease cutting properties and be evaluated by the degree of hazard for workers and the environment, (reference the Waste Management Plan). Brushes must be effective in removing contamination, but not damage clothing or PPE or cut/injure personnel.
- Wiping down personnel will always be done in a downward motion, away from the facial area (goggles should be left on until personnel enter the Cold Zone). Gloves off last!
- Adequate hazardous waste containment will be on hand and set up along the corridor. Once filled, containers will be closed, sealed and marked as hazardous waste before being removed to a collection area.
- Where hazardous waste is disposed of in plastic (garbage) bags, these will be collected and stored in a marked waste bin or other protective secondary containment.
- PPE items that may be reused after decontamination (e.g. rubber suits, rubber boots) will be collected and stored near the Cold Zone and made available to responders as required.
- A supply of fresh respirator cartridges will be available to responders. Used contaminated cartridges will be collected and stored in an identified container.
- A supply of facial wipes, paper towels and clean water will be maintained outside the Cold Zone for final, personal cleaning. A shower facility (if possible) should be available at this location.
- At demobilization, all materials used in the decon corridor will be marked and placed in suitable containment, including inner packaging and outer packaging, as required for further decontamination before final storage.
- Any tools and equipment that can be decontaminated will be decontaminated to allow future use and to reduce replacement cost.
- Any tools and equipment considered of no further use will be properly disposed of.

Heavy Equipment and Vehicles

Recommended equipment for decontaminating heavy equipment and vehicles include:

- Long-handled brushes for general exterior cleaning.
- Long-handled brushes, rods, and shovels to dislodge contaminated soil from tires and the undersides of vehicles and equipment.
- Wash and rinse buckets for decontaminating interior and exterior of vehicles and equipment.
- Brooms and brushes for cleaning operator areas inside vehicles and equipment.
- Containers or plastic-lined area to hold contaminated soil removed from vehicles and equipment (this can be included in overall cleanup of the Hot/Warm Zones).
- Wash solutions to remove and reduce the hazards associated with the contaminant.
- Rinse solutions to remove contaminants and contaminated wash solutions.
- Pumps for collecting wash and rinse solutions.
- Storage containers for temporary storage of contaminated solutions.
- Pressure and/or steam sprayers for washing and rinsing equipment or truck undercarriages, if applicable. Wash heavy equipment and vehicles in designated areas (e.g., lined areas, on contaminated soil) to prevent further contamination of the site.
- Containers for disposing of contaminated solutions.

Decon Corridor Equipment

Recommended equipment and cleaning supplies for establishing a decon corridor include:

- Barrier tape and pylons;
- Heavy gauge plastic drop cloths or containers with plastic liners for heavily contaminated tools, light duty equipment, duct tape, and protective clothing;
- Sorbent industrial rug to put down on walking surfaces to absorb oil and provide non-slip surface;
- Assorted long-handled, soft bristled brushes to remove and rinse off contaminants;
- Buckets for wash and rinse solutions;
- Tubs, livestock tanks, or children's wading pools large enough to hold wash and rinse solutions, if applicable (size depends on the situation, but should be large enough to place a booted foot. If liquid solutions are used, these may need to be bermed/diked. Consider disposal (drains) for waste water generated);
- Lined pit or box with absorbent pads to wipe off gross contaminants and liquid contaminants;
- Containers for clothing that require laundering, and for containing waste and solutions generated by the decontamination process (e.g., plastic or metal drums, plastic-lined trash cans);
- Chairs to assist with PPE removal;
- Baby oil to be used for safely dissolving heavy oils or tar from skin and hair;
- Spray bottles, small hand operated and or bug type sprayer for applying mild detergent and water mix and/or for rinsing;
- Decon solutions or detergent and water to remove the contaminants;
- Rinse solutions to remove the contaminants and contaminated wash solutions;
- Paper or cloth towels for drying protective clothing and equipment;
- Heavy duty cleaner (Gojo, Lava or other industrial hand cleaner), soap or wash solution, wash cloths, and towels for workers;
- Paper towels, facial wipes and clean water in the Cold Zone;
- Fresh respirator cartridges, outer gloves, boot covers and tape if worker returns to duty; and
- Tents or temporary facilities for the final staging area and during extreme weather provide tents for cool-down or warming area.

Decontamination Trailers

When using a decon trailer:

- Fill fresh water tanks onsite.
- Do not tow the trailer with full water tanks.
- A licensed contractor must pump waste water tanks onsite and waste water must be disposed of in an acceptable manner.
- Ensure the trailer is located on firm stable surface.
- Fill fuel tanks onsite, and maintain a generator onsite, if needed.
- Organize electric and water hookups, if available.
- Arrange for laundering clothing offsite.
- Level the trailer to ensure its components function properly.
- Stock with personal hygiene articles (e.g., soap, shampoo, towels).
- Complete and record trailer maintenance.

Trailer Decontamination:

- Follow decontamination procedure.
- Enter decontamination trailer and remove all other personal clothing.
- Place clothing into designated area.
- Shower.
- Redress in designated area.
- Exit decontamination area without passing through the undressing area.

General Mitigation Measures for Equipment and Tools

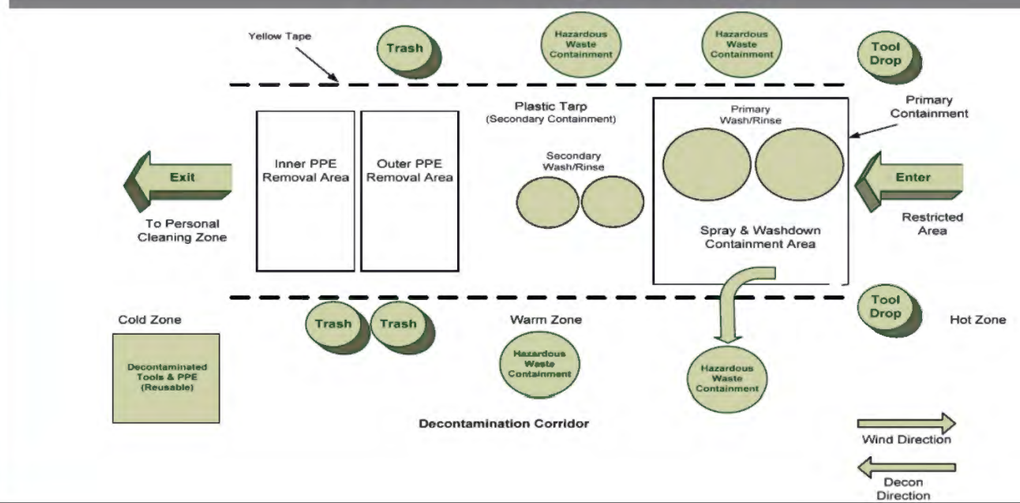
To prevent spreading contamination from equipment and tools outside the Warm Zone:

- Remove contaminated soil caught in tires and the undersides of equipment and vehicles as much as possible.
- Use pressure washers to clean the outsides and undersides of vehicles, boats (protection from invasive species and contamination) and equipment. When pressure washers are not feasible, use brushes and buckets with a cleaning solution.
- Ensure containers for storing contaminated materials are available.
- Dispose of all waste generated by cleaning equipment in an acceptable manner.
- Build bermed or lined areas to contain runoff or surface water.

Minimize waste generated from cleaning equipment as much as possible but not to the extent that it compromises adequate decontamination.

If large equipment must be moved offsite or from one location to another for more thorough cleaning, inspect the equipment to ensure contamination will not occur during transport and ensure the alternate location is pre-approved by IC.

Decontamination Corridor Diagram



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2.5 Demobilization

ALL Enbridge staff, contractors and sub-contractors are required to go through the demobilization process.

All Enbridge employees and contractors assigned to [Incident Name] are required to follow the demobilization process. Below are guidelines for completing the Demobilization form ICS-221 located in *Section 4 - Forms.*

Page 1

- Please indicate if you are an Enbridge employee, contractor or sub-contractor.
- Complete Section 1 by adding your personal information and, if applicable, the information you know about your replacement.
- Indicate the team you worked with during the response.

Page 2

- If you are an Enbridge employee enter the information about your usual office location. The two acknowledgement check boxes should be completed when you see HR during the Demobilization.
- In order to help review the incident, please add any thought about how well things went or where improvements can be made for incident response.

Page 3

- Section 2: Documentation Demobilization, and Section 3: Information Technology Demobilization, are to be completed by a Documentation Unit team member.

Page 4

- Section 4: Demobilization Acknowledgement & Approvals will require you to have your supervisor sign, and provide their title and phone number, under the appropriate section. The Documentation Unit will work with both the Information Technology and Human Resource groups to obtain their signatures.

If you have any questions about the demobilization process, or document handling procedures, please:

- Visit the Demobilization Unit at the Incident Command Center.
- Call the Demobilization Unit at [telephone].
- Call the Demobilization Unit Lead at [telephone].

Before demobilization of the IMT can occur, the following must be done:	
✓	Incident has been contained (the threat has been removed)
✓	ICS established
✓	Containment in place and effective
✓	The visual extent of impact has been identified
✓	Clean up resources are in place
✓	Stakeholder notification conducted (Including First Nations and Tribal Representatives
✓	Other plans have been considered and drafted: e.g. monitoring and sampling plan, remediation plan, wildlife mitigation plan, communications plan and waste management plan
✓	Transition Plan developed and agreed on by Incident Command/Unified Command

The demobilization should consider both the priority of release, and how activities will be transferred fully and effectively to regional operations, project teams, and/or other supporting business departments.

Resources no longer required for the response to the incident will be demobilized as rapidly as is feasible. They will be released in the following general priority.

Priority I -- Resources required to be returned to emergency services.
Priority II -- Resources mobilized from off-site
Priority III -- Local resources

Personnel:

- As appropriate, personnel demobilizing from the incident should check with their third-party contractors or Agency logistics contact for return of the radios, vehicles, materials, etc., that have been issued to them for use on the incident.
- When necessary, notify their respective third-party contractors or Agency logistics contact of their checkout from hotel/accommodations.
- As part of the demobilization process, all personnel will be required to complete a Demobilization Form that assists with the checkout process/transitioning in replacement staff and gathers insight to be used in the after-action review.
- The Documentation Unit Leader will direct all personnel to IT. IT will copy all electronic records from electronic devices and file as per records management policy.
- These steps will require sign off by the appropriate Section Chief before leaving the incident site/command post.

2.5.1 Equipment Inventory, Return and Restock

Emergency Response Equipment

This section outlines the deployment of equipment for tiered responses and inspection of Company owned equipment.

The Company owns and maintains spill response equipment, which is listed in *Annex 1*. Periodic inspection and maintenance is performed on each piece of equipment in accordance with recommendations from the manufacturer. After an equipment deployment exercise, or actual response, each piece of deployed equipment is inspected to assess the condition and determine if any repairs need to be made. Equipment found to be defective will be repaired or replaced.

Inspection and maintenance activities are tracked on the *Facility-Owned Equipment Inspection Log found in Section 4 – Forms* as per Maximo.

General Equipment Inspection/Tests should include:

- Visual
- Operability of moveable components
- Operability of running equipment
- Seals, valves and connector integrity
- Lubrication and fluid checks.

Equipment Considerations:

- Rental Vehicles – Clean out and refuel. Return to third party contractors, Agency, or appropriate rental company if individually rented.
- Contractor equipment, as required, will be decontaminated at the appropriate Decon facility. Once Decon is completed the equipment will be returned to the contractor/owner.
- Local equipment will be the responsibility of the contractor to remove from the site. Resources requiring transport to other locations will be coordinated through Operations and Logistics. Resources will normally be transported via the most cost effective means as appropriate.
- Agency equipment, as required, will be decontaminated at the appropriate Decon facility. Agency equipment will then be returned to the appropriate agency and transportation support will be provided by logistics as necessary.

2.5.2 After-Action Review

Post emergency activities are divided into three phases: debriefing the incident, post-incident analysis ("PIA"), and critiquing the incident response. The extent to which these phases are undertaken depends on the nature and magnitude of the spill or release. Even a small product release could elicit very detailed termination activities, such as a release of H_2S resulting in subsequent employee, or public, negative impact. Additionally, some spills or releases trigger outside agency reporting. These events would trigger the formal termination procedures outlined in this section.

Of particular importance during the After Action review is any spill that may have occurred in a high population area. Causes of the accident along with potential recurrences must be fully analyzed in order to preclude the same accident from happening again.

After termination activities, the Company can begin the planning process of safely restoring any service that has become out of service, due to the incident.

2.5.2.1 Debriefing the Incident

Debriefings should begin as soon as the "emergency" phase of the operation is completed. Ideally, this should be before Enbridge responders leave the scene, and it should include the key players such as the PIO and agency representatives who the IC determines would benefit from being involved.

Debrief Checklist		
☐	Use safety meeting attendance forms and other memoranda to document the debriefing	
☐	Inform responders exactly what hazardous materials they were (possibly) exposed to and the signs and symptoms	
☐	Identify equipment damage and unsafe conditions requiring immediate attention or isolation for further evaluation	
☐	Assign information-gathering responsibilities for a PIA and critique	
☐	Summarize the activities performed by each sector, including topics for follow-up	
☐	Reinforce the positive aspects of the response	
☐	Assign information-gathering responsibilities for a PIA and critique	
☐	Summarize the activities performed by each sector, including topics for follow-up	
	Debrief Performed By:	Date/Time

2.5.2.2 Post-Incident Analysis

Post-Incident Analysis:	
✓	PIA is the detailed, step-by-step review of the incident to establish a clear picture of the events that took place during the incident. It is conducted to establish a clear picture of the emergency response for further study
✓	The PIA is not the same as investigations conducted to establish the probable cause of the accident for administrative, civil, or criminal proceedings. Those are usually conducted utilizing root cause or hazard and operability methodologies. One person (or office) should be designated to collect information about the response during the debriefing. Additional data may be obtained from Command post logs, incident reports and eyewitness interpretations.
✓	Once all available data has been assembled and a rough draft report developed, the entire package should be reviewed by key responders to verify the available facts are arranged properly and actually occurred. The PIA should focus on four key topics: *Command and Control, Tactical Operations, Resources and Support Services.*
✓	*Command and Control* – Was command established and were sectors organized? Did information flow from operations personnel through Sector Officers to the IC? Were response objectives communicated to the personnel expected to carry them out?
✓	*Tactical Operations* – Were the tactical operations ordered by the IC and implemented by emergency response personnel effective? What worked? What did not?
✓	*Resources* – Were the resources adequate for the job? Are improvements needed to apparatus and/or equipment? Were personnel trained to do the job effectively?
✓	*Support Services* – Were the support services received from other organizations adequate? What is required to bring support to the desired level?

2.5.2.3 Critiquing the Incident

Critiquing the Incident Response	
A commitment to critique an all hazardous material response will improve IMT performance by improving efficiency and pinpointing weaknesses. Use the tool as a valuable learning experience (everyone came to the incident with good intentions). A good critique promotes:	
✓	Trust in the response system as being self-correcting
✓	Willingness to cooperate through teamwork
✓	Continuing training of skills and techniques
✓	Pre-planning for significant incidents
✓	Sharing information between response agencies.

Critique Format:	
A critique leader is assigned. This can be anyone who is comfortable and effective working in front of a group. The critique leader should:	
✓	Control the critique. Introduce the players and procedures. Keep it moving and on schedule
✓	Ensure that specific questions receive detailed answers
✓	Ensure that all participants follow the critique rules
✓	Ensure that each operational group presents their observations
✓	Keep notes of important points
✓	Sum up the lessons learned
✓	Follow up
✓	Following the critique, forward the written comments to management. They should highlight suggestions for improving response capabilities and alternative solutions
✓	When larger incidents are involved or injuries have occurred, formal reports shall be circulated so that everyone in the response system can understand the "lessons learned."

Section 3 – Table of Contents Page

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3.0 Training

Experienced, well-trained people are essential for successful implementation of this ICP. All Company employees attend Safety Orientation for New Employees at hire where they receive information on:

- The content of the information summary of the ICP (Response Plan);
- Their responsibilities under the ICP (as per the defined training matrices below); and
- Required safety training (as per the Company's safety program).

Other internal awareness and training programs include:

- Public Awareness Campaigns.
- Call Before You Dig Program.
- Annual Emergency Preparedness Week Bulletin.
- ICS Awareness Online Training.
- Security Awareness Online Training.

Specific information that is reviewed in training includes:

- The procedures for contacting the respective Control Centers, in their area, on a 24-hour basis.
- U.S reporting to the National Response Center ("NRC"), which is the sole federal point of contact for reporting oil and chemical spills. The NRC can be contacted toll-free at 1-800-424-8802 or at 202-267-2675.
- Canadian Reporting – the regulatory authority having jurisdiction (*See Annex 2*).

The training contained within this section compliments the existing safety training program.

Exercises are performed to check the effectiveness of the training, to test the Plan and refresh skills and knowledge obtained through training. Ongoing training and exercises are conducted within each Response Zone. In addition to training on the ICP, the training and exercise program provides members of the FRT with the basic knowledge, skills, and practical experience necessary to perform safe and effective spill response operations in accordance with the Plan.

The ER Coordinators (if applicable), training coordinators and relevant staff will devise a training plan and schedule in response to governmental regulations and the specific requirements of the Company. The regional training plan will include a regional training matrix based off of the matrix in this plan. The regional training plan will be implemented in cooperation with local oil spill response co-ops and selected contractors. Representatives of governmental agencies and other interested parties may be invited to observe or participate in these activities as determined appropriate.

ER Training matrices information is located in the ER Training Syllabi found in Governance Document Library.

3.1 Response Training

The company has developed a program for facility response training.

Regional Training Coordinators are responsible for overall coordination of emergency response training identified in the table that follows, including:

- Annually identifying emergency response training needs;
- Scheduling emergency response training;
- Ensuring training records are maintained and up-to-date;
- Ensuring training missed by employees who are absent is re-scheduled;
- Summarizing mandatory emergency response training for employees annually that compares scheduled training to actual training received; and
- Reviewing training with employees at least once per calendar year.

Records

Regional Training Coordinators will retain Annual Training Summary records in the regional office permanently and in the Company's Learning Management System ("LMS").

TRAINING MATRICES
Table 1
Emergency Response Training Matrix- Regional Personnel

ICS TRAINING	Duration	Recertification	Source	All Personnel [1]	Safety Coordinator [2]	Compliance Coord [2]	Terminal Staff [3]	PLM / Field Staff [3]	Regional IMT	Office Employees	Other Response Personnel *
ICS Awareness	1	every 3 yrs	internal	R							
ICS 100/200	8	one-time	vendor		O	R	O	O	R	O	
ICS 300	16	one-time	vendor		O	R	O	O	R	O	
ICS 320	24	one-time	vendor		O	O	O	O	O	O	
HAZWOPER TRAINING +											
HAZWOPER 24hrs	24	one-time	internal or vendor		R		N/A	N/A	O		
HAZWOPER 40hrs	40	one-time	internal or vendor		O		R	R	O		
HAZWOPER Refresher 8hrs	8	annual	internal or vendor		R		R	R	O		
OPERATIONAL/TACTICAL TRAINING											
Basic Boat Operations	3-4	One-time	vendor		R	O	O	R	O		
Boat Handling Operations	8	every 3 yrs	vendor		R	O	O	R	O		
Boom Deployment	8-16	every 3 yrs	vendor		R	O	R	R	O		
Enbridge Responder Awareness	1	every 3 yrs	internal		R	O	R	R	N/A	O	
NGL Planned Ignition	8	every 3 yrs	internal		R	O	R	R	O		
Oil Recovery Under Ice (Ice Slotting)	12-16	every 3 yrs	vendor		R	O	O	R	O		
Skimmer Operations	6	every 3 yrs	vendor		R	O	O	R	O		
Tank Fire Awareness	1	annual	vendor or internal		R	O	R	O	O		
Tank Rescue	4	annual	vendor		R	O	R	R	O		
VHF Radio Operators **Canada Only**	6	one-time	vendor		O	O	O	O	O		
INSTRUCTOR/TRAINER											
Inland Oil Spill Response	24-40	one-time	vendor		O	O	O	O	O		
Cold Weather Oil Spill Response	24-40	one-time	vendor		O	O	O	O	O		

NOTES: **R = Required attendance** (Mandatory training may not apply to all employees within the same job classification. Attendance is determined by regional management depending on the requirements of the job function).

O = Optional attendance – to be determined by regional or departmental management. Supervisors are included in the same training as the workers within their area of responsibility.

¥ = Required only for PLM Supervisors that will be in charge of on-scene clean-up operations

Ŧ = required for all U.S. personnel, and only required Canadian personnel that may respond in the U.S., for a release incident and work in the hot or warm zones

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* Other response personnel, including volunteers and casual workers (This group will not be used unless there is a prevalent need at the time of an incident. If used, all personnel will be trained onsite with the required OSHA standard.)

Regulatory Terminology:
[1] = All Personnel
[2] = Reporting Personnel
[3] = Response Personnel

The titles of the groups are high-level and should be synthesized by each department and/or regional management to determine appropriate attendance based on the employee's job function during an emergency. Other departments or employees may attend if deemed they will respond to an incident.

Table 2
Emergency Response Training Matrix- Business Support Personnel

ICS TRAINING	Duration	Recertification	Source	All Personnel [1]	Health & Safety [3]	Emergency Management	Compliance	Legal/Law	Environment	Other Response Personnel *
ICS Awareness	1	every 3 yrs	internal	R				O		
ICS 100/200	8	one-time	vendor		O	R	O	O	R	
ICS 300	16	one-time	vendor		O	R	O	O	R	
ICS 320	24	one-time	vendor		O	O	O	O	O	
HAZWOPER TRAINING Ŧ										
HAZWOPER 24hrs	24	one-time	internal or		O	N/A	O	N/A	O	
HAZWOPER 40hrs	40	one-time	internal or		O	R	O	N/A	R	
HAZWOPER Refresher 8hr	8	annual	internal or		O	R	O	N/A	O	

NOTES: **R = Required attendance** –(Mandatory training may not apply to all employees within the same job classification. Attendance is determined by regional management depending on the requirements of the job function).

O = Optional attendance – to be determined by regional or departmental management. Supervisors are included in the same training as the workers within their area of responsibility.

Ŧ = required for all U.S. personnel, and only required Canadian personnel that may respond in the U.S., for a release incident and work in the hot or warm zones

* Other response personnel, including volunteers and casual workers (This group will not be used unless there is a prevalent need at the time of an incident. If used, all personnel will be trained onsite with the required OSHA standard.)

Regulatory Terminology:
[1] = All Personnel
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[3] = Response Personnel

The Company's titles of the groups, expressed in the table above are high-level and should be synthesized by each department and/or regional management to determine appropriate attendance based on the employee's job function during an emergency. Other departments or employees may attend if deemed they will respond to an incident.

3.2 Incident Command System

The Company's ICS program follows the National Incident Management System.

3.2.1 Enbridge Responder Awareness Course

Abstract	This course provides identified responders with guidance and tools when first on-scene at a potential incident.
Target Audience	Identified responders as per the matrices
Frequency	Every 3 years
Description	• Responder and public safety • Identifying hazards • How to report an incident • Reporting phone numbers for the Company and regulatory agencies • Becoming familiar with Regional ER information • Understanding roles and responsibilities within the Company • Documentation
Estimated Duration	1 hour
Recertification	3 years
Material/Delivery Type	Interactive online, test requiring 80% completion, ICS 214 and ICS 201 packet

3.2.2 Incident Command System ("ICS") Awareness Course

Abstract	This course provides the employee with an introduction to the ICS and is not intended to supersede ICS 100/200. This course outlines the basics behind activation of the ICP. This program can be used as an ICS 100/200 refresher.
Target Audience	All staff
Frequency	Every 3 years
Description	• ICS definitions • ICS organization • Roles and responsibilities • Integrated Contingency Plan • Crisis Management • Documentation
Estimated Duration	1 hour
Recertification	3 years
Material/Delivery Type	Interactive Online, test requiring 80% completion and ICS 214

3.2.3 ICS 100/200 Course

Abstract	This intermediate level course provides identified responders with an introduction to the ICS.
Target Audience	Identified responders as per the matrices
Frequency	One time
Description	• ICS terminology and facilities • ICS organization • ICS tools • ICS 201 incident briefing packet
Estimated Duration	8 hours
Recertification	3 years (via online ICS awareness course)
Material/Delivery Type	Instructor led, PowerPoint slide deck handout, test requiring 80% completion, ICS 201 packet, USB (with ICS forms/reactive and proactive phase), Incident Management Handbook ("IMH")

3.2.4 ICS 300 Course

Abstract	This intermediate course provides identified responders with an expanded understanding of the basic ICS 100/200 course and provides an in-depth description of how the NIMS Command and Management System supports the management of expanding incidents.
Target Audience	Identified responders as per the matrices
Frequency	One time
Description	• Understanding the planning cycle • Developing an initial response organization • Conducting a planning meeting • Developing a detailed incident action plan
Estimated Duration	16 hours
Recertification	N/A
Material/Delivery Type	Instructor led, PowerPoint slide deck handout, in class exercise assessment, ICS 201 packet, USB (with ICS forms/reactive and proactive phase), IMH

3.2.5 ICS 320 Course

Abstract	This intermediate level course provides identified responders with an understanding of the ICS planning process within an incident. This course includes the integration of external stakeholders, agencies, and non-government organizations.
Target Audience	Identified responders as per the matrices
Frequency	One time
Description	• Step by step incident procession from the reactive through the proactive phases • Integrate ICS theory, tools, processes, and workshops with each step of the planning cycle of an incident • Key outcomes of each work period and meeting through all phases of an incident • Incident management team roles and responsibilities
Estimated Duration	24 hours
Recertification	N/A
Material/Delivery Type	Instructor led, PowerPoint slide deck handout, in class exercise assessment, ICS 201 packet, USB (with ICS forms/reactive and proactive phase), I M H

3.3 Operational Training

This section will address the operational training that is conducted by the Company in relation to established safety standards. The Company does not train to fight tank fires. Terminal personnel are trained to recognize tank fires and activate response. The course descriptions below provide detail regarding the content of the tank courses.

3.3.1 Tank Fire Response/Strategies Course

Abstract	To familiarize personnel with response strategies, equipment and resources.
Target Audience	All field staff that would respond to a tank fire.
Frequency	Every 3 years
Description	The purpose of this course is to provide personnel with the knowledge and tools to recognize and to safely deal with tank fires, within established Enbridge guidelines. Responders to tank fires must have the ability to recognize the hazards of an emergency situation and recognize when it is unsafe to be present in the situation. • Identify a minimum of three codes related to tank construction / fire safety. • Identify the consequence of inadequate ventilation of a tank exposed to fire. • Define the terms flammable and combustible liquids. • Define flash point, burning point, auto ignition point, boiling point; vapor pressure, vapor density, specific gravity. • Define boilover, frothover, slopover, BLEVE. • Explain the relationship of LEL/UEL. • Describe the difference(s) between vent fires, seal fires, fully involved fires, and spill fires. • Given a specific type of tank, explain its fire safety features and its fire hazards. • Identify a minimum of three benefits to site specific planning. • Identify the five steps involved in pre-planning. • Explain the potential fire hazards associated with tank confinement. • Describe the potential fire hazards associated with ancillary tank equipment. • Define the three types of fire suppression systems utilized in tank fires. • Given a tank fire scenario and utilizing the site specific Pre-Fire Plan, implement Enbridge's ICS. • Given a tank fire scenario, identify the type of and the application methodology of the site specific required foam.
Estimated Duration	4 hours
Recertification	3 years
Material/Delivery Type	Instructor led, student handbook, PowerPoint presentation, Terminal Pre Fire Plan's, tank information sheets, product MSDS, terminal map/layout, Book 2 – Evacuation Zones

3.3.2 Tank Rescue Course

Abstract	To ensure that workers who conduct safety watches are trained on the engineered systems used by Enbridge.
Target Audience	Operational, field staff and on-call employees
Frequency	Annually
Description	The purpose of this course is to provide personnel with the knowledge and tools to recognize and to safely deal with tank rescue, within established Enbridge guidelines. Responders must have the ability to recognize the hazards of an emergency situation and recognize when it is unsafe to be present in the situation. • Prepare safety watch to retrieve entrant • Rescue pre-plan • The safe use of rescue equipment • Recognize and manage risk during rescue • Use of engineered, swing davit arm
Estimated Duration	4 hours
Recertification	Annually
Material/Delivery Type	Instructor led, student handbook, PowerPoint presentation, hands-on practice with rescue equipment

3.4 HAZWOPER Training

OSHA's Hazardous Waste Operations and Emergency Response (U.S.) sets minimum training and/or competency requirements for responders who are exposed to or potentially exposed to hazardous substances including hazardous waste.

Canadian employees will be required to complete the appropriate training course based on their potential job duties for a cross border response.

The table below provides an overview of responsibilities for the training program.

Emergency & Security Management Department	• Establishing and maintaining the HAZWOPER standard • Approving all vendors and in-house training in accordance with OSHA standards in *29CFR§1910.120* and the OSHA recommendations for instructors in *29CFR§1910.120*; Appendix E "*Training Curriculum Guidelines*"
Operational Training Department	• Tracking training records for all participants • Maintaining computer based training modules • Developing curriculum for in-house training
Health & Safety Department	• Providing annual classroom-based refresher course in each region in conjunction with the Regional Emergency Response Coordinators. If no Regional Emergency Response Coordinator is in place, the responsibility lies with the Health and Safety Department to provide the course
Regional Training Coordinators	• Ensuring competent external vendors provide training • Ensuring training records are maintained and are up-to-date • Annually identifying employees that are required to attend training • Scheduling "HAZWOPER" training • Ensuring employees absent from scheduled training are re-scheduled • Responsible for the overall coordination of the delivery of HAZWOPER courses • Ensuring the initial training program will be no less than the 24 hour or 40 hour course time requirement, and no less than one-third (⅓) of the hours will be dedicated to hands-on training • Retaining Annual Training Summary records at the regional offices in the company LMS permanently. Courses shall be titled in the LMS and regional office records as stated above in the descriptions section.

The table below outlines response personnel HAZWOPER responsibilities.

Contractors	• All contractors responding to a spill/release that involves the Company will be required, by their contracts, to satisfy the HAZWOPER training requirements of *29CFR§1910.120* for their positions.
New Employees	• New employees that can provide a certificate of completion of a previous HAZWOPER course are not required to complete the initial training again. The previous training must be from an instructional company/institution that is currently conducting training.
Current Employees	• Previous work experience and/or training that an employee has had equivalent to the initial training required in this standard, shall be considered as meeting the initial training requirements. Equivalent training includes the training that existing employees might have already received from actual site work experience. Current employees are still required to attend annual eight hour (8) refresher training. Approval for previous work experience and/or training is the responsibility of the OI/Management or designee.
Casual Laborers	• Casual laborers will generally not be hired, but may be employed by the Company's response contractors or other response organizations. Contractors will be responsible for providing the appropriate HAZWOPER training to these laborers prior to their involvement in response operations.
Volunteers	• Normally, the Company will not hire and/or train volunteers for work on an oil spill response incident. Consequently, the Company will refer volunteers to appropriate provincial/state and/or local agencies or organizations that are set up to handle volunteers. In addition, the Company will refer volunteers to appropriate wildlife rescue agencies or contractors, such as the International Bird Rescue Research Center, which may be contracted by the Company to work on the spill cleanup. • In the event that the Unified Command approved "volunteers", the IAP will include them as resources with scope of work, training and PPE as required.
Specialist Employees	• Specialist employees are experts who would provide technical advice or guidance during response to a spill incident. Examples of such specialists might include chemists, biologists, industrial hygienists, physicians, or others with skills useful during a spill response operation. Such persons must receive appropriate training or demonstrate competency in their specialty annually. There are no specific requirements on training content or hours of training for these persons except that they must have whatever training is necessary to maintain competency in their specific area of expertise. Training and demonstration of competency for skilled support personnel and specialists should be documented.
Waste Handling Training	• Field operations personnel receive extensive regulatory-required training in HAZWOPER, HAZCOM, emergency response, firefighting, and other areas as described in this section. Employees at sites which generate hazardous waste receive additional orientation and training specific to hazardous waste regulatory requirements, and hazardous waste emergency response. Site emergency coordinators (qualified individuals) also receive additional training on incident command systems.

3.4.1 HAZWOPER Course Descriptions

The table on the following page describes the overview of the HAZWOPER courses as well as the annual refresher topics.

	24 HOUR INITIAL HAZWOPER COURSE	40 HOUR INITIAL HAZWOPER COURSE	ON SCENE INCIDENT COMMANDER COURSE
Abstract	This classification is considered the Enbridge Responder Operations Level training. Individuals are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading and prevent exposures.	This classification is considered the Hazardous Materials Technician Level training. Individuals with this training will assume a more aggressive role than an Enbridge responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance.	This course is designed for individuals with on-scene management control responsibilities during hazardous materials incident response. It is oriented toward developing an understanding of the concepts of effective incident management and the application of an incident command system to hazardous materials emergencies.
Target Audience	For individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for purposes of protecting nearby persons, property or the environment from the effects of the release.	For individuals who respond to releases or potential releases for the purpose of stopping the release.	Personnel that will be supervising or directing HAZWOPER operations (this course does not replace the "QI"/IC course). **NOTE:** those employees that will be in the field and supervising clean-up operations are required to take this training; this course is NOT for Incident Commanders working in an Incident Command Post or Emergency Operations Center.
Frequency	One time	One time	One time

Description	Includes:
	• Legal rights and respons bilities;
	• Hazardous materials regulatory overview;
	• Principles of toxicology;
	• Hazard and risk assessment;
	• Hazardous materials classes and physical hazards;
	  ◦ Characteristics and hazards of an oil spill
	• Identification systems;
	  ◦ Control and mitigation strategies of an accidental release (fire, explosion, toxicity, environmental damage, etc.)
	• Associated physical hazards;
	• Respiratory protection;
	• Personal protective equipment; and
	• Principles of decontamination
		Includes:
		• All of the 24 hour initial training program topics and;
		• Air and environmental monitoring;
		• Site control, supervision and incident management;
		• Response and site operations;
		• Review of conditions that are likely to worsen emergencies such as facility malfunctions or failures and appropriate corrective actions;
		• Hands-on practice of a minimum of decontamination, material handling, and source control (plugging/patching/over-packing, etc.)
			Should include:
			a) Know and be able to implement the Company's Incident Command System;
			b) Know how to implement the Company's Integrated Contingency Plan;
			c) Know and understand the hazards and risks associated with employees working in chemical protective clothing;
			d) Know how to implement the local Emergency Response Plan;
			e) Have knowledge of the State Emergency Response Plan and of the Federal Regional Response Team; and
			f) Know and understand the importance of decontamination procedures.

Estimated Duration	24 hours and includes one day of actual field experienced directly supervised by a trained, experienced supervisor.	40 hours and three days of actual field experienced directly supervised by a trained, experienced supervisor.	24 hours of training equal to the Enbridge Responder Operations level
Note	Supervised Days for Initial Training: Personnel that complete either the 24 hour or 40 hour initial training must complete the specified supervised days of field work. Those days shall be recorded on a form created and maintained by the Operations Training Department and stored in the company LMS. The activities that qualify for inclusion in the supervised days can be any of the topics listed in each of aforementioned course topics listed		
Re-certification	**ANNUAL REFRESHER** Each employee is required to attend an eight (8) hour refresher annually to include the above listed topics. No more than three topics of the 40-hour initial course may be duplicated in any given two year training cycle unless there has been a change in operations, for example; a change in air monitoring, respiratory or hearing protection equipment. Refresher training should include, at a minimum, the following topics and procedures: • Review of and retraining on relevant topics covered in the 40-hour course; • Update on developments with respect to material covered in 40-hour course; • Review of changes to EPA or OSHA standards or laws; • Introduction of additional subject areas as appropriate; • Hands-on review of new or altered PPE or decontamination equipment or procedures; • Review of newly developed air and contaminant monitoring equipment; and • Critique of the past year's incidents that can serve as training examples for future work situations.		
Material / Delivery Type	All HAZWOPER COURSES: Trainer led, Participant Handbook, appropriate certification (classroom and practical evaluation)		

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3.5 Response Exercise Program

Experienced, well-trained people are essential for successful implementation of this ICP. The exercise program is intended to provide employees of the Company with the basic knowledge, skills and practical experience necessary to perform safe and effective incident response operations.

The Company response exercise program is designed to be consistent with the exercise requirements as outlined in the PREP Guidelines, with guidance using LP's Exercise Design Guide (modelled after the HSEEP version). Participation in this program ensures that the Company meets all federal exercise requirements as this guideline has been adopted by Enbridge in the U.S. and Canada.

The primary elements of the Company exercise program are outlined below in the "*Quick Reference Guide*".

All exercises and actual responses will be critiqued by the Exercise Director or Incident Commander or their designee. If appropriate, the information derived from the post-exercise or post-event evaluation After-Action Report/Improvement Plan ("AAR/IP") will facilitate ICP revisions as necessary. Recommended revisions will be forwarded to the LP Emergency Management (LP EM) Department lead.

A single actual response or exercise may satisfy more than one type of exercise requirement (i.e., an actual response could give credit for an unannounced exercise, an equipment deployment, internal notification, and qualified individual notification).

Key Program Elements:

- The exercise year for all Company facilities will be from January 1 to December 31.
- All Regions must exercise all 15 core components outlined in the PREP Guidelines at least once during each triennial cycle.
- Regions will employ a "crawl-walk-run" exercise progression, using discussion-based exercises prior to operations-based exercises
- Ensure site sensitivity analysis has been completed. This requires significant warning time to the Environment Department
- LP will satisfy regulatory requirements both sides of the border. For example, the NEB requires a full scale exercise every three years. This will be achieved by all regions, with an FSE schedule coordinated by LP EM

    - *Canadian regions will update their exercise information in the exercise database at least 60 days prior to the conduct of an exercise (in accordance with NEB Order SO-E101-003-2013) and thereafter, for all regions, every quarter*.

3.5.1 Exercise Format and Procedures

When conducting exercises it is strongly recommended that the Exercise Planning Team invite external organizations to observe and/or participate once the region feels confident in doing so, employing the "crawl-walk-run" progression in trainng and exercise conduct. Example organizations are listed below:

The following is a list of suggested organizations that should be invited to exercises:	
✓	Federal Agencies having jurisdictional responsibility during a spill or emergency
✓	Provincial/State/Territorial agencies having jurisdictional responsibility during a spill or emergency
✓	Local agencies having jurisdictional responsibility during a spill or emergency
✓	Other interested entities that may play a critical role during a spill or fire (e.g. First Nations, Tribal Representatives, Local Utilities, other pipeline companies, spill contractors)
✓	Evaluators provide an unbiased observation of the exercise and document their observations accordingly. Evaluators should avoid interaction with exercise participants. Evaluators can be internal from the company or can be from any of the agencies listed above.

3.5.2 Company Facility Requirements

Emergency and security exercises and drills for training and regulatory requirements are required to be conducted at facilities as outlined in the PREP Guidelines that the Company follows; please see *3.6.8 Quick Reference Guide* for type and frequency of exercises required. Security exercises requirements are contained in the LP Security Management Plan.

3.5.3 Types of Exercises

	Exercise Type	Description
Discussion - Based	Seminar	Provides presentation of new or current plans, resources, strategies, concepts, procedures or tactics.
	Workshop	Achieves specific goal or builds upon a policy or guideline (e.g. exercise objectives, standards, policies, plans).
	Tabletop Exercise ("TTX")	Validates plans and procedures and provides experience for participants by using a scenario to drive discussions.
	Game	Explores decision-making process and examines consequences of those decisions. Infrequently used by Enbridge.
Operations - Based	Drill / Equipment Deployment	Focuses on a single operation or function of an agency or several agencies. Maximizes on-the-job training benefits.
	Functional Exercise ("FE")	Evaluates plans, functions, capabilities, and staffs of Incident Command, Unified Command, intelligence centers, or other multi-agency coordination centers. (e.g. Emergency Operations Centers, incident command posts, etc.). This type of exercise does NOT incorporate "boots-on-the-ground" activities.
	Full-Scale Exercise ("FSE")	Same as FE, but with actual deployment of field personnel; includes mobilization of operational and support resources, conduct of operations and integrated elements of exercise play.

3.5.4 Exercise Design Guide

This document, which is aligned with the HSEEP model, explains the suggested process to design any exercise in the Company. Included are job-aids for exercise designers to use and sample exercise packets. This guide may be used on all exercises regardless of size or complexity.

3.5.6 Regional Management

Regional Management is accountable for ensuring the following emergency response exercises are conducted in accordance with the table below:

•

3.5.7 Oil Spill Removal Organization Exercise Record

The QI/Regional Management or designee shall contact their contracted certified OSRO and ensure that **one** of the following has taken place:

- The OSRO has completed the required exercise(s) per the OSRO Classification Program and provided copies of the exercise(s) to the region; or

- If the Company has exercised with the OSRO for the minimum requirements set forth in the most current version of the PREP Guidelines. It is expected that each region shall exercise with their recorded OSRO at least one time in the triennial period.

Documentation provided to the regions for OSRO-conducted exercise(s) shall be maintained by the Regional Training Coordinator permanently in a manner for ready access. A copy of this documentation is to be forwarded to LP EM each year.

3.5.8 Quick Reference Guide

Exercise Type	Frequency	Required Participants	NPREP Reference and Remarks
		Discussion Based	
Qualified Individual/Regional On-call Notification Exercise	Quarterly	QIs, Regional On-call staff (Canada)	• Paragraphs 2.3.1., and 2.3.8.2. • QIs are not mandated in Canada, therefore regional on-call staff will be called At least 1 exercise/year will occur outside normal business hours
Table Top Exercise (TTX)	Annual	Regional IMT	• Paragraph 2.3.8.2. • Completion of PREP components over a triennial cycle • Minimum of one IMT exercise in a triennial cycle will involve the simulation of a worst case scenario • 75% of IMT as defined in ICP will be exercised FRT TTXs are optional
Unannounced Exercise	Annually	IMT Functional Exercise and/or TTX and/or FRT Equipment deployment	• Paragraph 2.3.7. and 2.3.8.2. • This may also include a Government-Initiated Unannounced exercise; • A real incident is acceptable; • 75% of IMT as defined in ICP, or FRT, will be exercised
		Operational	
Equipment Deployment	Annually/FRT	Field Response Team	• Paragraph 2.3.6., 2.3.6.6, and 2.3.8.2. • Regions to confirm number of FRTs; • Minimum 75% participation of FRT; • Key ER equipment to be used, including dedicated ER equipment. May also include OSRO equipment; Maximo to be updated as proof of "test" of dedicated ER equipment
Full Scale Exercise (FSE)	Once/3 years/Region	IMT, FRT, Support department staff (latter as required)	• Scheduling of FSEs to be coordinated via ERAT 75% of IMT, as defined in ICP, and FRT will be exercised
Security	Once annually per region/per critical site	Staff from Critical site	• This is an LP requirement as indicated in the LP SMP, • One exercise will suffice if personnel from all Critical Facilities in a region attend • Cyber-security is out of scope

Canada Only – Operational cont.			
Exercise Type	**Frequency**	**Required Participants**	**NPREP Reference and Remarks**

Environmental Emergency (E2) Exercise	Annually	IMT and/or Terminal Staff and/or FRT	• Only those regions with a Schedule 1 product designated under Enviro Canada E2 regulation
			• 1 exercise/site/year, ensuring a component of the E2 plan is exercised each year;
			• At the end of the 5 year cycle, all components of the E2 plan need to be exercised.
			• Exercise Type: The exercise can be an Equipment Deployment with a Command & Control component, or a Full Scale Exercise. The exercise will include:
			  ○ Scope: Area Operations-run (or equivalent);
			  ○ On-call Area Operations Chief (or equivalent) is the IC;
			  ○ Activities:
			  ▪ Notification,
			  ▪ Activation,
			  ▪ Deployment of ER equipment and others by PLM/FRT, and
			  ▪ Evacuation of staff
			• E2 exercise could be included as part of Terminal Evac Drill (regional decision); The E2 exercise can also satisfy the NEB-required FSE (see FSE requirements)

US Only – Operational cont.			
Area Exercise	Upon Request by US regulator	IMT and/or FRT and/or E3RT	• Paragraph 2.4; • Goal of the PREP is to conduct an Area FE/FSE for each ACP during quadrennial cycle; • An industry plan holder that participates in an Area FE/FSE should not be required to participate in another Area FE/FSE for a minimum of six years; Exercises that cross an Enbridge regional boundary, or that cross the international border, will be coordinated by LP EM.

Exercise Type	Frequency	Required Participants	NPREP Reference and Remarks
Government Initiated Unannounced Exercise (GIUE) (Functional Exercise and/or Equipment Deployment)	Not more than once/36 mo	TBC by PHMSA	Paragraph 2.3.7.2.

NOTE: After an equipment deployment exercise each piece of equipment is inspected to assess the condition and determine if any repairs need to be made. Preventive maintenance is performed on each piece of equipment in accordance with recommendations from the manufacturer and the LP EM Preventative Maintenance Guide. Equipment found to be defective will be repaired or replaced.

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3.5.9 Emergency Response Exercise Report

All exercise records will be maintained in the LP Emergency Response exercise database. See paragraph 3.6 for the updating of exercise information on the exercise database. This includes the completion of records indicating the completion of core components identified in the National Preparedness for Response Exercise Program Guidelines in the EGRET.

3.5.10 Internal Exercises

Internal exercises are those that are conducted wholly within the Company. The internal exercises test the various components of the response plan to ensure the plan adequately meets the PREP Guidelines requirements for spill response which fall under *OPA '90* in the U.S. and surpass the requirements outlined by the *NEB Onshore Pipeline Regulations* in Canada

All of the internal exercises, with the exception of the U.S. Government-Initiated Unannounced Exercises ("GIUE"), will be self-evaluated and self-certified.

3.5.11 External Exercises

The external exercises go outside the Company to test the interaction of the Company with the response community. The external exercises will test the Company's entire plan and the coordination with members of the response community necessary to conduct an effective response to a pollution incident.

External exercises include area exercises and government-initiated unannounced exercises.

An area exercise is conducted by the EPA, USCG, DOT/PHMSA and industry working in cooperation to exercise the ICP. This is a large-scale exercise that is planned and evaluated by all parties involved. All area exercises will be coordinated by LP EM.

Government regulatory agencies have the authority to direct the Company to participate in a GIUE. The Company must comply unless such an exercise would result in safety hazards. The cost of the GIUE is the responsibility of the Company.

3.5.12 Credit for Actual Response/Completed Exercise

Enbridge may take credit for responses to actual spills or releases, or to significant threats of a spill, instead of conducting exercises. The response must be evaluated using guidance in theExercise Design Guide. The lead evaluator must determine which exercise requirements were met during the response. This determination should be based on whether the response effort would meet the objectives of the exercise requirements as listed in the PREP Guidelines.

For regions in Canada taking credit for an actual incident for the purposes of reporting against NEB performance measures, the incident must take the place of a planned exercise in the applicable region in order to take credit for an NEB Performance Measure.

Credit may also be taken for a non-spill incident but only if:
- The IMT was activated;
- The incident had the significant threat of a release. e.g. a wildfire, tornado etc.

For non-spill incidents, the same requirements above apply.

Documentation for credit purposes will include (but not be limited to):

	Documentation for credit purposes will include (but not be limited to):
✓	ICS 201 Packet • Type of exercise/incident • Date and time • Description of exercise/incident • Objective of exercise/incident
✓	Incident Action Plan(s) (if applicable)
✓	Hot Wash Meeting Minutes
✓	Participant (Responder) Feedback/Critique Forms • Company Personnel • Contractor Personnel (if available)
✓	AAR/IP • Facility-Owned Equipment Inspection Log (drills and full scale exercises)
✓	Lessons Learned
✓	PREP Components Evaluation Worksheet
✓	Signature of IC or designee completing reporting

3.6 Third-Party Awareness Training

The Company considers various stakeholders when designing and conducting training across the pipeline system.

Target Audience within counties of operations	
✓	Fire departments' training officers and chiefs
✓	Police departments' training officers and chiefs
✓	Sheriff's departments' training officers and chiefs
✓	County Emergency Management training officers and chiefs
✓	Local Emergency Planning Committees /Community Emergency Managers
✓	911 Dispatch Centers/Public Safety Answering Points ("PSAPs")

3.6.1 U.S. Third-Party Training

Enbridge's emergency responder education program was developed to improve interactive, engaging, industry leading training for third-party emergency responders in close proximity to the companies' areas of operation. This education program aims to arm responders with the information they need to effectively and safely respond to a pipeline emergency involving an Enbridge Pipeline or facility.

Content addresses the following API RP 1162 elements:	
✓	Pipeline purpose and reliability
✓	Awareness of hazards and prevention measures
✓	Emergency preparedness communication
✓	Potential hazards
✓	Pipeline location information and availability of National Mapping Pipeline System 
✓	How to get additional information

3.6.2 Canadian Third-Party Training

Emergency Response agencies are those that have the potential to respond to an incident or emergency involving an Enbridge facility. Specific agencies targeted include fire departments, police, emergency responders, hospitals, EMS and municipal emergency response coordinators.

Enbridge meets with these stakeholders face-to-face on an annual basis. During these meetings, Enbridge representatives update the Public Awareness Contact Form- Emergency Response Agencies. As well, a list of important information is discussed and documented in a checklist. At these meetings, emergency responders are supplied with a letter from the Region, the Enbridge "Pipeline safety and emergency information for emergency responders" brochure, the Emergency Responders Online Education Program brochure, the "Pipeline safety and emergency information for healthcare providers" sheet (medical facilities only), the Pipeline to Safety Video, and promotional items with pipeline safety contact information.

During face-to-face visits, the Company encourages emergency responders to undertake the Emergency Responders Online Education Program, as well as to have other responders at their agency take the course as well. Enbridge is currently rolling out the 911 dispatchers training module which will be offered to 911 dispatchers in Canada.

Section 4 – Table of Contents

The forms and templates have been developed by the Company for use during an emergency response where applicable.

Section 4 – Table of Contents

ENBRIDGE	Receiving Emergency Information	ICP 001

Purpose: To be used by any employee receiving emergency information on a potential incident or in preparation to attend the emergency location as an early responder.

Notification		
Date and Time of Notification:		
Name of the Employee Receiving Call:		
Caller		
Name of Person Reporting :		
Caller's Location:		
Caller's Telephone # *(next 2 hours)*		(Home):
Caller's Address:		
Emergency Description		
Condition Observed *(spill, cloud, odor, etc):*		
Facility Involved, Location or Land Description:		
Date and Time Incident Observed:		
Nearest Community:		
Local Directions to Site:		
Nearest River, Stream, Lake *(direction & distance):*		
Other Helpful Information *(weather, wind, roads, public interest, injuries):*		
Emergency Reporting		
Did Caller Notify Community Emergency Responders or Other Agencies:		(Time of Call):
Are other Emergency Response Agencies On-Site or En-route *(provide details):*		

Internal Reporting	
If this is a potential emergency and you are the first Enbridge point-of-contact, call the Control Centre at:	
US Regions 1-800-858-5253	**EPSI Region** 1-888-440-4357
CND Region 1-877-420-8800	**Cushing Control Centre** 1-918-223-2461
Athabasca and Western Region 1-888-813-6844	**Enbridge Media Hotline Canada** 1-888-992-0997
In Quebec 1-780-420-8899	**Enbridge Media Hotline U.S.** 1-800-496-8142
North Dakota Region 1-888-838-4534	

Other Information	
Give Warning Information for NGL/Crude oil if appropriate *(see Form B – Warning Information)*	

Purpose: To be used when exploring a suspected or reported emergency. Safe work practices will be followed per the following guidelines (the order of these actions will depend on the situation).

EXPLORE- To be reviewed by the First Responder prior to taking any immediate action.	
☐	Notify Senior staff on-site immediately if a pressure drop has been observed or a leak is suspected and stop all product transfers. Close all automatic isolation valves, if available.
☐	Conduct a field level hazard assessment to identify and mitigate all hazards including potential for fire, explosion, and hazardous toxic vapors. • Determine the wind direction and approach cautiously from upwind. • Explore the suspected release area only when wearing appropriate PPE using the buddy system if possible. • Ensure safety of personnel in the area. • Eliminate or shut off all potential ignition sources in the immediate area • Use intrinsically safe equipment (e.g., flashlights, two-way radios, gas detectors with audible alarms).
☐	If appropriate, request surveillance fly-over to determine: • If there is any abnormal activity and dead vegetation in the vicinity of a pipeline; • Size and description of oil slick; • Direction of movement; • Coordinates of leading and trailing edge of oil slick; • Sensitivities endangered; and • Areas of population that are threatened. If radio contact cannot be made; the line flyer will land report to Company management by telephone
☐	Maintain regular/scheduled communication with the Control Centre and Regional Management/on-call person.
APPROACH	
☐	If hazards cannot be safely mitigated, move to a safe upwind location, monitor the incident, and keep people out the hot zone.
☐	Are people injured or trapped? Are there outside people involved in rescue or evacuation?
☐	Are there immediate signs of potential hazards such as: • Electrical lines down or overhead? • Unidentified liquid or solid products visible? • Vapors visible? • Smells or breathing hazards evident? • Fires, sparks or ignition sources visible? • Holes, caverns, deep ditches, fast water or cliffs nearby? • Is local traffic a potential problem? • Ground conditions (select one) ☐ Dry ☐ Wet ☐ Icy
CONFIRM & CONTROL	
☐	Begin a 214A Individual log when notified of an incident and continue documenting key actions throughout the response.
☐	Determine level of response needed, hazards of product(s) involved and proper response guidelines to be followed. Confirm identification of spilled material and check the SDS sheets. Consider the following: • Assess the spill threat, site safety, and parameters such as spill volume, extent and direction of movement. • Has pipeline(s) been shut down? • Has wind direction been confirmed and windsock erected? • Has the public been protected or evacuation considered if necessary? • Have all ignition sources been identified and eliminated? • Have personal protection and safety requirements been established and communicated? • Is adequate fire protection equipment available and in place? • Are tank and VAC-truck electrical equipment properly grounded? • Have decontamination sites and procedures been established? • Are activities and events being logged/ documented? • Eliminate sources of vapor cloud ignition, consider the ignition of NGL. Shut down all engines and motors. • Establish Exclusion zone and Safe Work Areas (Hot, Warm, and Cold).
☐	If on water, consult Control Point and HCA maps for appropriate response strategies for incoming resources. • Review pipeline alignment sheets to become familiar with the location of mainline valves and elevation characteristics. • Review ESA maps for the location of any sensitive area that may be impacted (Annex 3).
☐	Once support has arrived conduct transfer of command and start preparing for tactical and planning meetings.
COMMUNICATION/NOTIFICATIONS	
☐	Initiate actions to notify government agencies including local authorities of area affected or at risk areas via the Control Centre, Regional Management or designate. • Complete notifications for emergency call-out, including regulatory agencies. This will be done by Regional Management or designate. • If excavating, has One-Call agency been notified? • Has a Preliminary Incident Report been issued? • Has a radio channel been established for communication between the site and other personnel in field? • Notify External Emergency Services as appropriate. Work with local law enforcement to make sure all personnel/citizens are a safe distance away from the hazard area. • Notify the appropriate Company management. • Advise neighboring property owners and operators of any threat to their property or personnel. • Notify appropriate federal, state and local government agencies, including local utilities.
INCIDENT COMMAND	
☐	Once it has been determined to activate the ICS, the IC will initiate the following actions: • Confirm that containment equipment and oil spill contractors have been deployed. • Integrate local evacuation plans into the Unified Command decision-making process. Work with response team once they arrive on site to establish a workable Incident Command Post and Communications Center. • Direct initial response actions • Begin development of an initial incident action plan (ICS 201 Forms).
EMERGENCY SHUT DOWN PROCEDURES	
☐	The following emergency shutdown procedures should be initiated if company personnel are threatened by the release of product from a pipeline to the environment or when coordinating activities for prompt and safe repair of the pipeline and the return to normal operating conditions: • Shutting in the line at the nearest block valves. • Notifying the nearest pump station and/or the appropriate Control Center. • Maintenance crewmembers should notify their immediate supervisor who will in turn notify appropriate Company contacts. • If the exact location of the leak is unknown, the immediate supervisor will request a line flyer, or if it is at night, manpower might be used to walk the line. Once a leak site has been located, the following information should be obtained: • Have all ignition sources been eliminated? • Are any water intakes at risk? • Are any schools, homes or commercial properties at risk and should they be evacuated? • Should access to the area be restricted (roads blocked)? If so, assistance should be requested from law enforcement agencies. • Have local response agencies been advised of the product's characteristics and handling precautions which are described in the SDSs? • Are railroads or utility companies in the area and have they been notified? • Will product flow into any waterways or roadways? • In the U.S. work with Company Environmental Department to conduct a Natural Resource Damage Assessment. The Control Center should be notified following an assessment of the release site; an evaluation should be made regarding the effect of downtime on product scheduling. Appropriate report, logs & notifications will be made.

Purpose: To be provided as necessary to community Emergency Responders, such as local police or fire departments or as otherwise required.

Incident Follow-up Calling Guide To Community First Responders

"This is Enbridge Pipelines (*indicate region*) Inc. calling from _____

Our telephone number is _____

We have received a report of a smell of gas or crude oil vapor or a small leak from location (i.e., land description, station, etc.).

We have dispatched Company personnel to confirm the report. We are not requesting your assistance at this time. We will provide you with more factual information when it becomes available and confirm if your assistance is required."

(Give following warning information for NGL/Crude oil as appropriate)

Warning Information For NGL Incident (Community First Responders)

Natural gas liquids are mixtures of hydrocarbons – the major component is propane.

Vapors will usually appear as a white cloud. They are extremely flammable and will collect in low lying areas. Keep all ignition sources and vehicles away from leak and vapor cloud. Approach pipeline leaks using extreme caution.

Warning Information For Crude Oil Incident (Community First Responders)

Crude oil is flammable and toxic.

Vapours collect in low areas.

Approach pipeline leaks using extreme caution.

Keep all ignition sources and vehicles away from leak.

Avoid low lying areas without a self-contained breathing apparatus.

ENBRIDGE

General Incident Report

ICP 004

Incident:	**Incident Date/Time:**
Person Reporting Incident:	**Prepared:** **at:**
Person Contact Number(s):	**Version:**

Pipeline Information and Points of Contact

Pipeline Name:	
Contact:	**Phone:**
Owner:	**Phone:**
Operator:	**Phone:**

Pipeline Specific Information

Type(s) of Product:	
Equipment Involved:	

P/L Marker of Release	Nearest Upstream Block Valve	Nearest Downstream Block Valve

Incident Information

Incident Location:	**Latitude:**	**Longitude:**
Type of Casualty:		
Total Capacity of Pipeline:	**Potential for Additional Spillage:**	
Material(s) Spilled:	**API Gravity:**	
Estimated Quantity Spilled:	**Classification:**	
Source Secured?:	**If not, Estimated Spill Rate:**	
Notes:		

Incident Status

Injuries/Casualties:		
Fire:	**Fire Status:**	**Fire Assistance:**
Holed:	**Hole Location:**	**Hole Size:**
Notes:		

General Incident Report (Pipeline)	

Incident:	Incident Date/Time:
Person Reporting Incident:	Prepared: at:
Person Contact Number(s):	Version:

Facility Information and Points of Contact

Facility Name:	
Type of Facility:	
Number of People at Facility:	
Contact:	Phone:
Owner:	Phone:
Operator:	Phone:

Facility Specific Information

Type(s) of Product:	
Equipment Involved:	

Incident Information

Incident Location:	Latitude:	Longitude:
Type of Casualty:		
Total Capacity of Common Container:	Potential for Additional Spillage:	
Material(s) Spilled:	API Gravity:	
Estimated Quantity Spilled:	Classification:	
Source Secured?: Yes ☐ No ☐	If not, Estimated Spill Rate:	
Notes:		

Incident Status

Injuries/Casualties:			
Fire: Yes ☐ No ☐	Fire Status:	Fire Assistance:	
Notes:			

General Incident Report (Facility)	

ENBRIDGE

Threat Checklist

ICP 005

Date: _____

Person receiving threat/suspicious package: _____

Time received: _____

If by phone, time call terminated: _____

Phone number displayed by Caller ID: _____

Work location of person receiving threat/suspicious package: _____

EXACT WORDING OF THREAT

SUSPICIOUS PACKAGE/MAIL

Time delivered/discovered: _____

Location of delivery/discovery: _____

Who/how delivered or discovered: _____

Characteristics of package/mail (Select all that apply)

- ☐ Actual threat message
- ☐ Marked with any threatening
- ☐ Inappropriate or unusual labeling
- ☐ Strange or no return address
- ☐ Misspelled common words
- ☐ City of postmark does not match return address city
- ☐ Oil stains, discoloration or odor
- ☐ Lopsided/uneven package or envelope
- ☐ Excessive tape, string, or packing materials
- ☐ Incorrect titles or title without a name
- ☐ Handwritten or poorly typed address
- ☐ Protruding wires or aluminum foil
- ☐ Excessive postage
- ☐ Excessive weight
- ☐ Ticking sound

CALLER/SUSPECT VOICE AND DESCRIPTION (select all that apply)

Gender: ☐ Male ☐ Female

Age: ☐ Child ☐ Teen ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ Older

Voice characteristics: ☐ Loud ☐ Soft ☐ Deep ☐ Whisper ☐ Stutter ☐ Lisp ☐ Fast ☐ Slow ☐ Normal ☐ Nasal ☐ Slurred ☐ Broken ☐ Disguised ☐ Squeaky

Accent: ☐ **Other:** ☐

Manner: ☐ Angry ☐ Excited ☐ Giggling ☐ Crying ☐ Sincere ☐ Stressed ☐ Calm

Language: ☐ Well-spoken ☐ Incoherent ☐ Irrational

BACKGROUND NOISE

Street noises:

House/residence noises:

Aircraft:

Voices:

Music:

Machinery:

Bar/Tavern:

Other:

BOMB THREAT QUESTIONS

When is the bomb going to explode?

Where did you put the bomb?

Where is it right now?

Did you place the bomb? Why?

Do you know who placed the bomb?

What does it look like?

What kind of bomb is it?

What will make the bomb explode?

What is your name?

Where are you calling from?

What is your address?

Have you noticed anyone else?

Whom do you represent?

Do you know that there are innocent people in the building that may be injured or killed? ☐ Yes ☐ No (select if either is confirmed)

NOTES

ENBRIDGE

Site Monitoring Template	ICP 006

Date:	Time:	Wind Dir.	Wind Speed	Temp.
Event Description:				

Location Description	Time	PID / FID	H_2S	SO_2	CO	LEL	O_2	Benzene	Other	Comments
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

For spill response operations (as opposed to those that start from a remedial action) these plans will vary in detail as the response progresses. During the initial emergency phase, responders rely on generic emergency response plans - contingency plans - while a site-specific plan is being developed. As the response progresses into post-emergency phase recovery operations, a basic site-specific plan is used and may become quite detailed for prolonged or large cleanups. Finally, a spill response may become a fully controlled site cleanup (e.g., remedial cleanups) where a fully developed site-specific plan is developed, including detailed emergency response plans for on-site emergencies.

General – Identify and/or specify:

☐	Risks for each task in work plan	☐	Employee training assignments
☐	Protective equipment for each task/objective	☐	Medical surveillance requirements
☐	Frequency and types of air monitoring	☐	Frequency and types of personnel monitoring
☐	Sampling techniques	☐	Air monitoring instruments to be used
☐	Maintenance and calibration for instrumentation	☐	Site control measures
☐	Site map	☐	Work zones
☐	Use of "buddy system"	☐	Alerting means for emergencies
☐	Safe working practices	☐	Nearest medical assistance
☐	Decontamination procedures	☐	Emergency response plan
☐	Confined space entry procedures	☐	Spill containment program
☐	Pre-entry briefings	☐	Provisions for continual evaluation of plan

Site Characterization and Analysis:

☐	Spill sites shall be evaluated to identify specific site hazards and determine appropriate safety and health controls.

Preliminary Evaluation – Performed by a qualified person, prior to site entry, to identify and/or specify:

☐	Protection methods and site controls	☐	All inhalation/skin hazards
☐	Location and approximate size of site	☐	Description of response activity
☐	Duration of response activity	☐	Site topography and accessibility (include air and ground accessibility)
☐	Safety and health hazards anticipated	☐	Pathways for hazardous substance dispersion
☐	Status of emergency response units (rescue, fire, hazmat)		

Risk Identification

☐	Employees on site are informed of identified risks	☐	All information concerning chemical, physical and toxicological properties of each substance available to the Company are made available to the responders

Detailed Evaluation

☐	Immediately after preliminary evaluation, a detailed evaluation is conducted to determine safety controls and protection needed.

Monitoring

☐	Monitoring performed during initial entry	☐	Monitoring performed periodically
☐	Personnel monitoring performed		

Illumination Requirements		
	Areas accessible to employees are lighted to levels not less than the intensities outlined below:	
☐	**Foot-candles**	**Area of operations**
	5	General site areas.
	3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas.
	5	Indoors: Warehouses, corridors, hallways, and exitways.
	5	Tunnels, shafts, and general underground work areas. (Exception: Minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, and scaling. Mine Safety and Health Administration approved cap lights shall be acceptable for use in the tunnel heading.)
	10	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.)
	30	First aid stations, infirmaries, and offices.

Sanitation Requirements			
☐	Potable/ Non-potable water	☐	Toilet facilities
☐	Washing facilities	☐	Shower and change rooms

Purpose is to prepare for anticipated emergencies:	
☐	Plan is written and available for inspection

Elements to be specified	
☐	Pre-emergency planning
☐	Personnel roles, lines of communication
☐	PPE and emergency equipment
☐	Emergency recognition and prevention
☐	Safe distances and places of refuge
☐	Site security and control
☐	Evacuation routes and procedures
☐	Emergency medical treatment and first aid
☐	Emergency decon procedures
☐	Emergency alerting and response procedures
☐	Critique of response and follow-up

Additional Elements	
☐	Site topography, layout and prevailing weather conditions
☐	Procedures for reporting incidents to: local, provincial/state, and federal government agencies
☐	Employee alarm system is installed to notify persons of an emergency situation

Additional Requirements Emergency Response Plan shall be:	
☐	A separate section of Site Safety and Health Plan
☐	Compatible with federal, provincial/state and local plans
☐	Rehearsed as part of on-site training
☐	Current

ENBRIDGE	Demobilization Checklist	ICP 008

Enbridge Employee ☐ Contractor ☐ Sub-Contractor ☐

Section 1: Personnel Information

General Personnel Information			
Last Name, First Name		Start Date (DD/MM/YY)	End Date(DD/MM/YY)
Email Address	Site Phone/Cell No.	Planned Return (DD/MM/YY)	Planned End (DD/MM/YY)
Prime Contractor: N/A ☐		If You're a Sub-Contractor, Your Company Name: N/A ☐	
Location of Work Performed (specific site):		Position While Performing Work:	
Replacement's Name (if known):		Replacement's Phone/Cell No.	Replacement's Email
Replacement's Arrival Date (DD/MM/YY):		Replacement's End Date:	

Team Worked on During Incident Response			
Logistics ☐	Environment ☐	Air Operations ☐	Safety ☐
Finance ☐	IT ☐	Repair ☐	Liaison/Public Information ☐
Operations ☐	Planning ☐	Regulatory/Compliance ☐	
Recovery Branch ☐	Incident Command ☐	Staging ☐	Other _____ ☐

For Enbridge Staff Only (not applicable for contractors or sub-contractors)	
Home Office (City/Region):	Regular Office Phone/Cell No.
Citizenship: US ☐ Canada ☐ Do you have a Visa? ☐	Home Business Unit: LP ☐ MP ☐ EGD ☐ GT ☐ Corp ☐
I have copy of BU coding information for timesheet and Expenses ☐	I Understand Days of Rest ☐

Retention: Retained in the Region Permanently

Incident Participation Review
In your opinion, what are *3 things that went well* during this response?
1.
2.
3.
In your opinion, what are 3 things that could have gone better during this response?
1.
2.
3.

Section 2: Documentation Demobilization

Data Types	Collected Y	Collected N	Network Share Name Where Docs Preserved (eg: LiveLink, Enbridge Email, Network Drive, SharePoint, File Room, Portable drive)	All Items Saved to Enbridge Network Folder		Date to be Collected if not Current Date (DD/MM/YY)
Email	☐	☐		Y ☐	N ☐	
Files	☐	☐		Y ☐	N ☐	
Papers	☐	☐		Y ☐	N ☐	
Phone	☐	☐		Y ☐	N ☐	
Other E-Devices	☐	☐		Y ☐	N ☐	
Comments:						

Section 3: Information Technology Demobilization

Enbridge Incident Issued Laptop Returned Y ☐ N ☐	Laptop Serial Number:
User Name:	Password:
List other devices issued to you:	Did you use any portable drives? Please detail.

Section 4: Demobilization Acknowledgement & Approvals

Operations Section N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Planning Section N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Logistics Section N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Command Section N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Finance Section N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Documentation Unit N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Human Resources N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____
Information Technology N/A ☐	Name:_____ Title:_____	Signature:_____ Phone/Cell No. :_____

APPROVAL TO CONDUCT IN-SITU BURN					
Authority	**Name and Organization**	**Approval Signature (if verbal, identify recipient)**	**Date**	**Alternate Point of Contact**	**Phone Number**
Regulatory Authority					
Unified Command					
Incident Commander (Enbridge)					
Other (Specify)					

Confirm that all stakeholders with authority over the ability to conduct an in-situ burn are listed above and have approved the burn.		
Name (Enbridge Incident Commander)	**Signature**	**Date**

INCIDENT INFORMATION		
Incident General Description:		
Product(s) Type:		
Product Description (*general hazards and characteristics*) (GPS/LLD):		
MSDS attached?	YES	NO
Estimated Volume Released:		
Incident Discovery Date/Time:		
Initial Release Date/Time (*estimated*):		
SPILL LOCATION / TRAJECTORY		
Originating Spill Location and Impacted Area General Description:		
Estimated Size of Impacted Area:		

Estimated Potential for Further Migration and Ultimate Area of Impact		
Site Sketch Attached? *(Review Incident Records for sketch components)*	YES	NO
Aerial / Satellite Map Graphic Attached?	YES	NO
Trajectory of Spill Shown on Sketch / Graphic?	YES	NO
IN-SITU BURN ASSESSMENT		
List considerations that support in-situ burning at this location over manual / mechanical recovery and cleanup options:		
Product Thickness (mm)		
Product Likely to Burn? (*conduct test burn as necessary*)	YES	NO
Anticipate oil to remain ignitable (*fresh, not highly emulsified (>25%) or weathered*)?		
WEATHER CONDITIONS		
Weather conditions favorable for in-situ burn?	YES	NO
General Forecast for Next 48 Hours: (*e.g., stormy, clear, overcast, rainy, etc.*)		
Wind Speed and Direction Forecast for next 12 hours:		
Wind Speed and Direction Forecast for next 12 – 48 hours:		
Wind Speed and Direction Forecast for next 24-48 hours:		
Visibility Forecast for next 48 hours: (*sufficient for burn operations/observation is >500 ft (approximately 150 meters), ½ mile horizontal (1 kilometre)*		
IN-SITU BURN OPERATIONAL FEASIBILITY		
Operational Feasibility?	YES	NO
Is an operations plan (*strategy, method, resources*) and site safety plan written ? (*Attach*	YES	NO

Is air support needed? Available?	YES	NO
Are personnel properly trained, equipped with safety gear and covered by a site safety plan?	YES	NO
Is a site communications plan available?	YES	NO
Is the release contained?	YES	NO
Can all necessary equipment be mobilized during the window of opportunity (*e.g., containment, igniter, residue collection equipment, fireguard*)	YES	NO
Can the burn be safely extinguished or controlled? (*Attach contingency plan that identifies and manages potential impacts on surrounding area in case the burn becomes uncontrolled or secondary fires arise*)	YES	NO
Estimated area of proposed burn:		
Attachments / Additional Information / Comments:		

SAFETY AND ENVIRONMENT CONSIDERATION		
Is there probable public safety exposure?	YES	NO
Are there probable environmental impacts?	YES	NO
Can the burn be conducted at safe distance from other response operations and public, recreation and commercial activities?	YES	NO
Can the public be adequately notified of the burn? (*Attach notification / communication plan*)	YES	NO
Are evacuations necessary? (attach proposed evacuation plan)	YES	NO
Is limited shelter-in-place to be done?	YES	NO
Is a plan to manage environmental sensitivities (*e.g., wildlife, land use, groundwater impact)* written or in progress? (*Attach if available*)	YES	NO

Is particulate monitoring available? (*attach if available*)	YES	NO
What is the minimum public health safe distance? (*Attach method used to determine distance,* see *isolation distance table in Section 2).*		

Attach an In-Situ Burn Plan Diagram site sketch or area photo that illustrates:

- Size of burn area only (*this may or may not be different than the total impacted area*)
- Projected wind direction over the course of the burn duration
- Calculated minimum safe distances (shown as a radius around the burn location)
- Distances to populated areas (private, commercial, public)
- Evacuation and/or shelter-in-place areas (if applicable)
- Control measures and fire guard resources
- Smoke plume monitoring locations (if applicable)
- Impacted or nearby environmentally sensitive areas
- Adjacent land use

Attachments / Additional Information / Comments:

ENBRIDGE	Facility-Owned Equipment Inspection Log	ICP 010

Equipment Location:				
Inspected By:	**Print**		**Sign**	
Inspection Date:				
Recovery Capacity (EDRC):	*E.g.: 7,645 bpd x 20% daily recovery rate = 1,529 bpd EDRC (based on a 20% efficiency)*			

Equipment Type	Description - Model, Style, Size, Capacity, Shelf Life	Qty	Operational Status	Last Deployment Date
EXAMPLE: Boom	*50' Acme 6x6 booms*	*100'*	*Good*	*7/01/11*

ENBRIDGE	National Response Centre Questions (For Reference Only)	ICP 011

NRC 24 Hr. Incident Reporting (800) 424-8802 –

Reporting Party	
E-mail Address:	
Phone 1:	Primary | Alternate | Cell | On-Scene | Other
Last Name:	
First Name:	
Phone 2:	Primary | Alternate | Cell | On-Scene | Other
Phone 3:	Primary | Alternate | Cell | On-Scene | Other
Company:	
Organization Type:	***Private Enterprise***
Address:	
City:	
State:	
Zip Code:	
Are you calling on behalf of responsible party:	YES NO
Are you or your company responsible for material released:	YES NO

Incident Description		
Incident Date: DD // MM// YEAR	TIME:	Occurred | Discovered | Planned
Type of Incident: ***PIPELINE***		

Incident Location					
Location Description					
Address Location:					
State:					
County					
Zip Code:					
Nearest City:		Distance from Nearest City:		Units: Miles | Kilometers	
Direction: N NE NNE NWW NW E ENE ESE S SE SSE SSW SW W WNW WSW					
Range:	Section:	Township:			
Latitude: Degrees:	Minutes:	Seconds:	Quadrant:	North | South	
Longitude: Degrees:	Minutes:	Seconds:	Quadrant:	East | West	

Pipeline Details
Pipeline Type: Transfer | Flow | Transmission | Distribution | Service | Gathering | Offshore | Lateral | Highly Volatile Liquid (HVL) | Tank | Station | Load Line | Terminal | Unknown | Other
DOT Regulated: YES NO Unknown
Underwater: YES NO
Covered/Marked: YES NO Unknown
Above or Below Ground: ABOVE / BELOW
Material Involved
Material #1
Material:
CHRIS Code: CAS Code:
Amount Released: Units: Barrel(s) | Gallons | Liter(s) | Unknown
Amount in Water: Units: Barrel(s) | Gallons | Liter(s) | Other | Unknown
Material In Water Information
Body of Water Affected: Offshore: YES NO River Mile Marker:
Tributary of: Water Supply Contaminated: YES NO Unknown
Water Temperature: Units: Fahrenheit Celsius
Wave Condition: Calm | Smooth | Slight | Moderate | Rough | Very Rough | High | Very High | Precipitous | Confused
Speed: Knots MPH
Direction: N NE NNE NWW NW E ENE ESE S SE SSE SSW SW W WNW WSW
Sheen Information
Sheen Length: Units: Feet | Inches | Yards | Miles | Meters | Kilometers
Sheen Width: Units: Feet | Inches | Yards | Miles | Meters | Kilometers

Incident Name:	Operational Period to be covered by IAP: Period: (/ / to / /)

Approved by:

FOSC: _____

SOSC/Prov: _____

RPIC: _____

Incident Action Plan

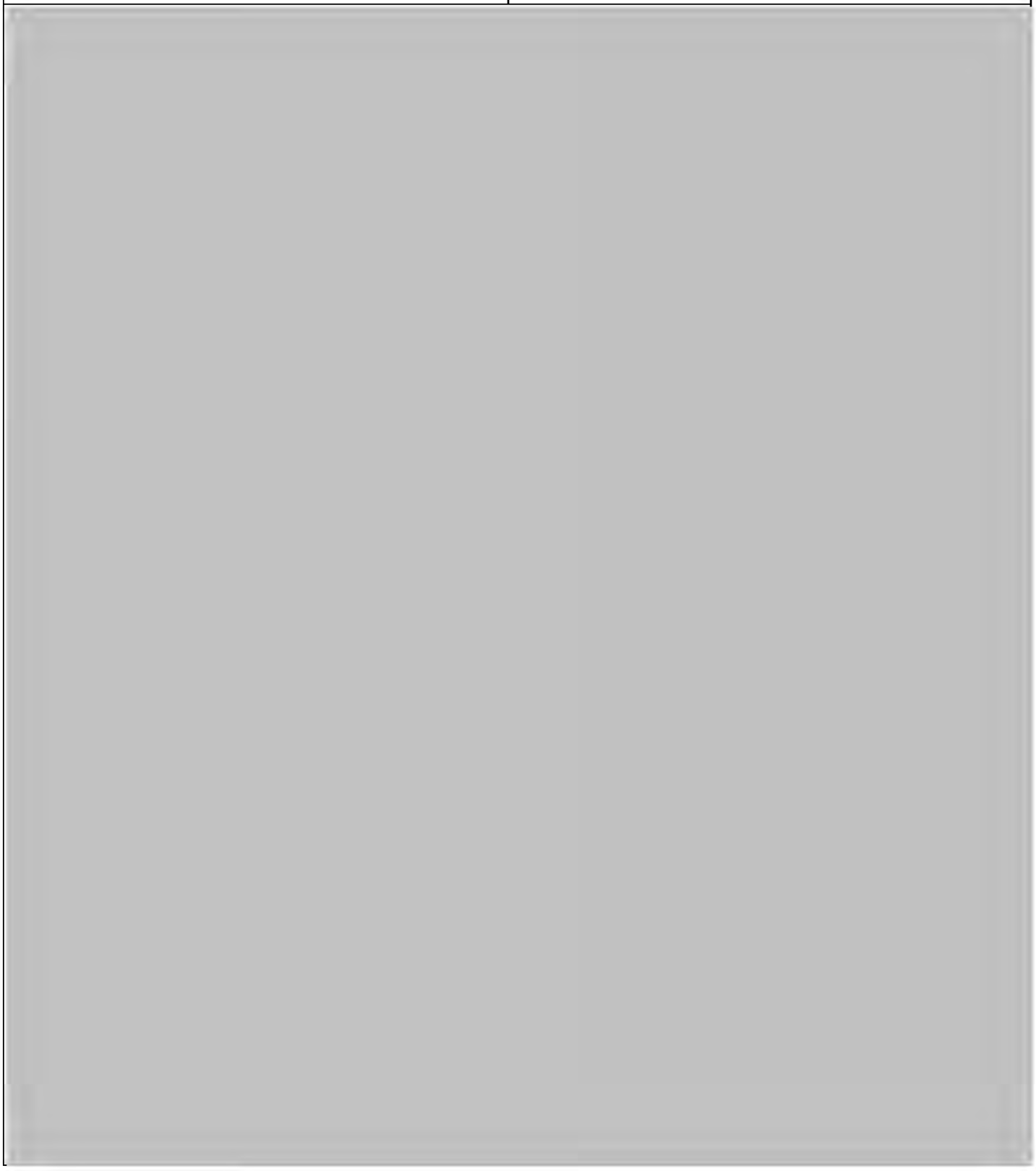
Prepared By:	Prepared Date/Time:

Incident:				Prepared By:			at:	
Period:		to		Version Name:				
Organization Notified	**Phone**	**Date /Time Notified**	**Person Contacted**	**Person Contacted Email**	**Case No.**	**Follow Up**	**ETA On Site**	**Notified By**
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								
						☐Y ☐N	HR	
Notes:								

Incident:		**Prepared By:**	**at**
Period:		**Version Name:**	
Present Conditions			
Wind Speed:		Wave Height:	
Wind Direction From The:		Wave Direction:	
Air Temperature:		Swell Height:	
Barometric Pressure:		Swell Interval:	
Humidity:		Current Speed:	
Visibility:		Current Direction Toward:	
Ceiling:		Water Temperature:	
Next High Tide (Time):		Next Low Tide (Time):	
Next High Tide (Height):		Next Low Tide (Height):	
Sunrise:		Sunset:	
Notes:			
24 Hour Forecast			
Sunrise:		Sunset:	
High Tide (Time):		High Tide (Time):	
High Tide (Height):		High Tide (Height):	
Low Tide (Time):		Low Tide (Time):	
Low Tide (Height):		Low Tide (Height):	
Notes:			
48 Hour Forecast			
Sunrise:		Sunset:	
High Tide (Time):		High Tide (Time):	
High Tide (Height):		High Tide (Height):	
Low Tide (Time):		Low Tide (Time):	
Low Tide (Height):		Low Tide (Height):	
Notes:			

ENBRIDGE	Incident Briefing Map/Sketch	ICS 201-1

Incident:	Prepared By: at:
Period:	Version Name:



ENBRIDGE	Summary of Current Actions	ICS 201-2

Incident:	Prepared By: at:
Period: to	Version Name:

Incident Information

Initial Incident Objectives

Summary of Current Actions

Date/Time	Action Notes

ENBRIDGE

Current Organization

ICS 201-3 / 207

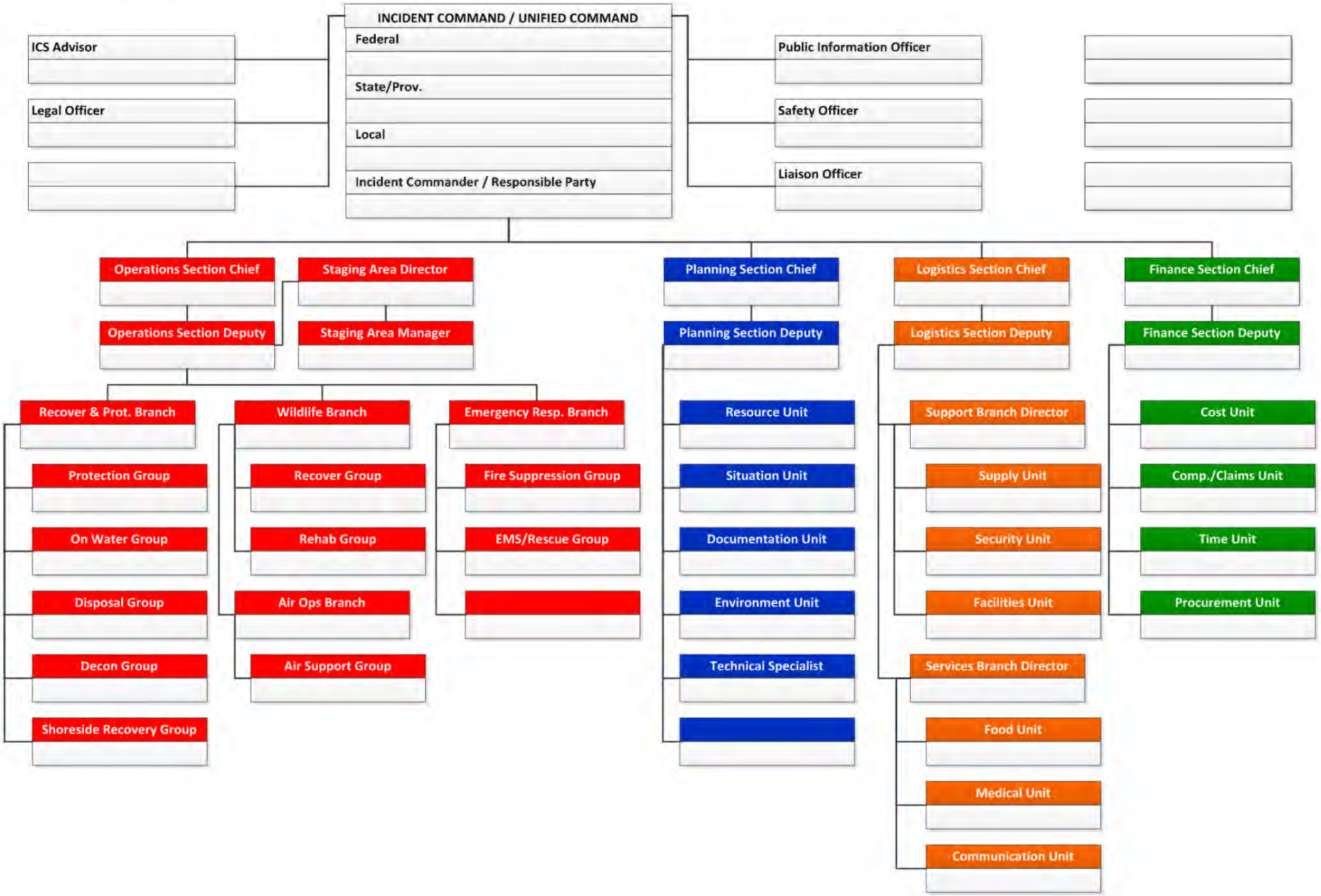
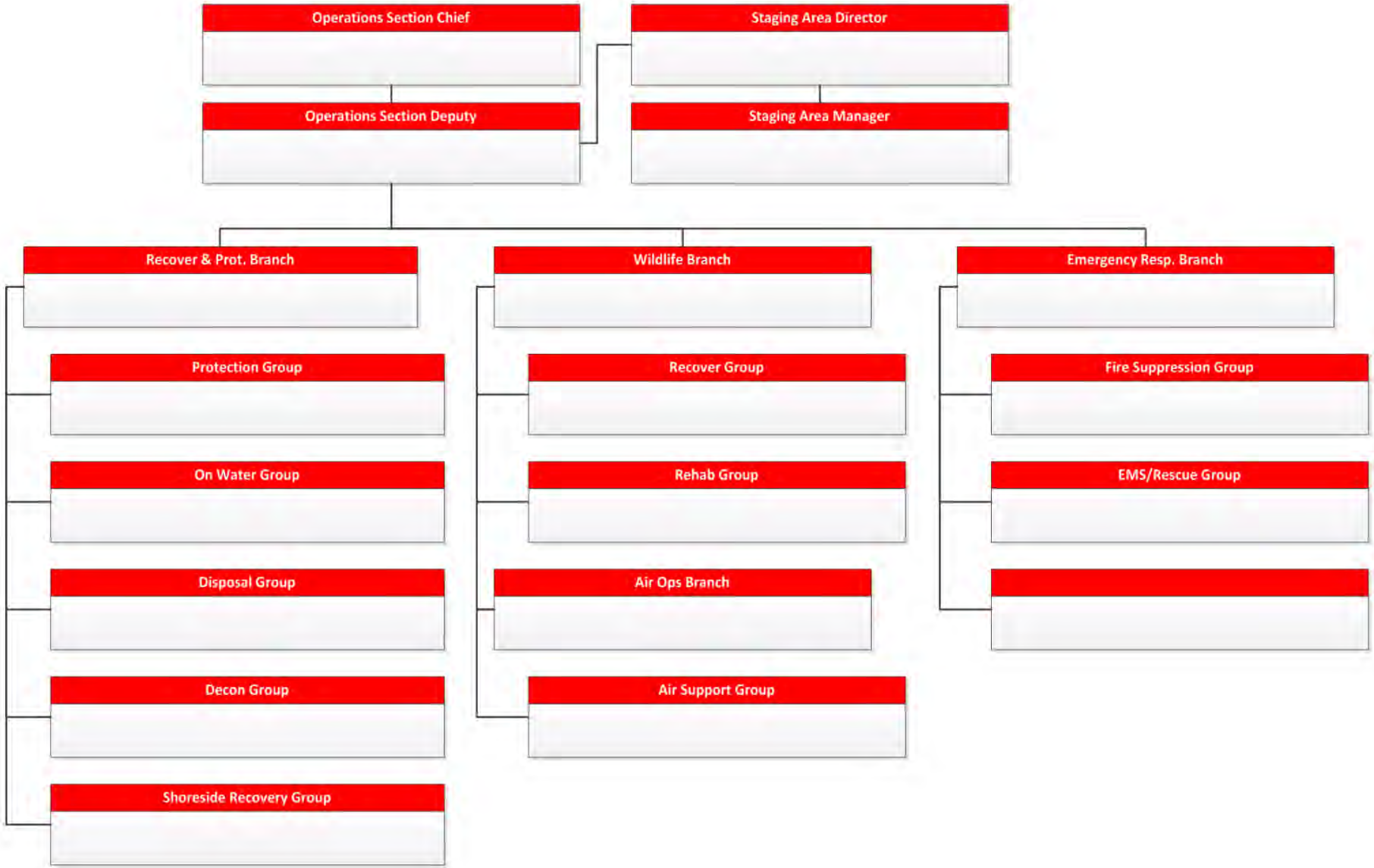


Illustration shows suggested ICS positions. ICS is scalable; the positions are filled according to the needs of the incident.
If positions are not filled, the responsibility is assumed by the Section Chief or Incident Commander.



ENBRIDGE

REDACTED SUBMITTAL - PUBLIC COPY

Resource Summary

ICS 201-4

Incident:

Period:

ID	Supplier	Resource Type	Description	Quantity	Size	Area of Operation	Status	Status Date/Time

Retention: Retained in the Region Permanently

ENBRIDGE

Site Safety and Control Analysis

ICS 201-5

Incident:	**Prepared By:** **at:**
Period:	**Version Name:**

Site Control

1. Is Site Control set up? ☐ Yes ☐ No	2. Is there an on-scene command post? ☐ Yes ☐ No If so, where?
3. Have all personnel been accounted for? ☐ Yes ☐ No ☐ Don't Know	Injuries: Fatalities: Unaccounted: Trapped:
4. Are observers involved, or rescue attempts planned? Observers: ☐ Yes ☐ No Rescuers: ☐ Yes ☐ No	5. Are decon areas setup? ☐ Yes ☐ No If so, where?

Hazard identification, immediate signs of: (if yes, explain in Remarks)

1. Electrical line(s) down or overhead? ☐ Yes ☐ No	2. Unidentified liquid or solid preducts visible? ☐ Yes ☐ No
3. Wind direction across incident: ☐ Towards your position Wind Speed: ☐ Away from your position	4. Is a safe approach possible? ☐ Yes ☐ No
5. Odors or smells? ☐ Yes ☐ No	6. Vapors visible? ☐ Yes ☐ No
7. Holes, ditches, fast water, cliffs, etc. nearby? ☐ Yes ☐ No	8. Fire, sparks, sources of ignition nearby? ☐ Yes ☐ No
9. Is local traffic a potential problem? ☐ Yes ☐ No	10. Preduct placards, color codes visible? ☐ Yes ☐ No
11. Other Hazards? ☐ Yes ☐ No	12. As you approach the scene from the upwind side, do you note a change in the status of any of the above? ☐ Yes ☐ No
13. Remarks:	

Hazard Mitigation: have you determined the necessity for any of the following?

1. Entry Objectives:	
2. Warning sign(s), barriers, color codes in place? ☐ Yes ☐ No	
3. Hazardous material being monitored? ☐ Yes ☐ No 3a. Sampling Equipment: 3b. Sampling location(s): 3c. Sampling frequency: 3d. Peak Reading: 3e. Personal exposure monitoring:	
4. Protective gear / level:	4a. Gloves: 4c. Clothing: 4e. Chemical cartridge change frequency:
4b. Respirators: 4d. Boots:	
5. Decon 5a. Instructions: 5b. Decon equipment and materials:	
6. Emergency escape route established? ☐ Yes ☐ No Route?	
7. Field responders briefed on hazards? ☐ Yes ☐ No	
8. Remarks:	

ENBRIDGE

Site Safety and Control Analysis	ICS 201-5

Protective Zones: record initial control perimeters (see Figure 1)

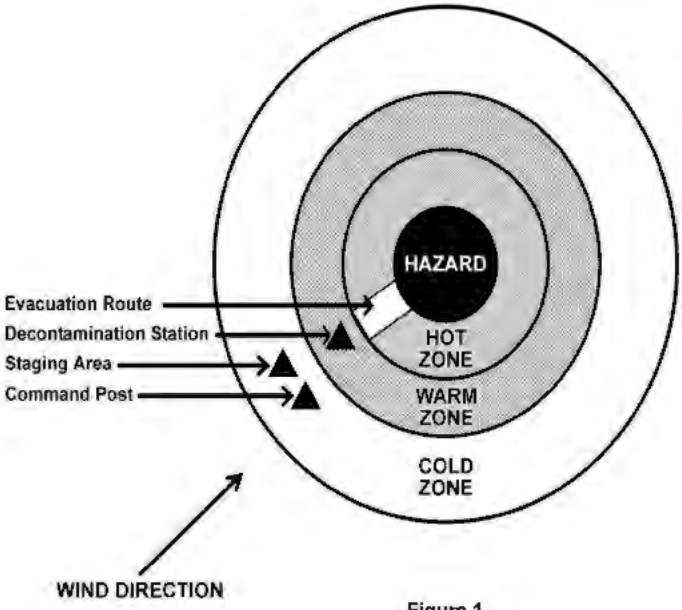


Figure 1
Protective Zones

1. Is there a Hot Zone established? ☐ Yes ☐ No
If so, where?

2. Is there a Warm Zone established? ☐ Yes ☐ No
If so, where?

3. Is there a Cold Zone established? ☐ Yes ☐ No
If so, where?

4. Remarks: (Include any information on evacuation route etc.)

5. Include any site sketches or photos of the protective zones (if available):

ENBRIDGE	General Response Objectives	ICS 202

Incident:	Prepared By:	at:
Period:	Version Name:	

Overall and Tactical Objectives	Assigned to:	Status
1. Ensure the Safety of Citizens and Response Personnel		
☐ 1a. Identify hazard(s) of spilled material		
☐ 1b. Establish site control (hot zone, warm zone, cold zone, & security)		
☐ 1c. Consider evacuations if needed		
☐ 1d. Establish vessel and/or aircraft restrictions		
☐ 1e. Monitor air in impacted areas		
☐ 1f. Develop site safety plan for personnel and ensure safety briefings are conducted		
2. Control the Source of the Spill		
☐ 2a. Complete emergency shutdown		
☐ 2b. Conduct firefighting		
☐ 2c. Initiate temporary repairs		
☐ 2d. Transfer lighter product		
☐ 2e. Conduct salvage operations, as necessary		
3. Manage a Coordinated Response Effort		
☐ 3a. Complete or confirm notifications		
☐ 3b. Establish a unified command organization and facilities (command post, etc.)		
☐ 3c. Ensure local and Aboriginal/tribal officials are included in response organizations		
☐ 3d. Initiate spill response Incident Action Plans (IAP)		
☐ 3e. Ensure mobilization and tracking of resources and account for personnel and equipment		
☐ 3f. Complete documentation		
4. Maximize Protection of Environmentally-Sensitive Areas		
☐ 4a. Implement pre-designated response strategies		
☐ 4b. Identify resources at risk in spill vicinity		
☐ 4c. Track oil movement and develop spill trajectories		
☐ 4d. Conduct visual assessments (e.g., overflights)		
☐ 4e. Develop/implement appropriate protection tactics		

Incident:	Prepared By:	at:
Period:	Version Name:	

Overall and Tactical Objectives	Assigned to:	Status
5. Contain and Recover Spilled Material		
☐ 5a. Deploy containment boom at the spill site and conduct open-water skimming		
☐ 5b. Deploy containment boom at appropriate collection areas		
☐ 5c. Evaluate time-sensitive response technologies (e.g., dispersants, in-situ burning)		
☐ 5d. Develop disposal plan		
6. Recover and Rehabilitate Injured Wildlife		
☐ 6a. Establish oiled wildlife reporting hotline		
☐ 6b. Conduct injured wildlife search and rescue operations		
☐ 6c. Set up primary care unit for injured wildlife		
☐ 6d. Operate wildlife rehabilitation center		
☐ 6e. Initiate citizen volunteer effort for oiled bird rehabilitation		
7. Remove Oil from Impacted Areas		
☐ 7a. Conduct appropriate shoreline cleanup efforts		
☐ 7b. Clean oiled structures (piers, docks, etc.)		
☐ 7c. Clean oiled vessels		
8. Minimize Economic Impacts		
☐ 8a. Consider tourism, vessel movements, & local economic impacts		
☐ 8b. Protect public and private assets, as resources permit		
☐ 8c. Establish damage claims process		
9. Keep Stakeholders and Public Informed of Response Activities		
☐ 9a. Provide forum to obtain stakeholder input and concerns		
☐ 9b. Provide stakeholders with details of response actions		
☐ 9c. Identify stakeholder concerns and issues, and address as practical		
☐ 9d. Provide timely safety announcements		
☐ 9e. Establish a Joint Information Center (JIC)		
☐ 9f. Conduct regular news briefings		
☐ 9g. Manage news media access to spill response activities		
☐ 9h. Conduct public meetings, as appropriate		

ENBRIDGE	Organization Assignment	ICS 203

Incident:	Prepared By:	at:
Period:	Version Name:	

Command Staff

Title	Name	Mobile	Pager	Other	Radio
Federal (FOSC)					
State (SOSC) Prov					
RP(s)					
Incident Commander					
Deputy Incident					
Safety Officer					
Information Officer					
Liaison Officer					
Intelligence Officer					

Operations Section

Title	Name	Mobile	Pager	Other	Radio
Operations Section					
Deputy Operations					
Staging Area Manager					
Recovery & Prot. Branch					
Emergency Resp.					
Air Ops Branch Director					
Wildlife Branch Director					
Branch Director					
Division/Group					
Disposal Group					

Planning Section

Title	Name	Phone	Fax	Other	Radio
Planning Section Chief					
Deputy Planning Section					
Situation Unit Leader					
Resource Unit Leader					
Documentation Unit					
Technical Specialist					
Demobilization Unit					
Check In Recorder					

ENBRIDGE	Organization Assignment	ICS 203

Incident:	Prepared By: at
Period:	Version Name:

Logistics section					
Title	**Name**	**Phone**	**Fax**	**Other**	**Radio**
Logistics Section Chief					
Deputy Logistics Section					
Service Branch Director					
Medical Unit Leader					
Food Unit Leader					
Communication Unit					
Support Branch Director					
Supply Unit Leader					
Facilities Unit Leader					
Ground Support Unit					
Vessel Support Unit					

Finance Section					
Title	**Name**	**Phone**	**Fax**	**Other**	**Radio**
Finance Section Chief					
Deputy Finance Section					
Time Unit Leader					
Procurement Unit					
Compensation/Claims					
Cost Unit Leader					

ENBRIDGE

Assignment List

ICS 204

Incident:	Branch:
Period:	Division:

Operations Personnel

Title	Name	Affiliation	Contact Number(s)
Operations Section Chief			
Branch Director			
Division/Group/STAM			

Incident Resources – Equipment

Supplier	Resource Type	Description	Quantity	Size	Status

Assignments

Special Instructions for Division/Group

Communications

Name/Function	Radio: Frequency/System/Channel	Phone	Cell/Pager

Emergency Communications

Medical	Evacuation	Other
Prepared by (Resource Unit Leader):	Approved by (Planning Section Chief):	Date/Time Approved:

ENBRIDGE	Assignment List	ICS 204

Incident:	Branch:
Period:	Division:
Prepared by Signature:	Task Force:
Approved by Signature:	Group:

Tactical Objective
Description of Work
Location of Work
Work Assignment Special Instructions
Special Equipment/Supplies Needed for Assignment
Special Environmental Considerations
Special Site-Specific Safety Considerations
Shoreline Cleanup Assessment Team (SCAT) Considerations

Prepared by (Resource Unit Leader):	Approved by (Planning Section Chief):	Date/Time Approved:

ENBRIDGE

Communications Plan

ICS 205

Incident:	Prepared By: at:
Period:	Version Name:

Phone Listing

Name	Main Phone	Fax	Other No. – Desc.	Other No. – Desc.	Radio

Radio Utilization

System	Channel	Function	Frequency	Assignment	Notes

ENBRIDGE

Medical Plan

ICS 206

Incident:	Prepared By:	at:
Period:	Version Name:	

First Aid Stations

Name	Location	EMT (On-Site)	Phone	Radio

Transportation (Ground and/or Ambulance Services)

Name	Location	EMT	Phone	Radio

Air Ambulances

Name	Location	Doctor/Nurse/EMT	Phone	Radio

Hospitals

Name	Location	Helipad Burn Center	Phone	Radio

Special Medical Emergency Procedures

Incident:	**Prepared by:** **at:**
Period:	**Version Name:**
Revision:	
Applies To Site:	
Products:	(Attach MSDS)

SITE CHARACTERIZATION

Water		Wave Direction	
Wave Height		Current Direction	
Current Speed		Use	
Land		Temp	
Weather		Wind Direction	
Wind Speed			

Pathways for Dispersion:

Site Hazards

☐ Boat safety	☐ Fire, explosion, in-situ burning	☐ Pump hose
☐ Chemical hazards	☐ Heat stress	☐ Slips, trips, and falls
☐ Cold stress	☐ Helicopter operations	☐ Steam and hot water
☐ Confined spaces	☐ Lifting	☐ Trenching/excavation
☐ Drum handling	☐ Motor vehicles	☐ UV radiation equipment
☐ Operational tactics	☐ Noise	☐ Visibility
☐ Electrical operations	☐ Overhead/buried utilities	☐ Weather
☐ Fatigue	☐ Plants/wildlife	☐ Work near water
☐ Other _____	☐ Other _____	☐ Other _____

Air Monitoring

%O2: _____ **%LEL:** _____ **ppm Benzene:** _____

ppm H2S: _____ **Other (Specify):** _____

CONTROL MEASURES

Engineering Controls

☐ Source of release secured	☐ Valve(s) closed	☐ Energy source locked/tagged out
☐ Site secured	☐ Facility shut down	☐ Other _____

Personal Protective Equipment

☐ Impervious suit	☐ Respirator liner	☐ Outer gloves
☐ Eye protection	☐ Inner gloves	☐ Personal floatation device
☐ Flame resistant clothing	☐ Boots	☐ Hard hats
☐ Other _____		

Additional Control Measures

☐ Decontamination	☐ Stations established as needed (e.g. safety or decontamination)
☐ Sanitation	☐ Facilities provided – OSHA 29 CFR 1910.120n
☐ Illumination	☐ Facilities provided – OSHA 29 CFR 1910.120m
☐ Medical surveillance	☐ Facilities provided – OSHA 29 CFR 1910.120fq

Incident:	Prepared By: at:
Period:	Version Name:

WORK PLAN

☐ Booming ☐ Skimming ☐ Vac trucks ☐ Pumping ☐ Excavation
☐ Heavy equipment ☐ Sorbent pads ☐ Patching ☐ Hot work ☐ Obtain appropriate permits
☐ Other

TRAINING

☐ Verified site workers trained per OSHA 29 CFR 1920.120

ORGANIZATION

Title	Name	Telephone/Radio
Incident Commander:		
Deputy Incident Commander:		
Safety Officer:		
Public Affairs Officer:		
Other:		

EMERGENCY PLAN

☐ Alarm system: _____
☐ Evacuation plan: _____
☐ First aid location _____

Notified:

☐ Hospital		Phone:	
☐ Ambulance		Phone:	
☐ Air ambulance		Phone:	
☐ Fire		Phone:	
☐ Law enforcement		Phone:	
☐ Emergency response/rescue		Phone:	

PRE-ENTRY BRIEFING

☐ Initial briefing prepared for each site

INCLUDING ATTACHMENTS/APPENDICES

Attachments

☐ Site Map
☐ Hazardous Substance Information Sheets
☐ Site Hazards
☐ Monitoring Program
☐ Training Program
☐ Confined Space Entry Procedure
☐ Safe Work Practices for Boats
☐ PPE Description
☐ Decontamination
☐ Communication and Organization
☐ Site Emergency Response Plan

Appendices

☐ Site Safety Program Evaluation Checklist
☐ Confined Space Entry Checklist
☐ Heat Stress Consideration
☐ Cold Stress and Hypothermia Consideration
☐ First Aid for Bites, Stings, and Poisonous Plant Contact
☐ Safe Work Practice for Oily Bird Rehabilitation
☐ SIPI Site Pre-Entry Briefing
☐ Personnel Tracking System

ENBRIDGE	Incident Status Summary	ICS 209

Incident:	Prepared By:	at:
Period:	Version Name:	

Type of Incident

☐ Oil Spill	☐ Hazardous Material(s)
☐ Search and Rescue	☐ Serious Incident/Security Threat
☐ Natural Disaster	☐ Fire
☐ Planned Event	☐ Other

Situation Summary as of Time of Report

Future Outlook/Goals/Needs/Issues

Safety Status / Personnel Casualty Summary

Casualty Type	Since Last Report	Adjustments to Previous Op. Period	Total
Responder Injury			
Responder Death			
Public Missing (Active Search)			
Public Missing (Presumed Lost)			
Public Uninjured			
Public Injured			
Public Death			
Total Public Involved			

Property Damage Summary

Property Type	Est. Damage Amount
Vessel	
Cargo	
Facility	
Other	

Incident:	Prepared By:	at:
Period:	Version Name:	

Equipment Resources

Type	Notes	Ordered	Available / Staged	Assigned	Out-of-Service
Aircraft – Fixed-Wing					
Aircraft – Helo					
Pollution Equip – Boom					
Pollution Equip – OSRV					
Pollution Equip – Portable Storage					
Pollution Equip – Skimmers					
Pollution Equip – Tank Vsl/Barge					
Pollution Equip – VOSS/SORS					
Vehicles – Ambulance					
Vehicles – Car					
Vehicles - Fire/Rescue/HAZMAT					
Vehicles – Truck					
Vehicles – Vac/Tank Truck					
Vessels – Boat					
Vessels – Deck Barge					
Vessels – Pilot Boat					
Vessels – SAR/LE Boat					
Vessels – Tug/Tow Boat					
Vessels – USCG Cutter					
Vessels – Work/Crew Boat					

Personnel Resources On Site

Company, Contractor, Federal, Provincial/State, Local and Territorial Agencies	Total # of People
Enbridge	
Total:	

ENBRIDGE	Incident Status Summary	ICS 209

Incident:	Prepared By: at:
Period:	Version Name:

HAZMAT/Oil Spill Status (Estimated)

Common Name(s):	
UN Number:	Source Status: ☐ Secured ☐ Unsecured
CAS Number:	Remaining Potential:
	Rate of Spillage:

All estimates are in:

	Adjustments to Previous Operational Period	Since Last Report	Total
Volume Spilled/Released			

Mass Balance – HAZMAT/Oil Budget

Recovered HAZMAT/Oil			
Evaporation/Airborne			
Natural Dispersion			
Chemical Dispersion			
Burned			
Floating, Contained			
Floating, Uncontained			
Onshore			
		Total HAZMAT/Oil Accounted for:	

Comments:

HAZMAT/Oil Waste Management (est., since last report)

Waste Type	Recovered	Disposed	Stored
Oil			
Oily Liquid			
Liquid			
Oily Solid			
Solid			

Comments:

HAZMAT/Oil Shoreline Impacts (Estimated)

Degree of Impact	Affected	Cleaned	To be Cleaned
Very Light			
Light			
Medium			
Heavy			
Total:			

Comments:

HAZMAT/Oil Wildlife Impacts (Since last report)

Wildlife Type	Captured	Cleaned	Released	DOA	Died in Facility	
					Euthanized	Other
Bird						
Mammal						
Reptile						
Fish						
Total:						

Comments:

ENBRIDGE

Change Status

ICS 210

Incident:	Prepared By: at:
Period:	Version Name:

Incident Resources to Change

ID	Supplier	Resource Type	Description	Quantity	Size	Current Location	Current Status

New Status and/or Location

New Status:

New Location:

Date/Time of Change:

Notes (Special Instructions, Safety Notes, Hazards, Priorities)

Retention: Retained in the Region Permanently

VERSION 1: (Revised April 5, 2014)

ENBRIDGE

Check-In List (Personnel)

ICS 211p

Incident:	Prepared By: at:
Period: to	Version Name:
Check-In Location ☐ Command Post ☐ Staging Area ☐ Other	Location Name:

Personnel Check-In Information

Name (Last, First) & Contact Information	Classification & Company/Agency	Assigned Section & Position	Quantity & UOM	Check-In Date/Time	Check-Out Date / Time Destination

ENBRIDGE

Check-In List (Equipment)

ICS 211e

Incident:		**Prepared By:**	**at:**
Period:		**Version Name:**	
Check-In Location:	☐ Command Post ☐ Staging Area ☐ Other	**Location Name:**	

Equipment Check-In Information

Equipment Description & Identifier	Supplier & Contact Information	Quantity & UOM	Size & UOM	Check-In Date/Time & Assignment	Check-Out Date / Time & Destination

ENBRIDGE	Unit Log	ICS 214

Incident:	Prepared By: at:
Period: to	Version Name:

Personnel Roster Assigned

Name	ICS Position	Home Base

Activity Log

Date/Time	Events/Notes

ENBRIDGE	Individual Logs	ICS 214a

Incident:	Prepared By:	at:
Period:	Version Name:	

Activity Log

Date/Time	Events/Notes

ENBRIDGE	**Operational Planning Worksheet**	**ICS 215**

Incident:	**Prepared By:** **at:**
Period:	**Version Name:**

Branch/Division/ Area of Operation	Work Assignments	Resource							Reporting Location	Requested Arrival Date/Time
		Required								
		Have								
		Need								
		Required								
		Have								
		Need								
		Required								
		Have								
		Need								
		Required								
		Have								
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		Have								
		Need								
		Required								
		Have								
		Need								
		Required								
		Have								
		Need								
		Required								
		Have								
		Need								

ENBRIDGE

Support Vehicle Inventory

ICS 218

Incident:	Prepared By: at:
Period:	Version Name:

Vehicle Category: ☐ Buses ☐ Dozers ☐ Engines ☐ Lowboys ☐ Pickups/Sedans ☐ Tenders ☐ Other

Vehicle Equipment Information

Resource Order # / *E* Number	Incident ID #	Vehicle Type	Vehicle Make	Capacity/Size	Agency/Owner	Vehicle License / Rig Number	Location	Release Time

Retention: Retained in the Region Permanently

VERSION 1: (Revised April 5, 2014)

ENBRIDGE

Air Operations Plan

ICS 220

Incident:	Prepared By:	at:
Period:	Version Name:	

Personnel and Communications

Title/Position	Name	Air/Air Frequency	Air/Ground Frequency	Phone

Planned Flight Information

Type Of Aircraft	Operating Base	Aircraft Company	Passenger Capacity	Purpose	Scheduled Flights

Notes (Special Instructions, Safety Notes, Hazards, Priorities)

ENBRIDGE

Demobilization Check Out

ICS 221

Incident:	**Prepared by:**
Period: to	**Version Name:**

Incident Resources to Change

ID	Supplier	Resource Kind	Description	Quantity	Equip ID/Tag#	Size	Original Location

New Status and/or Location

New Status:

New Location:

Release Date/Time:

Changes Processed On: **By:**

Comments

Approved By

You and your resources have been released, subject to signoff from the following:

Position	Printed Name	Signature	Date

	Prepared By: at / / :
	Page of

ENBRIDGE	Health and Safety Message	ICS 223

Incident:	Prepared By: at:
Period:	Version Name:

Major Hazards and Risks

Narrative

Signature:

ENBRIDGE	Long Term Planning Worksheet	ICS 226

Incident:	Prepared By: at:
Period:	Version Name:

ENBRIDGE

Daily Meeting Schedule

ICS 230

Incident:		Prepared By:	at:
Period:		Version Name:	
Meeting Name & Date/Time	**Purpose**	**Attendees**	**Location**

ENBRIDGE	Meeting Description Summary	ICS 231

Incident:	**Prepared By:** **at:**
Period:	**Version Name:**

Meeting Information

Meeting Name:	
Meeting Date/Time:	
Meeting Location:	
Meeting Facilitator:	

Purpose and Attendees

Purpose:	
Attendees:	

Agenda Outline

Meeting Minutes

ICS 232 – Resources at Risk	Version Name:
Incident Name:	Period: / / : to / / :

Environmentally Sensitive Areas and Wildlife Issues

Site #	*Priority*	*Site Name and/or Physical Location*	*Status*	*Date Completed*
Site Issues				
Notes				
Site Issues				
Notes				
Site Issues				
Notes				
Site Issues				
Notes				
Site Issues				
Notes				

ICS 232 – Resources at Risk	Version Name:
Incident Name:	Period: / / : to / / :

Archaeo-cultural and Socio-economic Issues

Site #	*Priority*	*Site Name and/or Physical Location*	Status	*Date Completed*
Site Issues				
Notes				
Site Issues				
Notes				
Site Issues				
Notes				
Site Issues				
Notes				
Site Issues				
Notes				

ENBRIDGE	ACP Site Index	ICS 232a

Incident:	Prepared By: at:
Period:	Version Name:

Index to ACP/GRP sites shown on Situation Map

Site #	Priority	Site Name and/or Physical Location	Action	Status
Notes:				
Notes:				
Notes:				
Notes:				
Notes:				
Notes:				
Notes:				
Notes:				
Notes:				
Notes:				

ENBRIDGE

Action Tracker Report

ICS 233

Incident:			Prepared By:		at:	
Period:			Version Name:			
Item Number	Description	Responsible Section/Person	Status	Start Date	Briefed	Target Date

ENBRIDGE

Work Analysis Matrix

ICS 234

Period:	Version Name:

Objectives		
Operations Objectives	**Optional Strategies**	**Tactics/Work Assignments**

Annex 1 – Table of Contents Page

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1.0 Owner & Operator

The Owner and Operator of this pipeline system is:

OWNER/OPERATOR ADDRESS	Enbridge Energy, Limited Partnership 1100 Louisiana, Suite 3200 Houston, TX 77002-5216 Phone: (713) 650-8900

EDMONTON CONTROL CENTER
24 hr. Contact: **(800) 858-5253** or **(780) 420-5221**

This pipeline system is comprised of the following legal entities:

- Enbridge Energy, Limited Partnership
- Enbridge Pipelines (Southern Lights) L.L.C.
- Enbridge Pipelines (Toledo) Inc.

1.1 Purpose

This Annex is designed to provide field personnel with the information necessary to respond to incidents in a safe and efficient manner in the Superior Region Response Zone, hereafter referred to as the Superior Region and to show the Company's compliance with the regulations set forth by the Department of Transportation in *49CFR§194*.

Emergency response operations involve actions taken at, or in close proximity to, the site of an incident that are designed to mitigate the situation and attain initial control over the incident, ensure safety of all concerned, develop plans of action and facilitate communications

1.2 Interface With Jurisdictional and Company Plans

This Plan has been prepared in accordance with jurisdictional Contingency Plans. The National Contingency Plan (NCP) and applicable Area Contingency Plan (ACP) are reviewed annually; Enbridge certifies this Integrated Contingency Plan is consistent with the NCP and applicable ACP. These plans are used to provide a framework for liaison and assistance during an emergency response. This liaison may be in part or in full depending on the necessity of Unified Command outlining areas of concern, such as-

- Identification of environmentally, culturally and economically sensitive areas potentially impacted by a spill.
- Descriptions of Company's response strategies and responsibilities in accordance with Enbridge Pre-Fire Plans,Tactical Response Plans and Control Point Maps..
- Integration of Company's response efforts with those of the Federal, State and local agencies.

1.2.1 Contingency Plans and Tactical Response Plans

Contingency Plans

- National Oil and Hazardous Substances Pollution Contingency Plan (NCP)
- Canada-United States Joint Inland Pollution Contingency Plan (CANUSPLAIN)
- EPA Region 5 and 8 Area Contingency Plans
- Inland Response Tactics Manual (USCG)
- Wisconsin Contingency Plan for Hazardous Substance Discharges
- Minnesota Emergency Operations Plan (MEOP)
- Minnesota's Preparedness for an Oil Transportation Incident
- Western Lake Superior Area Contingency Plan
- Wisconsin Emergency Response Plan
- Great Lakes Contingency Plan
- Canuscent Annex III to the Canada – United States Joint Inland Pollution Contingency Plan
- Region II (NY/NJ) Regional Response Team Regional Oil and Hazardous Substances
- Pollution Contingency Plan
- Sub-Area Geographical Response Plans (GRP):
    - Emergency Support Function 10- Wisconsin (GRP)
    - Great Rivers Sub-Area Contingency Plan
    - Minnesota Spill Bill (GRP)
    - Red River Sub-Area Contingency Plan (GRP)
    - Western Michigan Area Contingency Plan (GRP)

Tactical Response Plans

- Cass Lake
- Superior Terminal- Superior Bay
- Red River of the North
- Rock River
- Chippewa River- Flambeau River
- Black River- Lake Arbutus

1.3 Management Certification

Management Certification
This Plan is approved for implementation as herein described. Manpower, equipment and materials will be provided as required in accordance with this Plan. The Company is dedicated to protection of the environment and commits to implement the necessary measures, as specified in the Plan, as necessary in a spill response emergency. In addition to any non-company resources including Mutual Aid arrangements identified in this Plan, the necessary personnel and equipment resources, owned or operated by the facility owner or operator, are available to respond to a discharge within appropriate response times. The Regional Director has been identified and assumes the role of the Incident Commander. I, the undersigned, attest to the fact the information contained within this Integrated Contingency Plan is accurate and factual to the best of my knowledge. The listed individuals in this letter are considered, in priority of succession, as Qualified Individuals and have full authority to make all necessary decisions in an emergency situation. Such decisions include, but are not limited to the following: • Activate internal alarms and hazard communications systems; • Activate personnel, equipment, and response organizations Mutual Aid as needed • Identify character, source, amount, and extent of release; • Notify and provide information to appropriate Federal, Provincial/State and local authorities; • Assess interaction of spilled substance with water and/or other substances stored at facility and notify on-scene response personnel; • Assess possible hazards to human health and the environment including both the direct and indirect effects of the release (e.g., the effects of any hazardous surface waters runoffs from water or chemical agents used to control fire and heat-induced explosion); • Assess and implement prompt removal and containment actions; • Coordinate rescue and response actions with response personnel; • Activate and direct cleanup activities with emergency response contractors; • Act as a liaison with the regulatory authorities; and • Designate any funds required to carry out all required and directed oil spill response, mitigation and clean-up activities. Enbridge has determined that the Superior Region meets the criterion which requires the zone to be considered as having the potential to cause "significant and substantial" harm. This Plan has been prepared in accordance to and is consistent with applicable contingency plans for the facilities covered by this Plan.
CERTIFICATION SIGNATURE: SIGNATURE [redacted], Director Superior Region Ops Services TITLE DATE

1.4 Incident Commanders (Qualified Individuals)

The Regional Director has been identified as the Incident Commander and assumes the role of the Qualified Individual.

The Minimum Duties Required Of The QI /IC or designee Include:	
✓	Activate response personnel and response organizations' Mutual Aid as needed.
✓	Notify and provide necessary information to appropriate Federal, Provincial, State and local authorities with designated response roles. See *Annex 2 – Notification Procedures*.
✓	Assess the possible hazards to human health and the environment as a result of the release. This assessment must consider both the direct and indirect effects of the release (i.e., the effects of any hazardous surface waters runoffs from water or chemical agents used to control fire and heat-induced explosion).
✓	Assess and implement prompt removal actions to contain and then remove the substance released.
✓	Coordinate rescue and response action as previously arranged with all response personnel.
✓	Use authority to immediately access company funding to initiate response, mitigation and clean-up activities.

Superior Region- Qualified Individual:

[redacted]
Director Superior Region Ops. Services
Business Office: 715-394-1493
Cellular: [redacted]
Fax: 715-394-1405
E-mail: [redacted]

Alternate Qualified Individuals:

[redacted]
Manager, Superior Area Ops
Business Office: 715-394-1415
Cellular: [redacted]
Fax: 715-394-1405
E-mail: [redacted]

[redacted]
Manager, Bemidji Operations
Business Office: 218-755-6711
Cellular: [redacted]
Fax: 218-751-4927
E-mail [redacted]

1.5 Significant and Substantial Harm Certification

Applicability Of Significant And Substantial Harm – DOT / PHMSA All Relevant Pipelines As Listed In Section 1.6 Below
Pipeline Name: Superior Response Zone
Is the pipeline greater than 6 and 5/8 inches (168 mm) in outside nominal diameter, greater than 10 miles (16 kilometers) in length, and YES X NO
Has any line section experienced two or more reportable releases, as defined in *49CFR §195.50*, within the past five (5) years, or YES NO X
Does any line section contain any electric resistance welded pipe, manufactured prior to 1970 and operates at a maximum operating pressure established under *40CFR§195.406* that corresponds to a stress level greater than 50 percent of the specified minimum yield strength of the pipe, or YES X NO
Is any line located within a 5-mile (8 km) radius of potentially affected public drinking water intakes and could reasonably be expected to r public drinking water intakes, or YES X NO
Is any link located within a 1-mile (1.6 km) radius of potentially affected environmentally sensitive areas and could reasonably be expected to r these areas? YES X NO
Based on the DOT/PHMSA criteria above, ***ALL*** of Enbridge Pipelines are considered to be a system of Significant and Substantial Harm. Enbridge certifies to the Pipeline and Hazardous Materials Safety Administration of the Department of Transportation that we have obtained, by contract or other approved means, the necessary private personnel and equipment to respond, to the maximum extent practicable, to a worst-case discharge.

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining information, I believe that the submitted information is true, accurate and complete.

[redacted]
Name

October 03, 2016
Date

1.6 Response Zone Description (Information Summary)

1.6.1 Superior Region (#867)

The Superior Region Response Zone consists of three entities: Enbridge Energy, Limited Partnership, Enbridge Pipelines (Southern Lights) L.L.C. and Enbridge Pipelines (Toledo) Inc. This response zone begins at the Canadian border near Neche, North Dakota and continues across northern Minnesota throughout Wisconsin. The first section of this response zone includes seven pipelines (Lines 1, 2, 3, 4, 13, 65, and 67) that transport crude oil and natural gas south and diluent condensate north. The response zone continues south of Superior to the Wisconsin/Illinois state border with four pipelines (Lines 6A, 13, 14, and 61) transporting crude oil south to Illinois and diluent condensate from the Manhattan Terminal in Illinois north to Edmonton, Alberta. A 30-inch pipeline (Line 5) originates in Superior, WI that transports crude oil and natural gas liquids east across northern Wisconsin, the Upper Peninsula of Michigan and into lower Michigan with the Superior Region ending at the Wisconsin/Michigan state border.

1.6.2 Superior Region Pipeline Information

The Superior Region encapsulates the lines between the following coordinates:

Table 1- Pipeline Segments

Line	Pipeline Section	Begin Lat	Begin Long	End Lat	End Long
1	Gretna, Manitoba to Superior, WI	49.0	-97.5	46.6	-92.0
2	Gretna, Manitoba to Superior, WI	49.0	-97.5	46.6	-92.0
3	Gretna, Manitoba to Superior, WI	49.0	-97.5	46.6	-92.0
4	Gretna, Manitoba to Superior, WI	49.0	-97.5	46.6	-92.0
5	Superior, WI to Wisconsin-Illinois State Line	46.6	-92.0	46.4	-90.2
6A	Superior, WI to Wisconsin-Illinois State Line	46.6	-92.0	42.4	-88.8
So. Lights 13	Wisconsin-Illinois State Line to Superior, WI	42.4	-88.8	46.6	-92.0
So. Lights 13	Superior, WI to Gretna, Manitoba	46.6	-92.0	49.0	-97.5
14	Superior, WI to Wisconsin-Illinois State Line MP	46.6	-92.0	42.4	-88.5
61	Superior, WI to Wisconsin-Illinois State Line MP	46.6	-92.0	42.4	-88.8
LSr (65)	Gretna, Manitoba to Clearbrook, MN	49.0	-97.5	47.6	-95.4
Alberta Clipper 67	Gretna, Manitoba to Superior, WI	49.0	-97.5	46.6	-92.0

Enbridge Energy, Limited Partnership includes:

- **Lines 1** (18”/20”), **2** (26”), **3** (34”), **4** (36”/48”), and **67** (36”) flow from the US/Canadian border near Gretna, Manitoba to Superior, Wisconsin;
- **Line 65** (20”) begins at the U.S./Canadian border near Gretna, Manitoba and terminates at Clearbrook, Minnesota;
- **Line 5** (30”) starts at Superior, Wisconsin extending east across northern Wisconsin, the upper peninsula of Michigan and into lower Michigan, terminating in Sarnia, Ontario. The Superior Region ends at the Wisconsin/Michigan state line.
- **Lines 6A** (34”) and **14** (24”) begin at Superior, Wisconsin and traverse south, with Line 14 terminating at Mokena, Illinois and Line 6A terminating at Griffith, Indiana. The Superior Region ends at the Wisconsin/Illinois state line for both lines.
- **Line 61** (42”) (Southern Access) extends from Superior, Wisconsin to Flanagan, Illinois. The Superior Region ends at Wisconsin/Illinois state line.

Enbridge Pipelines (Southern Lights) L.L.C.:

Line 13 (18”/20”) runs from Manhattan, Illinois to the U.S./Canadian border near Gretna, Manitoba. The Superior Region begins at the Wisconsin/Illinois state line.

Superior Region valve schematics have been compressed into electronic media, and are accessible through the regional office.

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Table 2- Superior Region Pipelines Beginning and Ending Stationing

Line	Pipeline Sections	Begin Stationing	End Stationing	Miles	Pipeline Diameter	Product
1	Gretna, Manitoba to Clearbrook, MN	0	716,232	135.7	20"	Crude Oil & Natural Gas Liquids
1	Clearbrook, MN to Superior, WI	716,232	1,712,883	188.8	18"	Crude Oil & Natural Gas Liquids
2	Gretna, Manitoba to Superior, WI	0	1,712,887	324.4	26"	Crude Oil
3	Gretna, Manitoba to Superior, WI	0	1,712,887	324.4	34"	Crude Oil
4	Gretna, Manitoba to Donaldson, MN (MP814)	0	168,408	31.9	36"	Crude Oil
4	Donaldson, MN to Viking, MN	168,041	213,109	8.5	48"	Crude Oil
4	Donaldson, MN to Viking, MN (MP 834)	213,461	322,423	20.6	36"	Crude Oil
4	Donaldson, MN to Plummer, MN	320,971	393,021	13.6	48"	Crude Oil
4	Viking, MN to Plummer, MN (MP 874)	394,395	527,703	25.2	36"	Crude Oil
4	Viking, MN to Clearbrook, MN	526,404	545,840	3.7	48"	Crude Oil
4	Plummer, MN to Clearbrook, MN (MP 909)	547,141	647,345	19.0	36"	Crude Oil
4	Plummer, MN to Clearbrook, MN	645,406	716,261	13.4	48"	Crude Oil
4	Clearbrook, MN to Cass Lake, MN Loop (MP 940)	716,411	878,927	30.8	36"	Crude Oil
4	Cass Lake, MN Loop (MP939.87 to MP 953.04)	877,981	946,695	13.1	48"	Crude Oil
4	Clearbrook, MN to Deer River ,MN Loop (MP 996)	946,641	1,059,570	21.4	36"	Crude Oil
4	Deer River, MN Loop (MP 974.73 to MP995.83)	(127,102)*	1,173,196	22.0	48"	Crude Oil
4	Cass Lake, MN to Floodwood, MN Loop (MP1044)	1,173,151	1,306,304	25.2	36"	Crude Oil

Line	Pipeline Sections	Begin Stationing	End Stationing	Miles	Pipeline Diameter	Product
4	Floodwood, MN Loop (MP1019.73 to MP1044.33)	1,299,654	(47,009)*	24.6	48"	Crude Oil
4	Deer River, MN to Wrenshall, MN Loop (MP 1080)	1,429,072	1,512,231	15.7	36"	Crude Oil
4	Wrenshall, MN Loop (MP1060.11 to MP1079.91)	1,512,091	1,616,806	20.0	48"	Crude Oil
4	Wrenshall, MN Loop to Superior, WI (MP 1098)	1,616,840	1,712,760	19.8	36"	Crude Oil
13	Gretna, Manitoba to Clearbrook, MN	0	715,074	135.4	18"	Diluent Condensate
13	Clearbrook, MN to Superior, WI	0	1,003,300	190	20"	Diluent Condensate
13	Superior, WI to Wisconsin-Illinois State Line	0	1,822,865	345.2	18"/ 20"	Diluent Condensate
5	Superior, WI to Wisconsin-Michigan State Line	0	481,627	91.2	30"	Crude Oil & Natural Gas Liquids
6A	Superior, WI to Wisconsin-Illinois State Line	0	1,821,436	345	34"	Crude Oil
14	Superior, WI Wisconsin-Illinois State Line	0	1,822,865	345.2	24"	Crude Oil
61**	**Superior, WI to** Wisconsin-Illinois State Line	0	481,627	91.2	42"	Crude Oil
65	Gretna, Manitoba to Clearbrook, MN	0	721,140	136.6	20"	Crude Oil
67	Gretna, Manitoba to Superior, WI	0	1,723,800	326.7	36"	Crude Oil
	Total Pipeline Miles			3,561.6		

*Diversion Stationing **Line 61- **Superior, WI to** Wisconsin-Illinois State Line **is designated for WCD**

The Superior Region System is comprised of:

- Approximately 3,562 miles of pipeline, with pipe diameters ranging from 18 to 48 inches;
- 39 pump stations located along the pipe; and
- Two terminal facilities with a total of 54 tanks 45 breakout tanks are located at Superior, WI Terminal and 9 tanks at Clearbrook, MN Terminal.

Table 3- Tank Table

TANK NO.	LOCATION	DATE BUILT	TOTAL VOLUME	Total Facility Capacity (Bbls)
56	Clearbrook	1960	54,000	1,264,000
57		1960	120,000	
58		1960	80,000	
59		1972	80,000	
60		1972	80,000	
61		1994	200,000	
62		1995	200,000	
63		1995	200,000	
64		1996	250,000	
1	Superior	1973	390,000	See Below
2		1973	390,000	
3		1989	150,000	
4		1989	150,000	
5		1951	150,000	
6		1951	150,000	
7		1951	150,000	
8		1951	150,000	
9		1951	150,000	
10		1951	150,000	
11		1951	150,000	
12		1951	150,000	
13		1952	217,000	
14		1952	217,000	
15		1952	217,000	
16		1952	217,000	
17		1952	217,000	
18		1952	217,000	
19		1968	217,000	
20		1952	217,000	
21		1952	217,000	

TANK NO.	LOCATION	DATE BUILT	TOTAL VOLUME	Total Facility Capacity (Bbls)
22	Superior	1952	217,000	11,841,000
23		1971	217,000	
24		1971	217,000	
25		1990	217,000	
26		1994	217,000	
27		1995	217,000	
28		1969	217,000	
29		1969	217,000	
30		2000	250,000	
31		2000	250,000	
32		2003	180,000	
33		2003	180,000	
34		2007	390,000	
35		2008	250,000	
36		2010	250,000	
37		2010	250,000	
38		2010	250,000	
39		2010	250,000	
40		2010	250,000	
41		2014	550,000	
42		2014	640,000	
43		2015	644,000	
44		2015	644,000	
45		2015	644,000	
Total Region Capacity		**13,105,000 bbls**		

Table 4- Superior Region State/County Crossings

North Dakota			
County	Line	MP Beginning	MP Ending
Pembina	1-4	774.0	801.8
	13	774.0	801.8
	65	774.0	801.8
	67	774.0	801.8
Minnesota			
Kittson	1-4	801.8	817.0
	13	801.8	817.0
	65	801.8	817.0
	67	801.8	816.8
Marshall	1-4	817.0	851.7
	13	817.0	851.7
	65	816.8	852.9
	67	817.0	851.7
Pennington	1-4	851.7	871.6
	13	851.7	871.4
	65	852.9	872.0
	67	851.7	871.4
Red Lake	1-4	871.6	886.9
	13	871.4	887.0
	65	872.0	886.9
	67	871.4	887.0
Polk	1-4	886.9	900.4
	13	887.0	900.5
	65	886.9	900.8
	67	887.0	900.5
Clearwater	1-4	900.4	921.1
	13	900.5	921.3
	65	900.8	909.6 (END)
	67	900.5	921.3
Beltrami	1-4	921.1	943.6
	13	921.3	944.1
	67	921.3	944.1
Hubbard	1-4	943.6	951.5
	13	944.1	958.0
	67	944.1	958.0
Cass	1-4	951.5	986.2
	13	958.0	986.0
	67	958.0	986.0
Itasca	1-4	986.2	1035.4
	13	986.0	1035.4
Itasca	67	986.0	1035.4
Aitkin	1-4	1035.4	1036.4
	13	1035.4	1036.4
	67	1035.4	1036.4

Minnesota cont.			
County	Line	MP Beginning	MP Ending
St. Louis	1-4	1036.4	1061.2
	13	1036.4	1061.2
	67	1036.4	1061.2
Carlton	1-4	1061.2	1084.9
	13	1061.2	1084.9
	67	1061.2	1084.9
Wisconsin			
Douglas	1-4	1084.9	1098.0 (END)
	6A	0.0	40.8
	13	1084.9	1095.0
	13	0.0	40.6
	14	0.0	40.4
	61	0.0	40.45
	67	1084.9	1095.0 (END)
Washburn	6A	40.8	60.0
	13	40.6	59.8
	14	40.4	59.8
	61	40.5	59.6
Sawyer	6A	60.0	84.5
	13	59.8	84.9
	14	59.8	84.4
	61	59.6	84.6
Rusk	6A	84.5	112.5
	13	84.9	112.5
	14	84.4	112.4
	61	84.6	113.7
Chippewa	6A	112.5	115.2
	13	112.5	115.1
	14	112.4	115.1
	61	113.7	116.3
Taylor	6A	115.2	135.5
	13	116.6	136.9
	14	115.1	135.3
	61	116.3	136.6
Clark	6A	135.5	162.3
	13	136.9	163.7
	14	135.4	162.2
	61	136.6	163.4
Marathon	6A	162.3	167.1
	13	163.7	168.5
	14	162.2	167.0
	61	163.4	168.3
Wood	6A	167.1	205.2
	13	168.5	206.8

Wisconsin cont.			
County	Line	MP Beginning	MP Ending
Wood	14	167.0	205.1
	61	168.3	207.0
Adams	6A	205.2	235.9
	13	206.8	237.5
	14	205.1	235.8
	61	207.0	237.1
Marquette	6A	235.9	252.4
	13	237.5	253.9
	14	235.8	252.3
	61	237.1	253.6
Columbia	6A	252.4	283.5
	13	253.9	285.0
	14	252.3	283.4
	61	253.6	284.6
Dane	6A	283.5	295.5
	13	285.0	296.3
	14	283.4	295.2
	61	284.6	296.4
Jefferson	6A	295.5	317.9
	13	296.3	319.4
	14	295.2	317.8
	61	296.4	319.1
Rock	6A	317.9	323.6
	13	319.4	345.2
	14	317.8	323.5
	61	319.1	345.0
Walworth	6A	323.6	345.9
	14	323.5	345.7
Douglas	5	1098.2 (Start)	1123.6
Bayfield	5	1123.6	1154.4
Ashland	5	1154.4	1172.9
Iron	5	1172.9	1189.2

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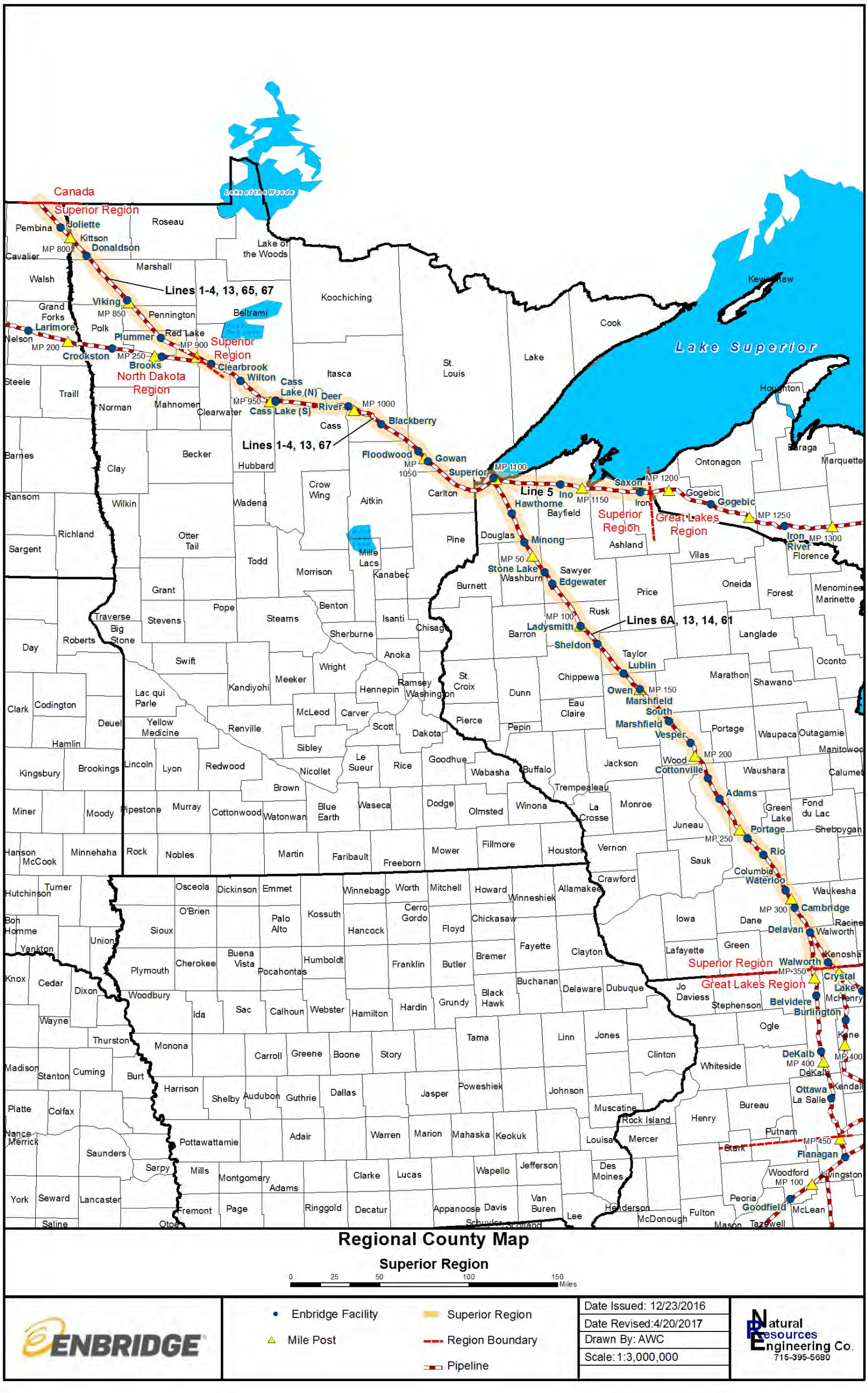
Figure 1- Superior Region County Map



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1.7 Local Spill Response Equipment

It is the responsibility of Area Supervisor/ Maintenance Team Leader to ensure that the spill response equipment is inventoried annually and restocked as resources are expended.

The following table lists the Enbridge owned primary spill recovery equipment and its capabilities. Emergency response trailers contain hard boom, sorbent boom, skimmers, and porta-tanks as well as various tools for initial emergency response to both land and water releases.

The locations of these facilities are noted on emergency response maps within this Annex under *Section 1.10*.

Enbridge has an OSRO Master Service Agreement with Marine Pollution Control Corp. (MPC) and T & T Marine Salvage, Inc. The agreements and lists of OSRO Equipment can be found in *Annex 2*.

Resource Type	Item Description	Total
ADAMS STATION		
SPECIALIZED EQUIPMENT	MOTOR, GENERAL ELECTRIC, 2500 HP, 1800 RPM Frame 8411Z	1
BEMIDJI PLM		
BOAT & RESPONSE VEHICLE	BOAT, WORK, LUND, 18FT, 150HP, YAMAHA MOTOR, C/W TRAILER/40020775	1
	BOAT, WORK, ALUMACRAFT, 20FT, 90 HP, EVINRUDE, C/W TRAILER/40020778	1
	BOAT,VESSEL, LUND, 20FT, ALUMINUM, ENGINE OUTBOARD, 90 EVINRUDE, C/W TRAILER/40020776	1
	BOAT,WORK BOAT, ALUMACRAFT, 14FT, 25HP EVINRUDE, C/W TRAILER/40020777	1
BOOM	BOOM, RIVER, CANADYNE, LONG SKIRT, 18"/40020795	350'
	BOOM, CONTAINMENT, CORRAL/40020798	100'
	BOOM, SORBENT, 3M, 4 X 10FT/40020829	9
	BOOM, RIVER, CANADYNE, LONG SKIRT, 12"/40020796	350'
	BOOM, CORRAL CONTAINMENT,/40020797	1000'
SKIMMER	SKIMMER, GROOVED DRUM, OSYSTSK340, 70 G.P.M., TDS118G, ELASTEC/AMERICAN MARINE, HYDRAULIC Drive, SHALLOW WATER/40013608	2
	SKIMMER, MECHANICAL, GROOVED DRUM, 8 FT, UN358, ELASTEC/AMERICAN MARINE/40020828	2
	SKIMMER, MECHANICAL, SMOOTH DRUM, 8FT, TDS136, ELASTEC/AMERICAN MARINE, HYDRAULIC/40020811	1
	SKIMMER, MECHANICAL, DRUM, 4FT, UNO 481, ELASTEC/AMERICAN MARINE/40020830	1
	SKIMMER, DRUM, MINI MAX, ELASTEC/AMERICAN MARINE/40020800	1
	SKIMMER,SMOOTH DRUM, OSYSTSK340, MECHANICAL, TDS118G, 70.0 GPM, ELASTEC/AMERICAN MARINE, HYDRAULIC, SHALLOW WATER 40021922	2
	SKIMMER, MECHANICAL, GROOVED DRUM, 8 FT, UN358, ELASTEC/AMERICAN MARINE/40020828	1
	SKIMMER, MECHANICAL, SMOOTH DRUM, 8FT, TDS136, ELASTEC/AMERICAN MARINE, HYDRAULIC/40020811	2
	SKIMMER, SKIM PACK, DOUGLAS ENGINEERING, MODEL 1800/40020799	1
	SKIMMER, DRUM, MINI MAX, ELASTEC/AMERICAN MARINE 40020800	1
	SKIMMER, VACUUM, MANTA RAY/40020801	1
SHALLOW WATER EQUIPMENT	DAM, SELF INFLATING, 28IN X 25FT (7.5M), ELASTEC/AMERICAN MARINE, WA-2825, WATERGATE/40013619	2
	PUMP, HYDRAULIC, STANLEY, SMP 22/40020790	1
	TANK. PORTABLE, SEI INDUSTRIES/40020366	1
	PUMP, DIAPHRAM, 3IN. HYDRAULIC/40020793	2
	PUMP, TRASH, 2IN/40013876	1
SORBENTS	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG/40013873	10
	PADS, ABSORBENT, PIG, 8IN, 10FT SECTIONS/40020794	5
SPECIALIZED EQUIPMENT	BLOWER, AIR, MAKITA 40020401	1
	SAW, CHAINSAW, 32IN BAR, 40020836	2
	HEATER, PORTABLE, MASTER 150000 BTU, SALAMANDER 40020788	1
	LIGHT PLANT, INGERSOLL RAND, 40020786	1
	VEHICE, OFF HIGHWAY, HYDRATEK, AMPHIBIOUS/40020785	1
	ARGO, DIESEL, AMPHIBIOUS, PERSONNEL, ALLWHL DRIVE, 950DT/40013663	1
	VEHICLE, OFF HIGHWAY, GASOLINE, SIDE BY SIDE, 4WHL DRIVE/40015239	2
	VEHICLE,OFF HIGHWAY VEHICLES, SNOWMOBILE/40020781	1

Resource Type	Item Description	Total
BEMIDJI PLM		
SPECIALIZED EQUIPMENT	GENERATOR, HONDA 3500 WATTS/40020791	2
	GENERATOR, HONDA, 1000 WATT/40020792	1
CLEARBROOK PLM		
BOAT & RESPONSE VEHICLE	BOAT, WORK, ALUMACRAFT, 20FT, 90 HP, EVINRUDE, C/W TRAILER/40020778	1
	BOAT,WORK BOAT, ALUMACRAFT, 14FT, 25HP EVINRUDE, C/W TRAILER/40020777	1
BOOM	BRIDLE, TOW, W/BULLET FLOAT, P/N 0540420F ELASTEC, FOR AIRMAX RIVER BOOM/40013602	5
	BOOM, FOAM, RIVER, OPTIMAX, ELASTEC/AMERICAN MARINE, P/N 00420501031, 6IN X 6IN X 50FT/40013616	10
	ANCHOR, SYSTEM FOR BOOM, ELASTEC/AMERICAN MARINE, 23 LB W/STEEL ANCHOR, W/8' CHAIN, 60' ROPE, 15" BUOY STD.&6' ROPE/40013610	3
	VANE, BOOM, 20FT, C/W RUDDER, ELASTEC/AMERICAN MARINE,/40020400	1
	BOOM, FOAM, RIVER, OPTIMAX, ELASTEC/AMERICAN MARINE, P/N 00420501031, 6IN X 6IN X 50FT/40013616	10
	BOOM,ABSORBENT, ELASTEC/AMERICAN MARINE, 5IN X 10FT/40020803	20
SKIMMER	SKIMMER MECHANICAL, GROOVED DRUM, UNO48G, ELASTEC/AMERICAN MARINE/40020831	1
	SKIMMER, MECHANICAL, GROOVED DRUM, 8 FT, UN358, ELASTEC/AMERICAN MARINE/40020828	1
SORBENTS	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG/40013873	5
SPECIALIZED EQUIPMENT	SOCK, WIND, 48IN X 18IN 40015581	2
	TANK. PORTABLE, ELASTEC, 1400 GALLONS/40020804	1
FORT ATKINSON PLM		
BOAT & RESPONSE VEHICLE	BOAT, LANDING CRAFT, 26FT, 150HP SUZUKI, ELASTEC/AMERICAN MARINEC/W TRAILER/40021021	1
	BOAT,LANDING CRAFT, 26FT, 2 X 150HP SUZUKI, ELASTEC/AMERICAN MARINE/40021549	1
	BOAT,WORK BOAT, 20FT, 115HP MERCURY, CRESTLINER/40021481	1
	BOAT,WORK BOAT, 14FT, 9.9HP JOHNSON, OUTBOARD, ALUMACRAFT 1457, C/W TRAILER 40021480	1
BOOM	BOOM, ABSORBENT, SOCK NET, SPILLTECH, 5IN X 10FT/40021455	15
	BOOM, ABSORBENT, WBOOM, 810, 8IN X 10FT/40021449	5
	BOOM, FOAM, RIVER, SLICK BAR, 6IN X 18IN/40021454	600'
	BOOM,ABSORBENT, SPILLTECH, P/N WB510SN, 5IN X 10FT/40021450	18
	BOOM, ABSORBENT, WBOOM, 810, 8IN X 10FT/40021449	1
	BOOM, SORBENT, 3M, 4 X 10FT/40020829	7
	BOOM FOAM, ACME MINI BOOM, 50FT/40021451	2
	BOOM, ABSORBENT, WBOOM, 810, 8IN X 10FT/40021449	120
	BOOM, FOAM,YELLOW SHORE, POLEMAR, 50FT/40021447	54
	BOOM,ABSORBENT, SPILLTECH, P/N WB510SN, 5IN X 10FT/40021450	800'
	BOOM,ACCESSORIES, BOOM, RIVER, 12IN TO SECURE 6FT X-TEX, OPTIMAX/40013593	500'
	BOOM, ABSORBENT, SPILFYTER M-54S, 5IN X 10FT, OIL ONLY, 4 PER BAG/40013874	10 Bags
	BOOM,FOAM, ACME MINI BOOM, 50FT/40021451	2
	POM POM, CLOSED LOOP OIL SNARES, 30 PER BUNDLE. 40013585	24
	BOOM, FOAM, ELASTEC/AMERICAN MARINE, 6IN X 50FT, C/W QUICK LATCH COUPLING 40021475	1,280'

Resource Type	Item Description	Total
FORT ATKINSON PLM		
BOOM	BOOM, ABSORBENT, SORBENT PRODUCTS COMPANY (SPC), (4) 5"X10' LENGTHS = 40 FT 40022000	4
	BOOM, HARD, RIVER, ELASTEC/AMERICAN MARINE, 6"X6"X100' 40022002	13
	BOOM,FOAM,3M, 8"X40' 40022003	1
	BOOM,FOAM, ACME MINI BOOM, 50FT 40021451	1
	BOOM, ABSORBENT, WBOOM, 810, 8IN X 10FT 40021449	120'
SKIMMER	SKIMMER, DRUM, 4 DRUM,4 FT,, MAG200, ELASTEC/AMERICAN MARINE 40020787	2
	SKIMMER, GROOVED DRUM, OSYSTSK340, 70 G.P.M., TDS118G, ELASTEC/AMERICAN MARINE, HYDRAULIC DRIVE, SHALLOW WATER 40013608	2
	SKIMMER,MECHANICAL, SMOOTH DRUM, ELASTEC/AMERICAN MARINE 40021997	1
	SKIMMER, MECHANICAL, GROOVED DRUM, TDS136, ELASTEC/AMERICAN MARINE 40021053	2
	SKIMMER, SKIM PACK, DOUGLAS ENGINEERING, MODEL 1800/40020799	1
	SKIMMER, MECHANICAL, GROOVED DRUM, 8 FT, UN358, ELASTEC/AMERICAN MARINE 40020828	1
	SKIMMER MECHANICAL, GROOVED DRUM,, UNO48G, ELASTEC/AMERICAN MARINE 40020831	1
	SKIMMER, VACUUM, MANTA RAY/40020801	1
SHALLOW WATER EQUIPMENT	PUMP, ELASTEC/AMERICAN MARINE, 10 HP DIESEL, MODEL #E150, 180 GPM, 48 PSI, C/W HYDRAULIC HOSES - (2) ½" x 50', (1) ¾" x 50' - VACUUM HOSE - (4) 2" x 10' (150 PSI) 40021998	1
	VACUUM, ELASTEC MINI VAC II, P/N MI32115080 40021446	1
	DAM, PORTABLE, PORTADAM, W/20 5IN 40021478	3
SORBENTS	ABSORBENT, ROLL, 3FT x 150FT, BLANKETS/40020850	30 Rolls
	ABSORBENT, ROLL, BRADY SPC, WHITE, 30IN X 150FT/40021445	28 Rolls
	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG/40013873	52 Bags
	ABSORBENT, PAD, OIL ONLY, 3M HP-156 , 100/BAG/40021033	5
	ABSORBENT, PAD, OIL ONLY, HIGH LOFT, 100/BAG 40021456	1
	ABSORBENT, PAD, OIL ONLY, HIGH LOFT, 100/BAG/40021456	2
	ABSORBENT, PAD, OIL ONLY, HIGH LOFT, 100/BAG/40021456	1
	ABSORBENT, PAD, OIL, 3M/SPC, 16"X20", 100 PADS/BALE 40022001	13 Bales
	ABSORBENT, PAD, SPILLTECH, 100/BAG/40021457	1
	ABSORBENT, ROLL, BRADY SPC, 'RAG RUG', P/N RAG36150, 36IN X 150IN 40021448	384'
	ABSORBENT, PAD, OIL ONLY, 3M , 36IN X 150FT 40021547	1
	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG 40013873	8
SPECIALIZED EQUIPMENT	AUGER HAND, ICE, 8INCH 40021548	1
	AUGER, ICE, 8INCH, GASOLINE POWERED 40020812	1
	GENERATOR, HONDA 3500 WATTS 40020791	1
	SAW, CHAINSAW FOR ICE USE, 24IN BAR 40021479	2
	BLOWER, AIR, STIHL 40020371	1
	TANK, PORTABLE, TEXABOOM, 1800 GAL/40021452	1
	TANK, FAST, 2000 (FULL KIT),INCLUDES ROOF COVER, GROUND MAT, T ANK LINER, VALVE OUTLET, PIPE SADDLE, TAPSTAND & HANDPUMP/ 40013599	2
	PACK, HYDRAULIC POWER, ELASTEC D22, KUBOTA DIESEL MOTOR 40020907	2

Resource Type	Item Description	Total
FORT ATKINSON PLM		
SPECIALIZED EQUIPMENT	POWER PACK, KUBOTA POWER PACK, D10, HANDLES WITH BOLTS, WHEELS, KIT FILTER ENGINE, COVER 40015601	5
SUPERIOR PLM & BLOCK BUILDING		
BOAT & RESPONSE VEHICLE	BOAT, 18 FT, 40HP HONDA, OUTBOARD 40021926	1
	BOAT, JON, 20 FT, 2-40HP ENGINES, OUTBOARD 40021927	1
BOOM	BOOM, WESTERN SUPPLY, 56FT, C/W 4FT SKIRT/40020969	3
	BOOM, GATOR BOOM, 120FT, C/W 4FT SKIRT/40020970	4
	BOOM, RIVER, 10 FT SECTIONS/40020848	4
	BOOM, ACME, OK CORRAL, 50FT, C/W 8IN SKIRT/40020972	30
	BOOM, ACME, 200FT, C/W 6IN SKIRT/40020971	4
	BOOM, BOOM REEL, OREEPBO072, FOR SHOREMAX/OPTIMAX,, HAND AND ELECTRIC DIESEL ENGINE, ELASTEC/AMERICAN MARINE/40013638	1
	BRIDLE, TOW, W/BULLET FLOAT, P/N 0540420F ELASTEC, FOR AIRMAX RIVER BOOM 40013602	3
	BOOM, ABSORBENT, SPILFYTER M-54S, 5IN X 10FT, OIL ONLY, 4 PER BAG 40013874	15
	BOOM, RIVER, 16FT, CANADYNE, LONG SKIRT 40020808	18
	BOOM, ABSORBENT, SPILFYTER M-54S, 5IN X 10FT, OIL ONLY, 4 PER BAG 40013874	5
	BOOM, YELLOW SHORE, POLEMAR, 50FT 40020353	7
	BOOM, YELLOW SHORE, POLEMAR, 50FT 40020968	3
	BOOM, RIVER, CANADYNE, ORANGE, 50FT 40020949	3
	BOOM, FOAM, RIVER, OPTIMAX, ELASTEC/AMERICAN MARINE, P/N 00420501031, 6IN X 6IN X 50FT 40013616	10
	POM POMS, OIL POMS POMS 40015603	48
	BOOM, FOAM, RIVER, OPTIMAX, ELASTEC/AMERICAN MARINE, P/N 00420501031, 6IN X 6IN X 50FT 40013616	10
SKIMMER	SKIMMER,WEIR, ES400 HELICAL SCREW PUMP, OSYSTSK440S, 520.0 GPM, SEA SKATER WEIR, ELASTEC/AMERICAN MARINE, SELF ADJUSTING/40013609	1
	SKIMMER, SKIM PACK, DOUGLAS ENGINEERING, MODEL 1800/40020799	1
	SKIMMER, MECHANICAL, SMOOTH DRUM, 8FT, TDS136, ELASTEC/AMERICAN MARINE, HYDRAULIC 40020811	1
	SKIMMER,SMOOTH DRUM, OSYSTSK340, MECHANICAL, TDS118G, 70.0 GPM, ELASTEC/AMERICAN MARINE, HYDRAULIC, SHALLOW WATER 40021922	1
	SKIMMER, MECHANICAL, RIDGE DRUM, 4FT, UNO 340, ELASTEC/AMERICAN MARINE 40020835	1
	SKIMMER, MECHANICAL, GROOVED DRUM, 8 FT, UN358, ELASTEC/AMERICAN MARINE 40020828	1
SHALLOW WATER EQUIPMENT	PUMP, HYDRAULIC, ELASTEC/AMERICANMARINE, 3IN 40020395	2
	PUMP, DIAPHRAM, NPS3, PNEUMATIC 40021988	1
	PACK, HYDRAULIC POWER, ELASTEC/AMERICAN MARINE, D10, ITEM NO. OPOWEKU310, KUBOTA DIESEL DRIVEN 40015238	2
	DAM, SELF INFLATING, 28IN X 25FT (7.5M), ELASTEC/AMERICAN MARINE, WA-2825, WATERGATE 40013619	2
SORBENTS	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG/40013873	14
	ABSORBENT, OIL, EARTHCARE, 2.2 CU FT BAG OF LOOSE OIL ABSORBENT - PEAT MOSS/40015611	5
	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG 40013873	5
	ABSORBENT, ROLL, DOUBLE WEIGHT, 32IN X 150FT, SPILFYTER Z-97RBW, SMS MFG 40013872	1

Resource Type	Item Description	Total
SUPERIOR PLM & BLOCK BUILDING		
SPECIALIZED EQUIPMENT	ACTUATOR,ELECTRIC,LIMITORQUE,SMB2 40021526	2
	ACTUATOR,ELECTRIC,EIM USA,MODEL 3JNK-3 40021527	2
	VALVE, GATE, NPS30, PN20, FLGD X FLGD, SLAB, SPX VALVES 40021525	4
	PUMP, LAYNE & BOWLER (BOOSTER) 40021806	1
	MOTOR, AC, 700HP, 900RPM, FRAME 6808PA, US MOTORS 40021807	1
	VEHICLE, ATV, ALLWHL DRIVE, C/W WINCH 40020820 VEHICLE,OHV 40021930	1
	PACK, HYDRAULIC POWER, ELASTEC D22, KUBOTA DIESEL MOTOR 40020907	1
	PUMP, TRASH, 2IN 40013876	1
	GENERATOR, HONDA 3500 WATTS 40020791	1
	TANK, FAST, 2000 (FULL KIT),INCLUDES ROOF COVER, GROUND MAT, T ANK LINER, VALVE OUTLET, PIPE SADDLE, TAPSTAND & HANDPUMP 40013599	2
THIEF RIVER FALLS PLM		
BOAT & RESPONSE VEHICLE	BOAT, VESSEL, 14FT, OUTBOARD, 15HP MERCURY, LOW LINE, 40020814	1
	BOAT, WORK, 18FT, 175HP, OUTBOARD, AQUA DECK, 40020816	1
	BOAT,VESSEL, LUND, 20FT, ALUMINUM, ENGINE OUTBOARD, 90 EVINRUDE, C/W TRAILER 40020776	1
BOOM	BOOM, RIVER, CANADYNE, LONG SKIRT, 12"/40020796	500'
	BOOM, CONTAINMENT, ELASTEC, AIRMAX/40020817	1,000'
	BOOM,INFLATABLE, RIVER, AIRMAX, 8IN X 8IN X 50FT, P/N 01208080050ENB ELASTEC/AMERICAN MARINE,/40013601	30
	BOOM, RIVER, CANADYNE, LONG SKIRT, 12"/40020796	1,000
	BOOM, RIVER, CANADYNE, LONG SKIRT, 12"/40020796	1100
	BOOM,ABSORBENT, ELASTEC/AMERICAN MARINE, 5IN X 10FT/40020803	660'
SKIMMER	SKIMMER, MECHANICAL, SMOOTH DRUM, 8FT, TDS136, ELASTEC/AMERICAN MARINE, HYDRAULIC 40020811	1
	SKIMMER, DRUM, 4 DRUM,4 FT,, MAG200, ELASTEC/AMERICAN MARINE 40020787	1
	SKIMMER, MECHANICAL, SMOOTH DRUM, 8FT, TDS136, ELASTEC/AMERICAN MARINE, HYDRAULIC 40020811	1
SHALLOW WATER EQUIPMENT	PUMP, TRASH, 3IN/40020394	1
SORBENTS	PAD, ABSORBENT, OIL ONLY, 100PADS/BAG/40013873	5
SPECIALIZED EQUIPMENT	VEHICLE, OFF-HIGHWAY, GASOLINE, SIDE-BY-SIDE, 4WHL DRIVE/40015239	1
	VEHICLE,OFF-HIGHWAY VEHICLES, SNOWMOBILE/40020781	1
	GENERATOR, HONDA, EB6500, GASOLINE/40020882	1
	GENERATOR, HONDA, EU2000IA/40020883	1
	LIGHT PLANT, DOOSAN, DIESEL, 4 BULB 40021943	1
	SOCK, WIND, 48IN X 18IN 40015581	1
	SOCK, WIND, 48IN X 18IN 40015581	1
	SAW, CHAINSAW, STIHL, 48IN BAR 40021944	2
	SAW, CHAINSAW, 28IN BAR 40020881	1
	KIT, WILDLIFE, ENBRIDGE ENVIRONMENT WILDLIFE KIT 40015615	1
	AUGER, ICE, 8INCH, GASOLINE POWERED 40020812	1
	VEHICLE,OHV, GASOLINE, SNOW MOBILE, POLARIS 40021945	1
	TANK. PORTABLE, FAST TANK, C/W SECONDARY CONTAINMENT/40020760	1

Resource Type	Item Description	Total
Vesper PLM Yard		
BOAT & RESPONSE VEHICLE	BOAT,WORK BOAT, VESSEL, 22 FT, C/W TRAILER, TWIN 175HP MERCURY, OUTBOARD 40021513	1
	BOAT, LANDING CRAFT, 24FT, HANKOS, C/W TRAILER, TWIN 150HP SUZUKI, OUTBOARD 40021516	1
	BOAT,WORK BOAT, 18FT, 90HP MERCURY OUTBOARD, LUND, C/W TRAILER 40021515	1
BOOM	BOOM, CONTAINMENT, ELASTEC, AIRMAX 40020817	600'
	BOOM,FOAM, MINIMAX, ELASTEC/AMERICAN MARINE, 50FT 40021467	250'
	BOOM, SORBENT, 3M, 4 X 10FT 40020829	3
	BOOM, ABSORBENT, 3M , SPC-810, 8IN X 10FT 40021472	3
	BOOM, SORBENT, 3M, 4 X 10FT 400208291BOOM,FOAM, MINIMAX, ELASTEC/AMERICAN MARINE, 50FT 40021467	250'
	BOOM,INFLATABLE, 12IN, AIRMAX, ELASTEC/AMERICAN MARINE 40021462	1,200'
	BOOM, ABSORBENT, 3M , SPC-810, 8IN X 10FT 40021472	2
	BOOM VANE, ELASTEC/AMERICAN MARINE, C/W MOORING AND ROPE 40020372	1
	BOOM, ABSORBENT, 3M , SPC-810, 8IN X 10FT/40021472	4
SKIMMER	SKIMMER, MECHANICAL, SMOOTH DRUM, 8FT, TDS136, ELASTEC/AMERICAN MARINE, HYDRAULIC 40020811	1
	SKIMMER, GROOVED DRUM, OSYSTSK340, 70 G.P.M., TDS118G, ELASTEC/AMERICAN MARINE, HYDRAULIC DRIVE, SHALLOW WATER 40013608	1
SHALLOW WATER EQUIPMENT	DAM, SELF INFLATING, 28IN X 25FT (7.5M), ELASTEC/AMERICAN MARINE, WA-2825, WATERGATE/40013619	2
SORBENTS	ABSORBENT, SOAKS, CARPET, 3M, 100/BAG/40021473	8
	ABSORBENT, PAD, OIL ONLY, 3M HP-156 , 100/BAG/40021033	8
	ABSORBENT, PAD, OIL ONLY, 3M HP-156 , 100/BAG 40021033	10
SPECIALIZED EQUIPMENT	GENERATOR, 40KW, 3 PHASE, CUMMINS/OWEN,/40021514	1
	SAW, CHAINSAW FOR ICE USE, 24IN BAR 40021479	2
	AUGER, ICE, 8INCH, GASOLINE POWERED 40020812	1
	SHELTER, ICE, ESKIMO QUICKFISH 6 40021474	1
	TANK, FAST, 2000 (FULL KIT),INCLUDES ROOF COVER, GROUND MAT, TANK LINER, VALVE OUTLET, PIPE SADDLE, TAPSTAND & HANDPUMP/ 40013599	2

1.7.1 Spill Response Organizations – Internal & External Locations

Equipment Locations	Emergency Phone Number	Address	Coordinates
Superior Region Response Units			
Adams	608-339-7172	[redacted] Grand Marsh, WI 53936	43.9[redacted] -89.6[redacted]
Bemidji, MN	218-755-6635	[redacted] Bemidji, MN 56601	47.4[redacted] -94.8[redacted]
Clearbrook, MN	218-776-3115	[redacted] Clearbrook, MN 56634	47.6[redacted] -95.4[redacted]
Fort Atkinson PLM	920-563-6648	[redacted] Fort Atkinson, WI 53538	42.9[redacted] -88.8[redacted]
Superior, WI	715-398-8322	[redacted] Superior, WI 54880	46.6[redacted] -92.0[redacted]
Thief River Falls		[redacted] Thief River Falls, MN 56701	48.1[redacted] -96.1[redacted]
Vesper PLM	715-569-4290	[redacted] Vesper, WI 54489	44.4[redacted] -89.9[redacted]
External Response Agencies			
Marine Pollution Control Corp. (MPC)	24 Hr. 313-849-2333	Detroit, MI (6 Systems in area)	NA
T & T Marine Salvage, Inc. (Superior-Great Lakes)	24 Hr. 713-534-0700	Port Huron, MI, Toledo, OH, Marshall, MI, Kalamazoo, MI, Buffalo, NY, Mackinaw City, MI, Chicago, IL, Milwaukee, WI, Green Bay, WI, New York, NY, Superior, WI, Duluth, MN, Fargo, ND	NA

1.8 Evacuation

It is important to remember that evacuations beyond Company property will have to be initiated and coordinated with local emergency response/management organizations which have the legislative authority to order the movement of persons. State, tribal and local authorities have primary responsibility and authority for evacuation planning and for the transportation, sheltering, public safety, and security of persons and non-Federal property within their respective jurisdictions. The unique challenges that might confront State, tribal and local governments during a mass evacuation could require them to request additional assistance, of either logistical or operational nature, from within their state, from other states pursuant to mutual aid and assistance compacts, or from the Federal government.

If the public is at risk, Regional Management will contact the Public Affairs department for a list of landowners in the emergency planning zone to initiate notifications.

Company Responsibilities:

- The company should ensure that local emergency response/management organizations are provided with a clear recommendation to evacuate the public should the Company become aware of an immediate threat to life and safety that may not be under action by first responders.
- The company will serve only in an advisory capacity during an evacuation order and may assist with the logistics of an evacuation.
- The Company must provide as much product information as possible to any emergency management organization coordinating an evacuation. The latest version of the Emergency Response Guidebook (ERG) should be consulted in order to determine safe evacuation distances. See Table in *Core II- Section 2.3.1 Isolation Distance/2012 Emergency Response Guidebook.*

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1.9 Worst-Case Discharge

Enbridge has determined the worst-case discharge for of its response zones, refer to *Annex 4 – Regulatory Cross Reference* for the methodology and calculation used to arrive at the volume-out.

Shown below is the worst-case discharge of the largest volume in barrels, of a pipeline, a historic discharge, or the single largest tank or battery of tanks.

1.9.1 Regional Pipeline Worst-Case Discharge

[redacted] presents the region's worst-case discharge results:

Milepost (mile)	Elevation (ft)	Initial Volume Out (bbls)	Gravity Drainage Downstream (bbls)	Gravity Drainage Upstream (bbls)	Outer Diameter (in)	Wall Thickness (in)	Time to Isolate Rupture (min)	Design Throughput (bbls/day)	Volume-Out Total (bbls)
[redacted]									

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Table 5- Superior Region Worst-Case Discharge Line Calculations

Superior Region Worst-Case Discharge Line Calculations															
Line	Approx. MP	Relative Location (ft)	Actual Location (ft)	Elevation (ft)	Max Initial LVR (bbls)	Maximum Stabilization Downstream LVR (bbls)	Maximum Stabilization Upstream LVR (bbls)	Maximum Total LVR (bbls)	Outer Diameter (in)	Wall Thickness (in)	Time to Recognize Rupture (min)	Design Flow Rate (bbls/day)	Valve Name	Valve Type Code	Isolation (Y/N)	Valve Distance
[redacted]																

Figure 2- Worst-Case Discharge

1.9.2 Maximum Historic Discharge

Date	Location	Line or Tank #	MP	Released bbls	Recovered bbls
[redacted]					

1.9.3 Breakout Tank Worst-Case Discharge

The WCD for tanks is calculated on the capacity of the single largest tank or battery of tanks within a single secondary containment system, adjusted for the capacity or size of the secondary containment system, expressed in barrels.

The largest tank within a single secondary containment system for the Superior Region is located at Superior Terminal- [redacted]

Under *49CFR§194.105*(b)(4) Operators may claim prevention credits for breakout tank secondary containment and other specific spill prevention measures. The percentage (credits) is a maximum of 75%. Under this section, and with the following criteria, the Company is entitled to receive a 75% credit on their WCD volumes.

Prevention measure	Standard	Credit (%)
Secondary containment > 100%	NFPA 30	**50%**
Built/repaired to API standards	API STD 620/650/653	**10%**
Overfill protection standards	API 2350	**5%**
Testing/Cathodic Protection	API STD 650/651/653	**5%**
Tertiary containment/drainage/treatment	NFPA 30	**5%**
Maximum Allowable Credits		75%
Company claimed credits		**75%**

The prevention credits for the above tank are based upon the Company meeting or exceeding certain industry standards. The secondary and tertiary containment systems are built to NFPA 30. The tank is built, inspected, and repaired to API Standard 650/653. Overfill protection is in place and meets API RP 2350. Cathodic protection and testing is in place to prevent the **corrosion** of pipelines and breakout tanks and meets API Standard 651.

1.9.4 Determined Worst-Case Discharge Volume

Worst Case Discharge Volume Calculation						
Tank(s) Number	Product	Tank(s) Capacity (bbls)	Secondary Containment Capacity (bbls)	Secondary Containment ≥ 100%	Prevention Credit Taken (%)	Final WCD Planning Volume (bbls)
[redacted]						

*The worst-case discharge is based on the Capacity of the single largest breakout tank or largest breakout tank within a battery of tanks within a single secondary containment system (NFPA 30), adjusted for the capacity or size of the secondary containment system

Note: The above mentioned worst-case discharge volume-outs are based on the assumption that the tank or battery of tanks and all secondary containment systems in place have a catastrophic and complete failure. These calculations are based upon regulatory requirements; however the most probable scenario for worst-case discharge is a rupture along the pipeline. As referenced in the Regional Worst-Case Discharge table line calculations above the pipeline volume-out would be significantly lower.

1.9.5 Planning Volume: Light Crudes – Group II

Location Data	
Location Type	Nearshore / Inland Great Lakes
WCD Product Type	Crude Oil
Product Group	II
WCD = PHMSA Worst-Case Discharge Volume (bbls)	**161,000**

Selected Calculation Factors (Based on 33CFR§154 Appendix C)	
Removal Capacity Planning Volume:	
Percent Natural Dissipation (PND)	50%
Percent Recovered Floating Oil (PRFO)	50%
Percent Oil Onshore (POO)	30%
Emulsification Factor (EF)	1.8
Tier 1 - On Water Oil Recovery Resource Mobilization Factor (T1)	15%
Tier 2 - On Water Oil Recovery Resource Mobilization Factor (T2)	25%
Tier 3 - On Water Oil Recovery Resource Mobilization Factor (T3)	40%

Response Planning Volume Calculation			
On-Water Recovery Volume (OWRV)(bbls) = PRFO * WCD			80,500
Shoreline Recovery Volume (SRV) (bbls) = POO * WCD			48,300
Shoreline Cleanup Volume (SCV) (bbls/day) = SRV * EF			86,940
	Tier 1	Tier 2	Tier 3
On-Water Recovery Capacity (RC) (bbls/day) = T1, T2 or T3 * SCV	13,041	21,735	34,776
Response Capability Cap by Operation Area – Amount Needed (T1, T2, or T3 RCCOA) bbls/day	6,250	12,300	25,000
On-Water Recovery Capacity Not Contracted in Advance = RC – T1, T2, or T3 RCCOA	6,791	9,435	9,776

*Gray areas are fixed values based on 33CFR§154 Appendix C

1.9.6 Planning Volume: Medium Crudes and Fuels – Group III

Location Data	
Location Type	Nearshore / Inland Great Lakes
WCD Product Type	Crude Oil
Product Group	III
WCD = PHMSA Worst-Case Discharge Volume (bbls)	**161,000**

Selected Calculation Factors (Based on 33CFR§154 Appendix C)	
Removal Capacity Planning Volume:	
Percent Natural Dissipation (PND)	30%
Percent Recovered Floating Oil (PRFO)	50%
Percent Oil Onshore (POO)	50%
Emulsification Factor (EF)	2
Tier 1 - On Water Oil Recovery Resource Mobilization Factor (T1)	15%
Tier 2 - On Water Oil Recovery Resource Mobilization Factor (T2)	25%
Tier 3 - On Water Oil Recovery Resource Mobilization Factor (T3)	40%

Response Planning Volume Calculation			
On-Water Recovery Volume (OWRV)(bbls) = PRFO * WCD			80,500
Shoreline Recovery Volume (SRV) (bbls) = POO * WCD			80,500
Shoreline Cleanup Volume (SCV) (bbls/day) = SRV * EF			161,000
	Tier 1	Tier 2	Tier 3
On-Water Recovery Capacity (RC) (bbls/day) = T1, T2 or T3 * SCV	24,150	40,250	64,400
Response Capability Cap by Operation Area – Amount Needed (T1, T2, or T3 RCCOA) bbls/day	6,250	12,300	25,000
On-Water Recovery Capacity Not Contracted in Advance = RC – T1, T2, or T3 RCCOA	17,900	27,950	39,400

*Gray areas are fixed values based on 33CFR§154 Appendix C

1.9.7 Planning Volume: Heavy Crudes and Fuels – Group IV

Location Data	
Location Type	Nearshore / Inland Great Lakes
WCD Product Type	Crude Oil
Product Group	IV
WCD = PHMSA Worst-Case Discharge Volume (bbls)	**161,000**

Selected Calculation Factors (Based on 33CFR§154 Appendix C)	
Removal Capacity Planning Volume:	
Percent Natural Dissipation (PND)	10%
Percent Recovered Floating Oil (PRFO)	50%
Percent Oil Onshore (POO)	70%
Emulsification Factor (EF)	1.4
Tier 1 - On Water Oil Recovery Resource Mobilization Factor (T1)	15%
Tier 2 - On Water Oil Recovery Resource Mobilization Factor (T2)	25%
Tier 3 - On Water Oil Recovery Resource Mobilization Factor (T3)	40%

Response Planning Volume Calculation	
On-Water Recovery Volume (OWRV)(bbls) = PRFO * WCD	80,500
Shoreline Recovery Volume (SRV) (bbls) = POO * WCD	112,700
Shoreline Cleanup Volume (SCV) (bbls/day) = SRV * EF	157,780

	Tier 1	Tier 2	Tier 3
On-Water Recovery Capacity (RC) (bbls/day) = T1, T2 or T3 * SCV	23,667	39,445	63,112
Response Capability Cap by Operation Area – Amount Needed (T1, T2, or T3 RCCOA) bbls/day	6,250	12,300	25,000
On-Water Recovery Capacity Not Contracted in Advance = RC – T1, T2, or T3 RCCOA	17,417	27,145	38,112

*Gray areas are fixed values based on 33CFR§154 Appendix C

1.9.8 OSRO Worst-Case Discharge Certification

The OSROs contracted to respond to the Superior Region Response Zone have the appropriate equipment to operate in the given environment for the WCD. See contracts in *Annex 2- Notifications* of this Plan. For a full list of OSRO Mechanical Certification follow the link below.

https://cgrri.uscg.mil/UserReports/WebClassificationReport.aspx

1.10 Emergency Response Time Maps

1.10.1 Superior Region Response Zone

Regional Emergency Response Time Maps were created utilizing ESRI® (Environmental Systems Research Institute) ArcMap. Times were calculated from actual street speed limits based on a network dataset built from ESRI's World Routing Service dataset which contains street information from 2014. Peak travel time conditions were used in this analysis. Actual time is subject to change based on local road, traffic and weather conditions.

These response time maps are considered a conservative timeframe for travel to site and include time to deployment. In the event of an incident, reference to individual maps will be necessary.

Manned facility travel times are calculated every hour up to five hours. This will show **only** the travel time required from the manned facilities, after notification, **to the company trailers or to areas along the pipeline.**

Enbridge Emergency Response Trailer location travel times are calculated every hour up to 5 hours depicting the notification, deployment and travel time for the trailer to locations along the pipelines with time allotted for deployment included. trailer location has its own map with color changes representing one-two hour time changes.

OSRO Emergency Response Trailer location travel times are represented by calculating every hour up to five hours based on the above criteria. The color changes represent hourly travel time changes. Response times may vary with the locations of OSRO personnel at the time of an event. This is representative of travel time for the trailers only.

1.10.2 DOT/PHMSA Tiered Response Times (49CFR§194.115)

The Company has the ability to respond to an incident within the times identified by the below DOT/PHMSA table.

	Tier 1	Tier 2	Tier 3
High Volume Area	6 Hrs.	30 Hrs.	54 Hrs.
All Other Areas	12 Hrs.	36 Hrs.	60 Hrs.

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Emergency Response Maps
Superior Region

1.10.3 Enbridge Facility Emergency Response Manned, Trailer & Storage Maps

This will show the travel time **only,** required from the facilities, after notification and deployment, to areas along the pipeline.

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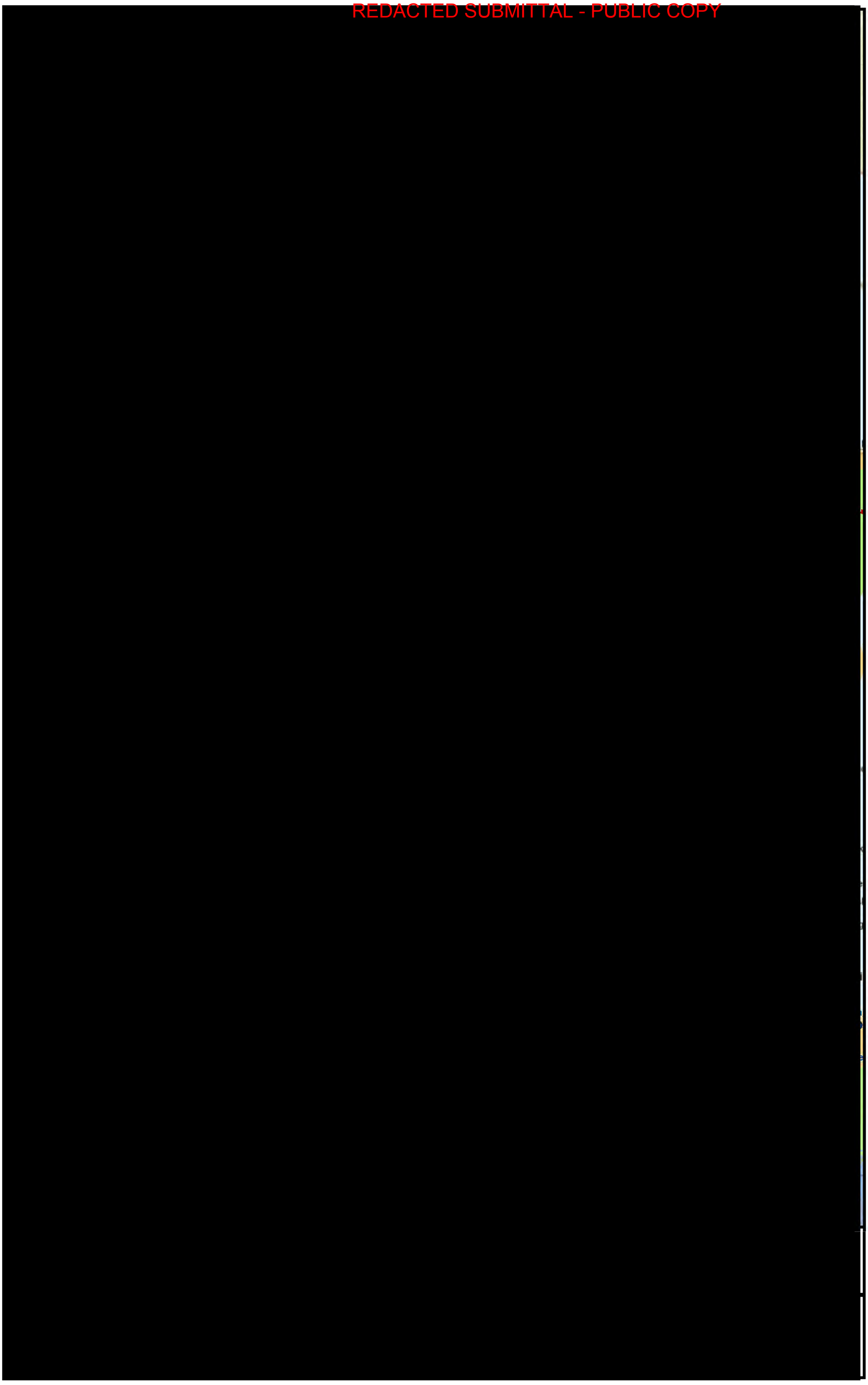

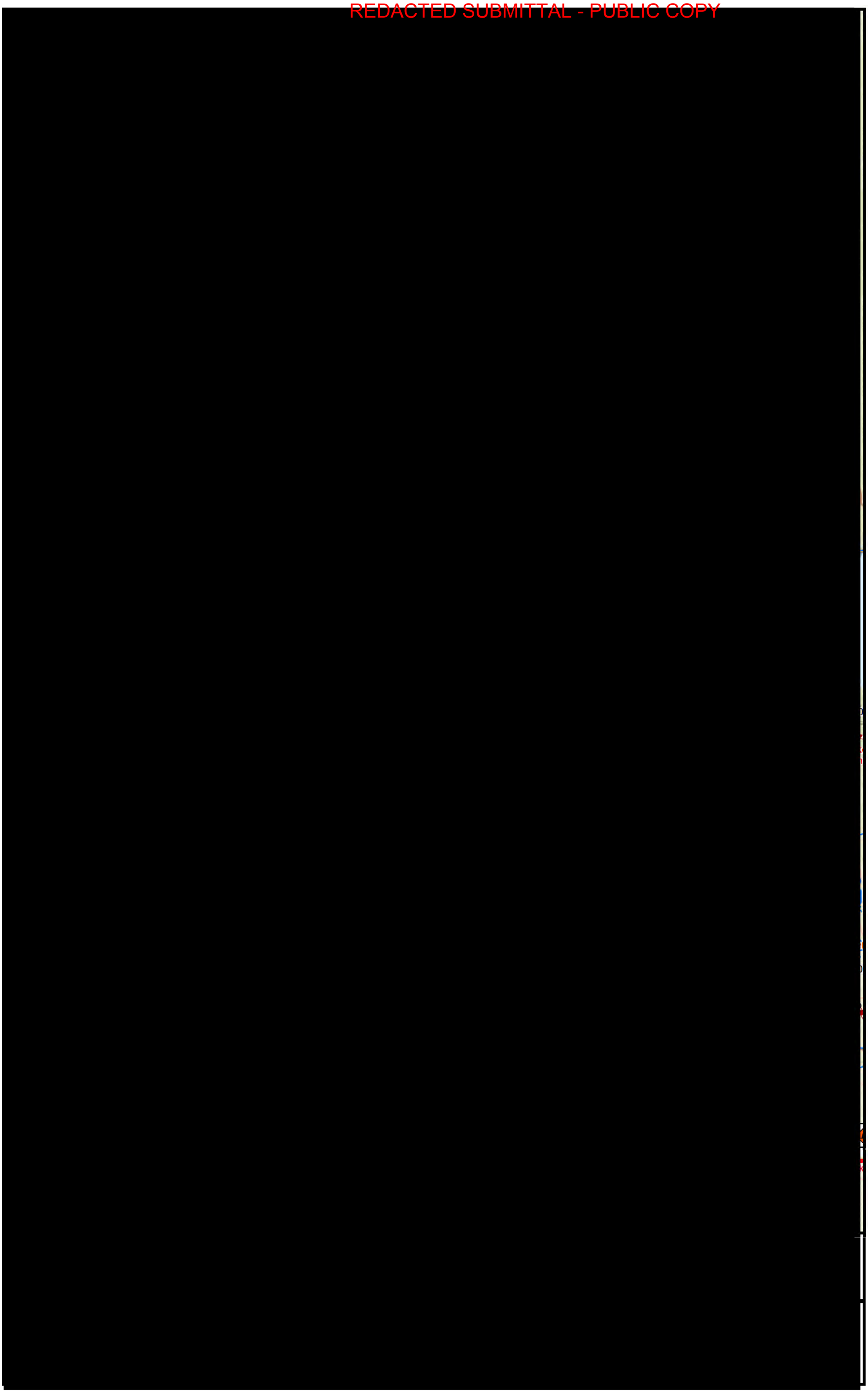

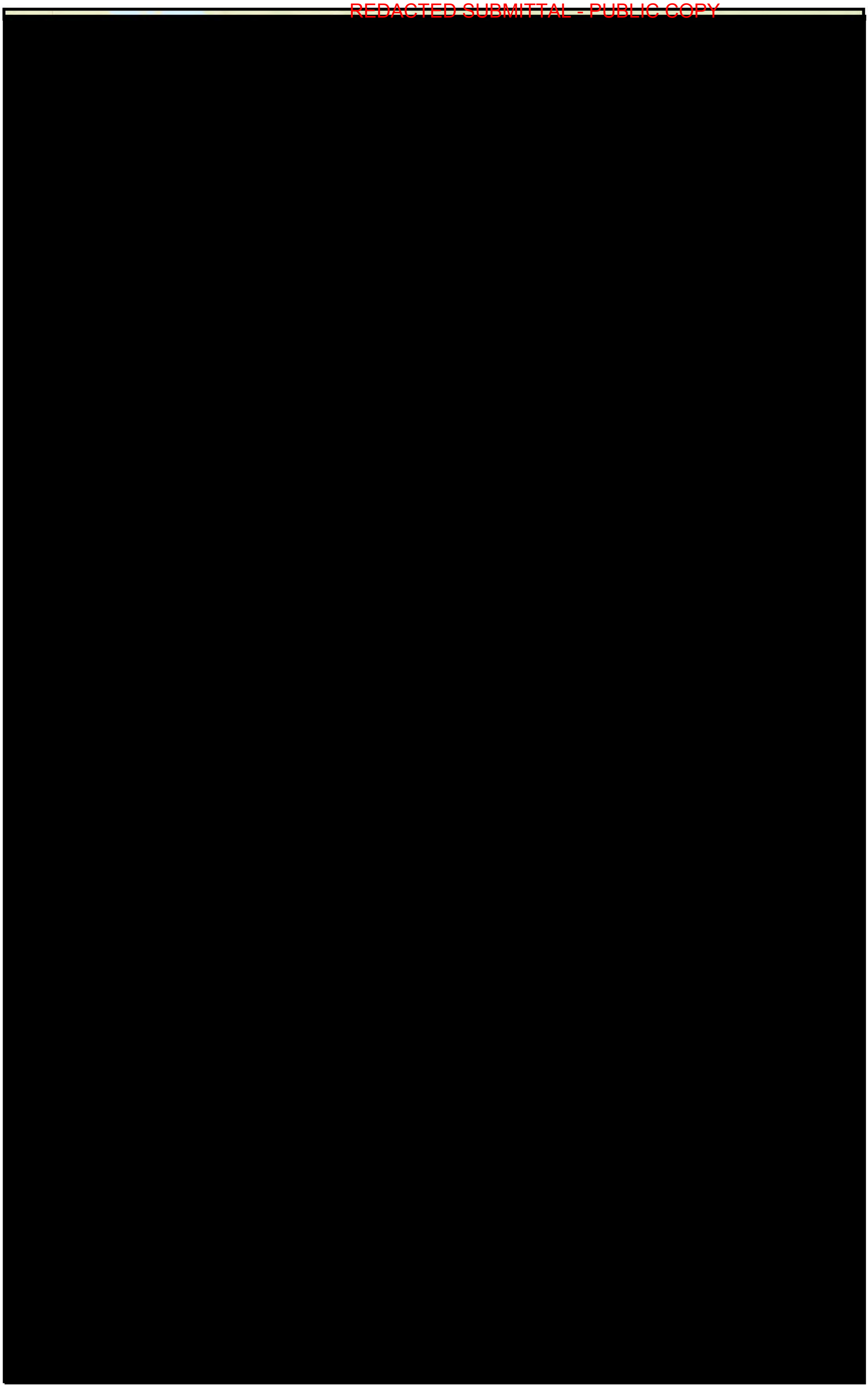

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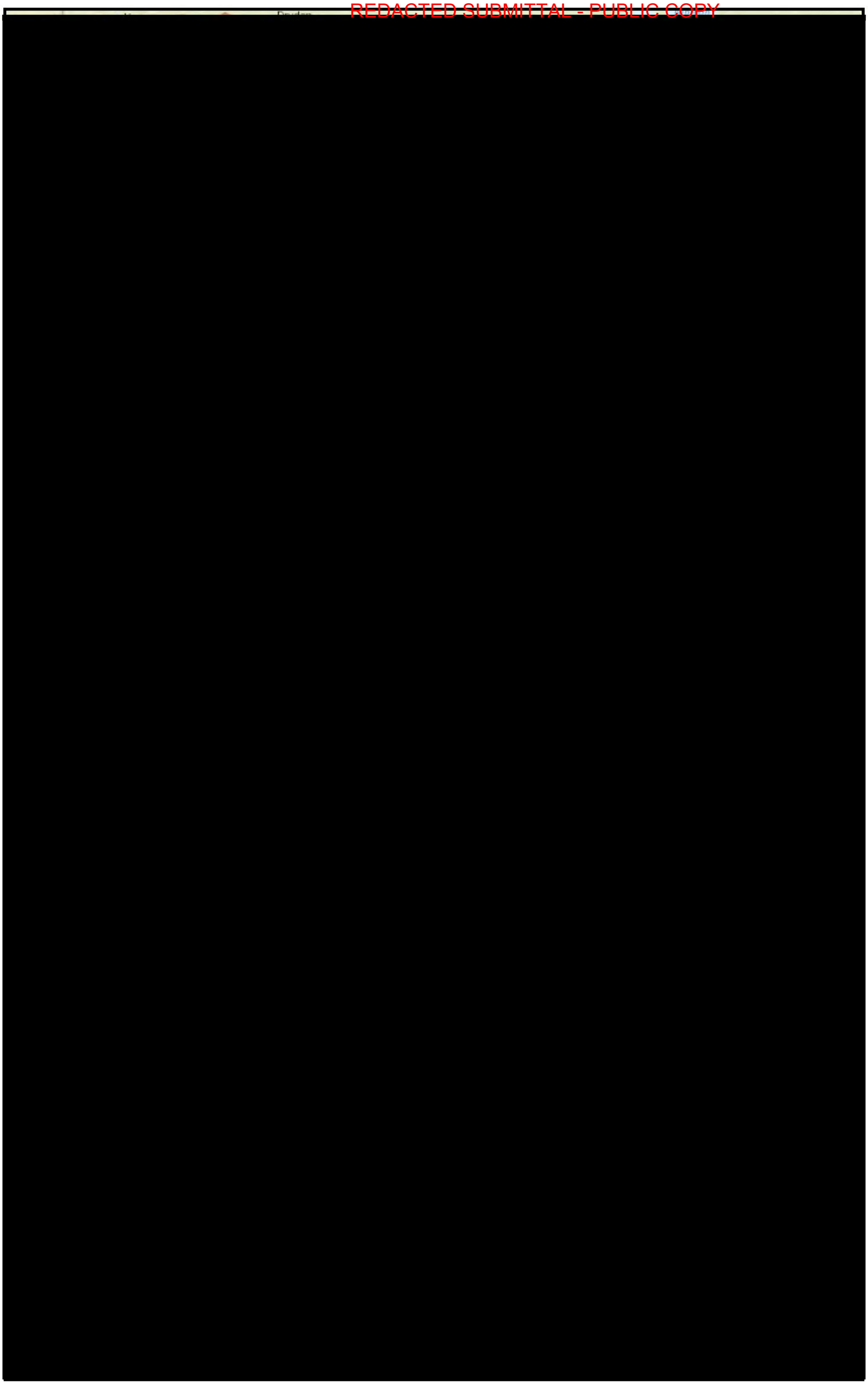

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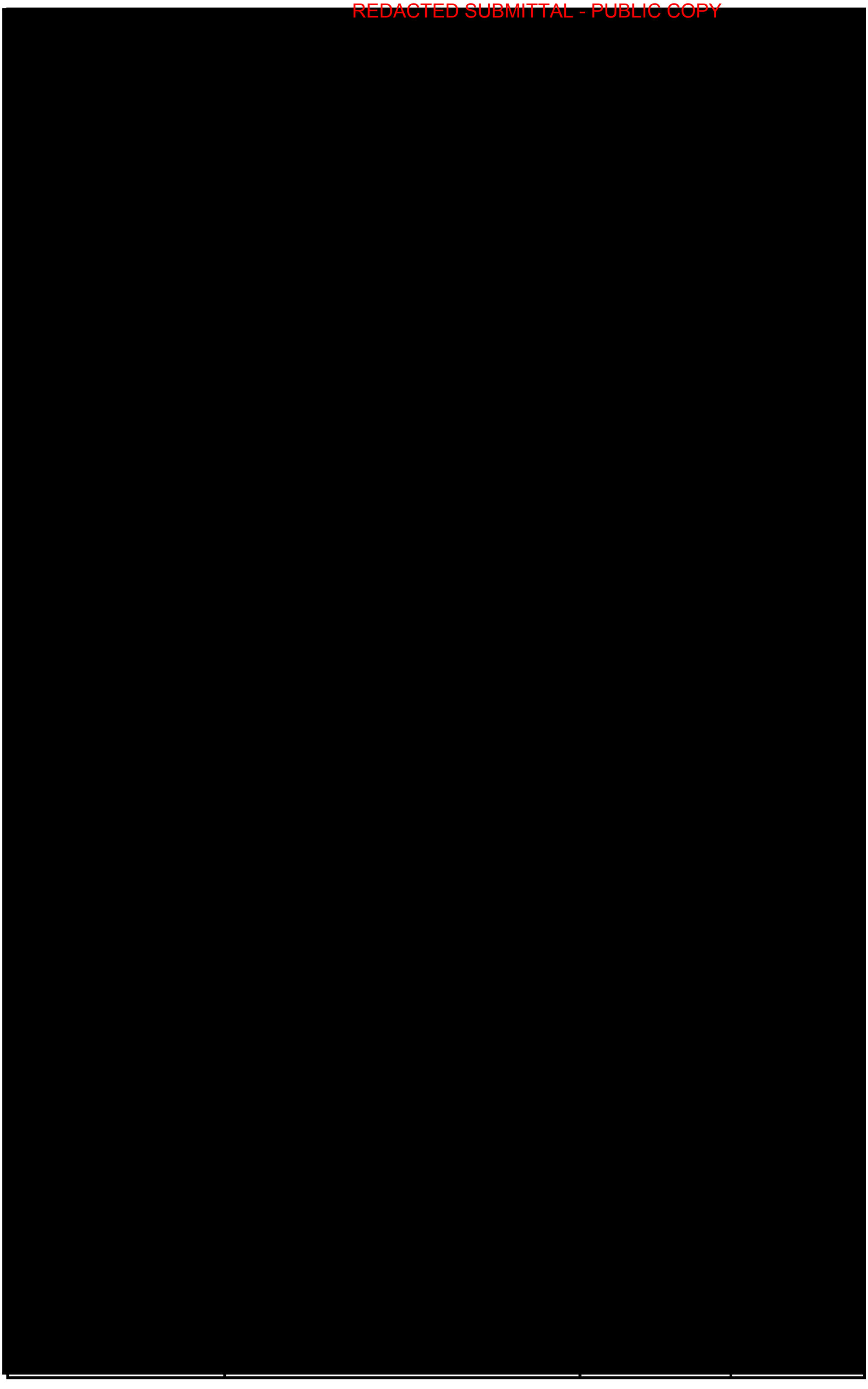

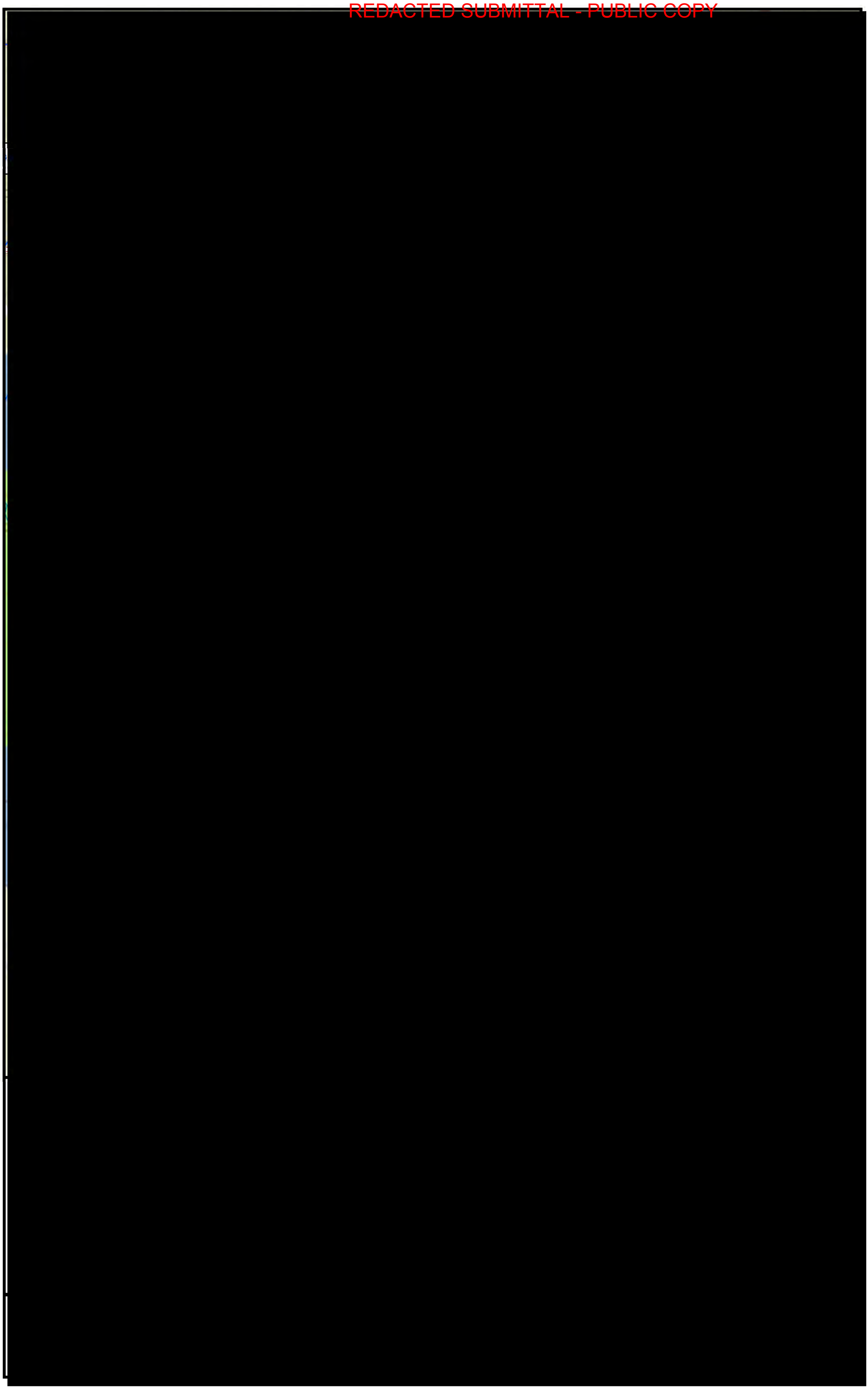

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1.10.4 OSRO Facility Maps

Emergency Response Maps
Superior Region

OSRO Overview Map	1 of 22
MPC – Chicago, IL	2 of 22
MPC – Detroit, MI	3 of 22
MPC – Duluth, MN	4 of 22
MPC – Eveleth, MN	5 of 22
MPC – Flint, MI	6 of 22
MPC – Kalkaska, MI	7 of 22
MPC – St. Paul, MN	8 of 22
T&T Marine Salvage – Alpena, MI	9 of 22
T&T Marine Salvage – Bay City, MI	10 of 22
T&T Marine Salvage – Cheboygan, MI	11 of 22
T&T Marine Salvage – Dearborn, MI	12 of 22
T&T Marine Salvage – Detroit, MI	13 of 22
T&T Marine Salvage – East Chicago, IN	14 of 22
T&T Marine Salvage – Indian River, MI	15 of 22
T&T Marine Salvage – Jackson, MI	16 of 22
T&T Marine Salvage – Ludington, MI	17 of 22
T&T Marine Salvage – Marquette, MI	18 of 22
T&T Marine Salvage – Milwaukee, WI	19 of 22
T&T Marine Salvage – Port Huron, MI	20 of 22
T&T Marine Salvage – River Rouge, MI	21 of 22
T&T Marine Salvage – Roseville, MI	22 of 22

This will show the travel time **only,** required from the OSRO trailer location, after notification and deployment, to areas along the pipeline.

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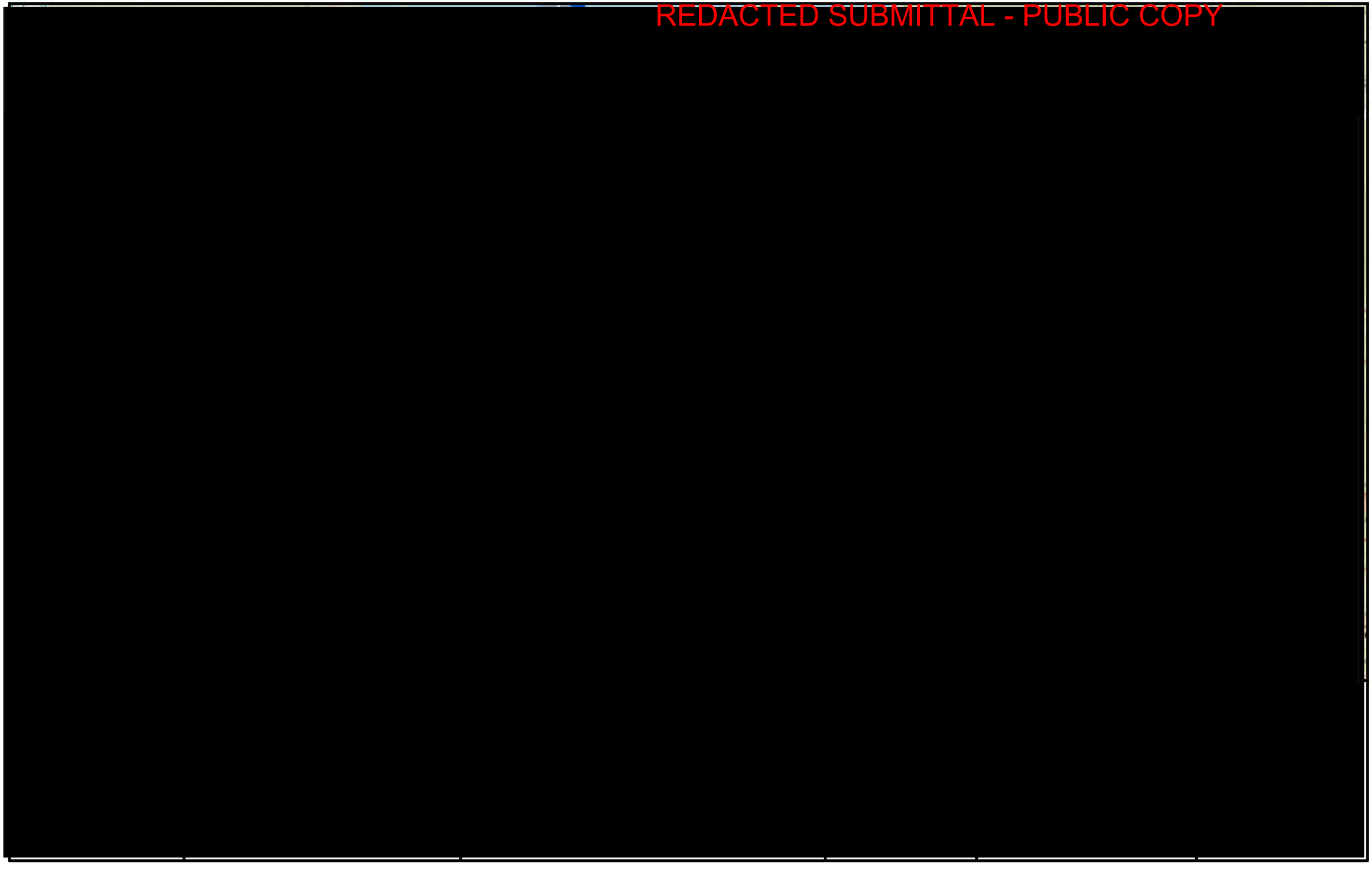

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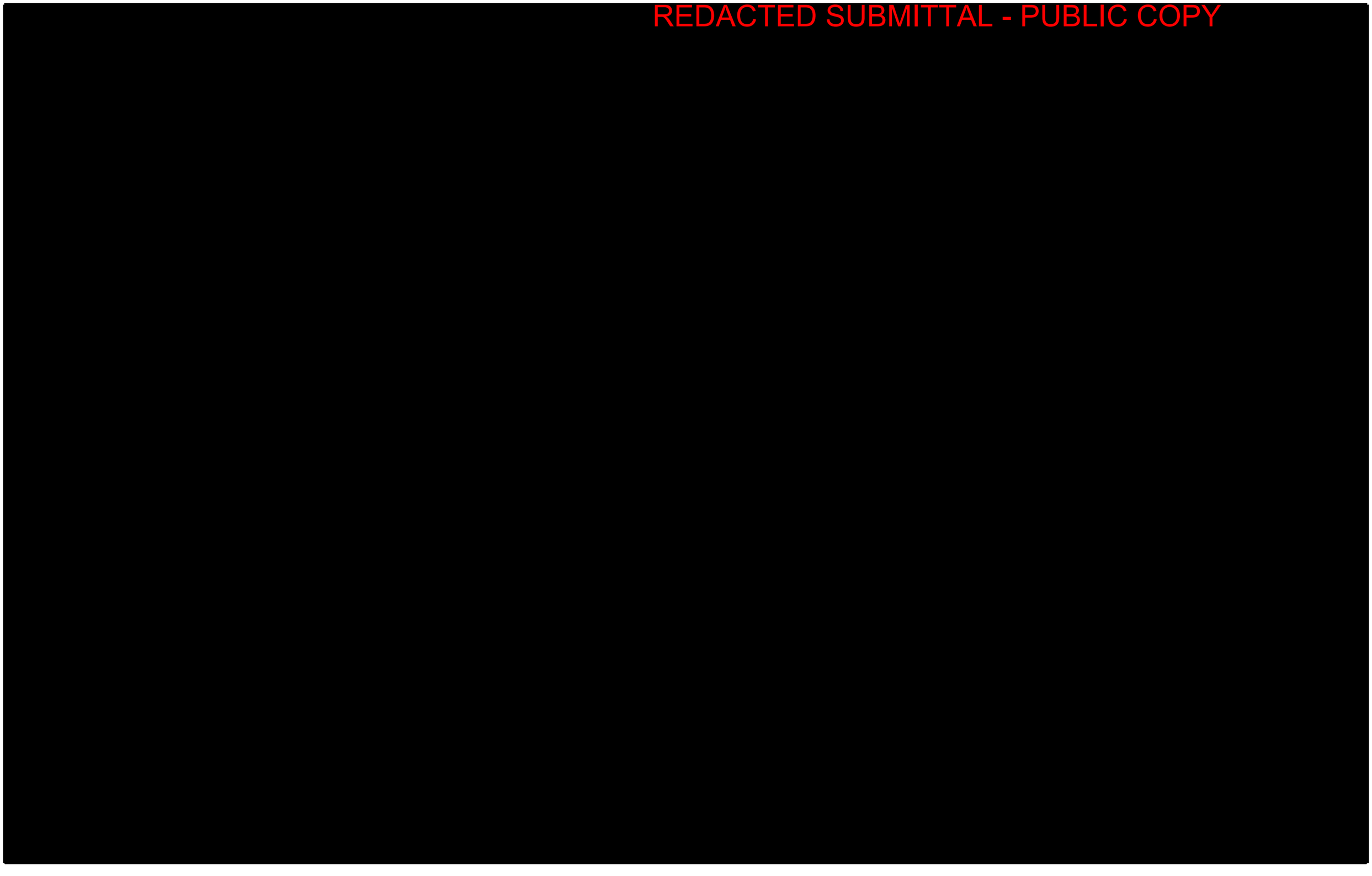

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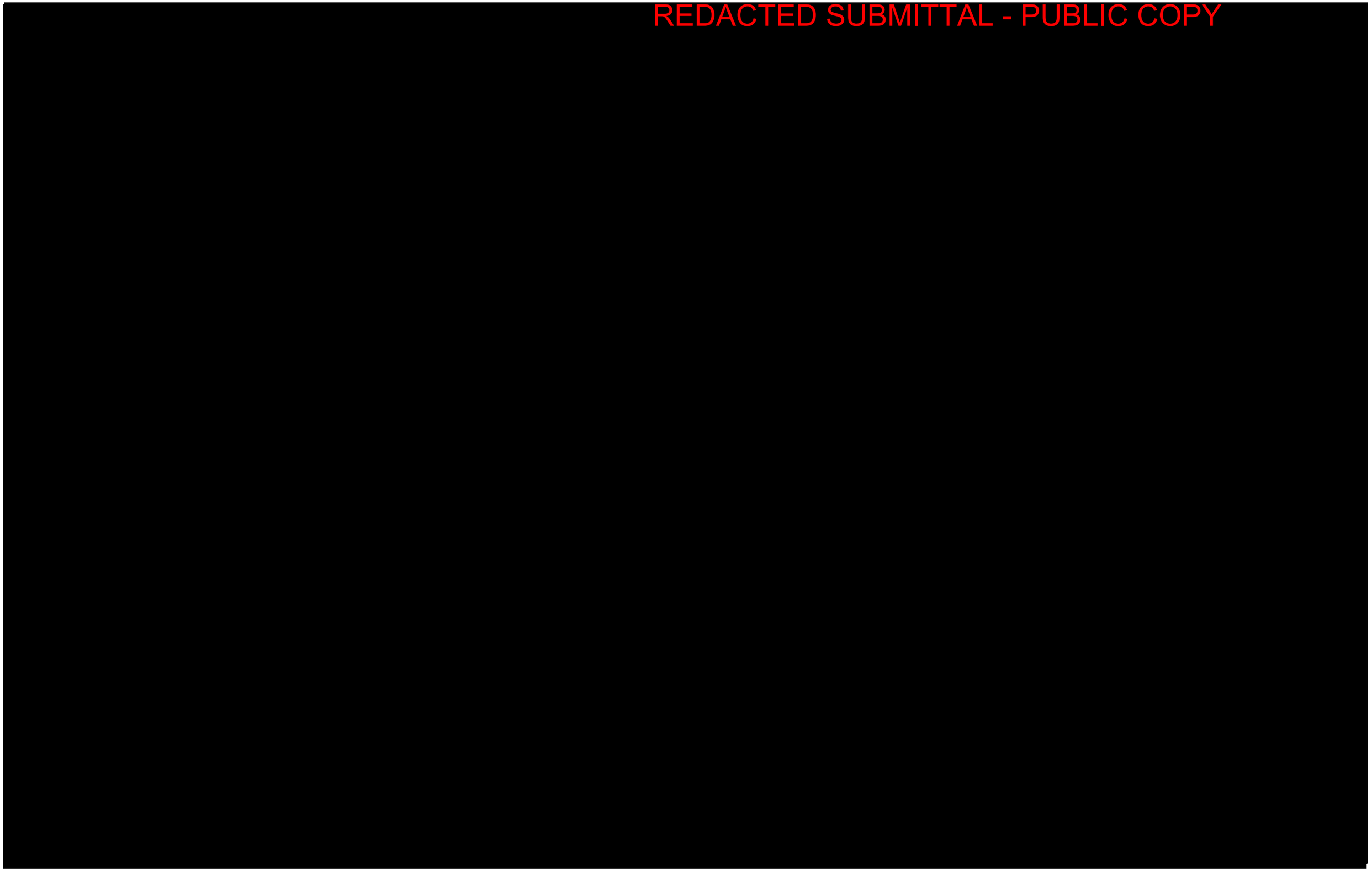

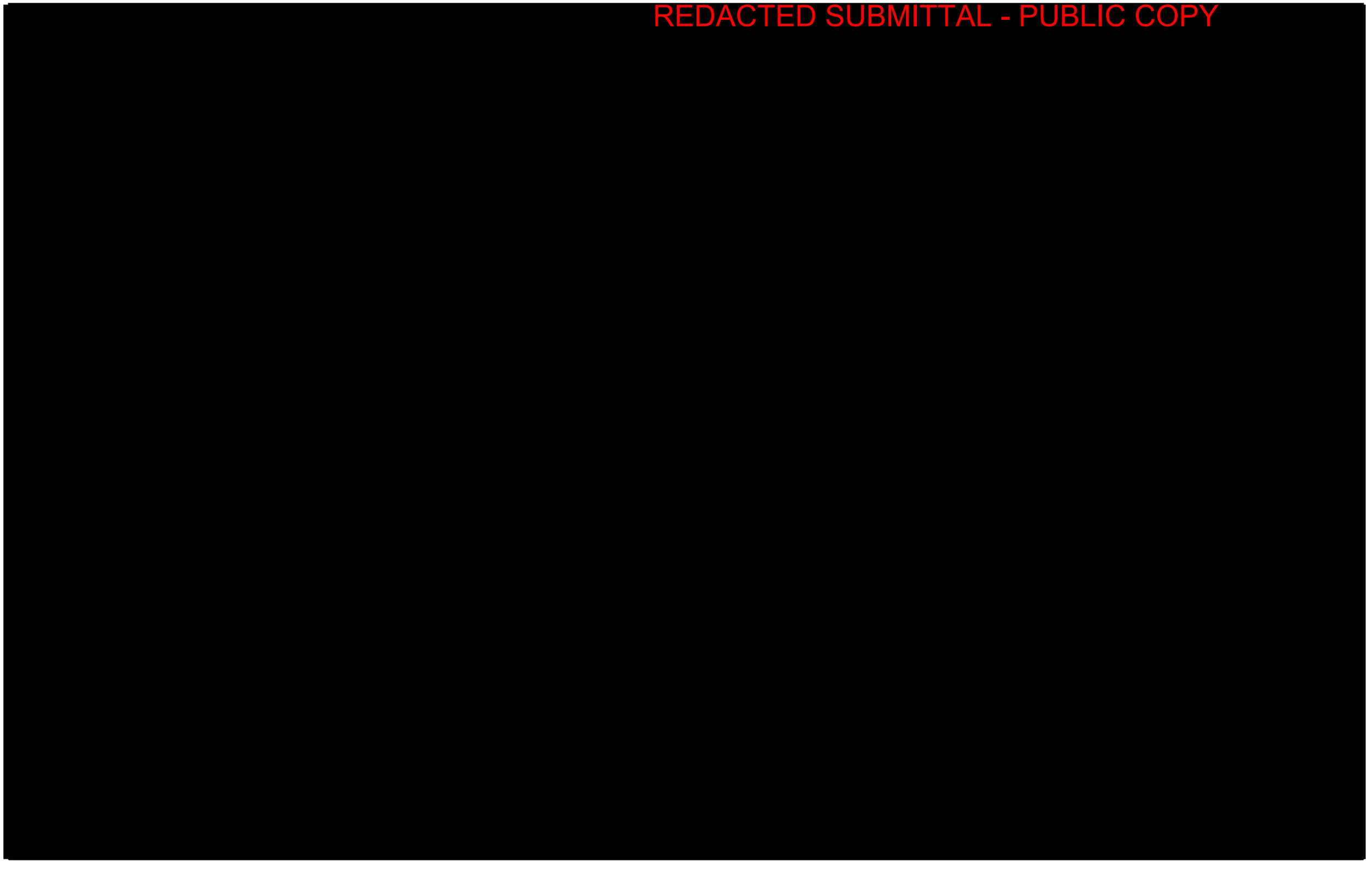

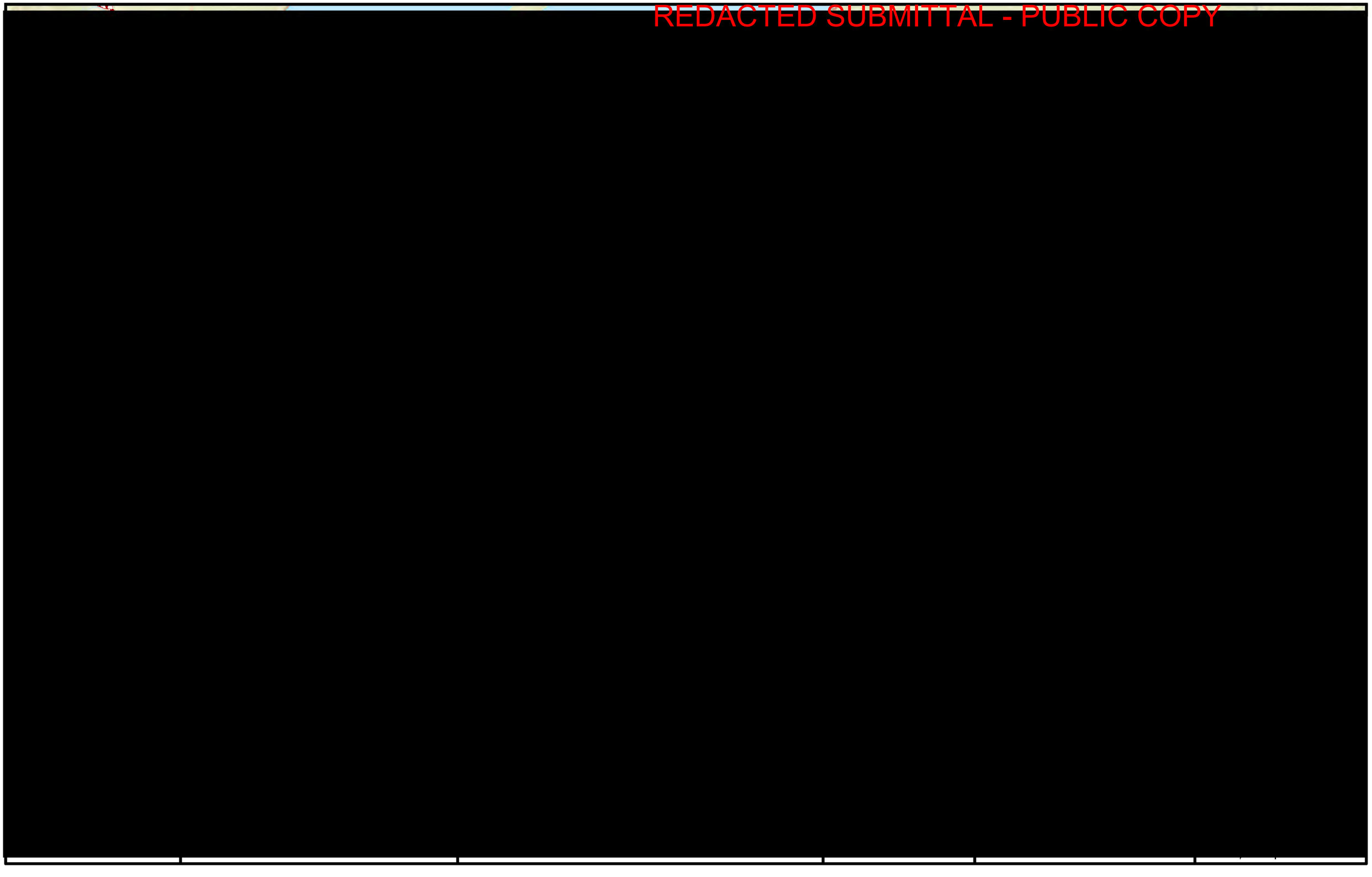

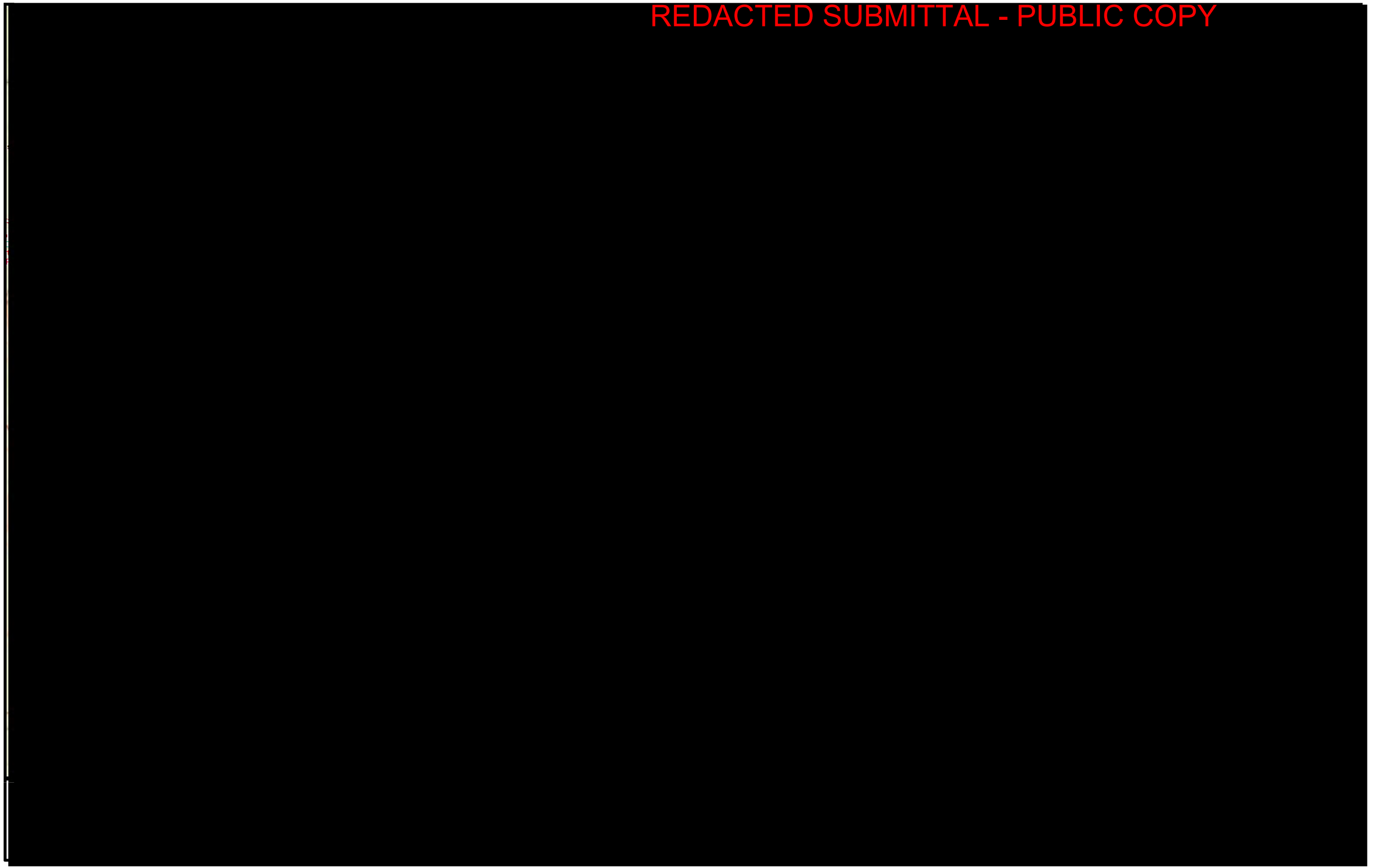

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1.11 Safety Data Sheets (SDS)

AMH_Albian Muskeg River Heavy
ARB_Albian Residual Blend
ASH_Albian Synthetic Heavy
AVB_ Albian Vacuum Blend
AWB_Access Western Blend
BHB_Borealis Heavy Blend Suncor
BR_CL_CLB_CDB_CSB_WH_WCS_Bow River
BSO_BP Sour Crude
CHS_Canadian Heavy Sweet
CRW_ENB Condensate
Diluent- Light Debutanized Naptha
DRA LP 100 Flow Improver
EP™ 2000Flow Improver
FLO Fusion3000 Pipeline Booster
Gasoline
HSC_PSY_SYN_ENB Crude Oil Synthetic
Husky Synthetic Crude Oil
KDB_Kearl Lake Dilbit
MSB_CAL1_PLS1_GLS1_PLO1_MGS2_KHE2_PHO2_SPR2_RSO2_GHE2_MBL3_MM4_MSM4_MLS_MJT_ENB Crude Oil Sour
MSW_MGL_MLN_PSB_RSW_RA_FD_MSY_MST Crude Oil-Sweet
Natural Gasoline - Explorer
NGL Natural Gas Liquids
NSA_Husky Synthetic Crude Oil
OSC_Suncor C
OSH_Suncor H
OSJ Suncor J
PBS_Crude Oil Canada
PCH_CHV_ENB Crude Oil Heavy
PSY_SYN_HSC_ENB Crude Oil Synthetic
SCB_Statoil Cheecham Blend
SCS_SHB_CSB_MKH_PSH_ENB Synbit
SH_Crude Oil Sour
SPX_Shell Upgraded Crude
SSX_Shell Synthetic Light
TURBOFLO SVX
UHC_US Sweet- Clearbrook; NSW_North Dakota Sweet
WCS_ENB Heavy Crude

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Shell Canada Limited
Material Safety Data Sheet

Effective Date: 2011-02-16
Supersedes: None

Class B2 Flammable Liquid

Class D2A Embryo/Fetotoxicity
Class D2A Carcinogenicity

Class D2A Mutagenicity
Class D2B Skin Irritation

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT:	**ALBIAN MUSKEG RIVER HEAVY (AMH)**
SYNONYMS:	AMH Synthetic crude oil is a mixture of paraffins, naphthenes, aromatics and sulphur compounds
PRODUCT USE:	Base product for Petroleum Refining.
PRODUCT CODE:	**9700-140**

SUPPLIER
Shell Canada Limited (SCL)
P.O. Box 100, Station M
400-4th Ave. S.W.
Calgary, AB Conada
T2P 2H5

TELEPHONE NUMBERS	
Shell Emergency Number	1-800-661-7378
CANUTEC 24 HOUR EMERGENCY NUMBER	1-613-996-6666
For general information:	1-800-661-1600
	www.shell.ca

This MSDS was prepared by the Toxicology and Product Stewardship Section of Shell Canada Limited.
*An asterisk in the product name designates a trade-mark of Shell Brands International AG. Used under license.

2. HAZARDS IDENTIFICATION

Physical Description: Viscous Liquid Dark Brown Hydrocarbon Odour

Routes of Exposure: Exposure will most likely occur through skin contact or inhalation.

Hazards:
Flammable Liquid.
Irritating to skin.
A component in this product has been classified by IARC as carcinogenic to humans (Group 1).
May affect fetal development.
This product contains a component that has produced mutagenic effects.
May be irritating to eyes.
Inhalation of oil mist or vapours from hot oil may cause irritation of the upper respiratory tract.

Handling:
Eliminate all ignition sources.
Avoid inhalation of vapours.

Wear suitable gloves and eye protection.
Bond and ground transfer containers and equipment to avoid static accumulation.
Empty containers are hazardous, may contain flammable / explosive dusts, liquid residue or vapours. Keep away from sparks and open flames.

For further information on health effects, see Section 11.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	CAS Number	% Range	WHMIS Controlled
Residues (Petroleum), Vacuum	64741-56-6	35 - 50	Yes
Distillates (petroleum), petroleum residues vacuum	68955-27-1	10 - 30	Yes
Natural Gas Condensates (C2 to C20)	64741-47-5	0 - 30	Yes
Naphtha (Petroleum), Hydrotreated Light	64742-49-0	0 - 30	Yes
Distillates (Petroleum), Straight-run Middle	64741-44-2	7 - 15	Yes
Naphtha (petroleum), heavy straight-run	64741-41-9	0 - 5	Yes
Naphtha, heavy hydrocracked	64741-78-2	0 - 5	Yes
Toluene	108-88-3	0 - 3	Yes
n-Hexane	110-54-3	< 1	Yes
Benzene	71-43-2	0.1 - 1	Yes
Xylene (Mixed Isomers)	1330-20-7	0.1 - 0.5 % (wt)	Yes
Ethylbenzene	100-41-4	0.05 - 0.5	Yes

Note: N-hexane, toluene, xylene, ethylbenzene and benzene are not introduced into the product as intentional additives. These chemicals may be contained in one or more of the blending components that make up the product.

See Section 8 for Occupational Exposure Guidelines.

4. FIRST AID MEASURES

Eyes: Flush eyes with water for at least 15 minutes while holding eyelids open. If irritation occurs and persists, obtain medical attention.

Skin: Wash contaminated skin with mild soap and water for at least 15 minutes. If irritation occurs and persists, obtain medical attention.

Ingestion: Do not induce vomiting; get medical help immediately. Guard against aspiration into lungs by having the individual turn on to their left side. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs. Do not give anything by mouth to an unconscious person.

Inhalation: Remove victim from further exposure and restore breathing, if required. Obtain medical attention.

Notes to Physician: The main hazard following accidental ingestion is aspiration of the liquid into the lungs producing chemical pneumonitis.

5. FIRE FIGHTING MEASURES

Extinguishing Media:	Dry Chemical Carbon Dioxide Foam Water Fog
Firefighting Instructions:	Flammable. Clear area of unprotected personnel. Vapours may travel along ground and flashback along vapour trail may occur. Do not use a direct stream of water as it may spread fire. Containers exposed to intense heat from fires should be cooled with water to prevent vapour pressure buildup, which could result in container rupture. Do not enter confined fire space without adequate protective clothing and an approved positive pressure self-contained breathing apparatus. Delayed lung damage can be experienced after exposure to combustion products, sometimes hours after the exposure. Fight fire from maximum distance.
Hazardous Combustion Products:	A complex mixture of airborne solid, liquid, particulates and gases will evolve when this material undergoes pyrolysis or combustion. Carbon monoxide, carbon dioxide, oxides of nitrogen and oxides of sulphur may be formed on combustion.

6. ACCIDENTAL RELEASE MEASURES

Issue warning "Flammable". See Section 8 for advice on personal protective equipment. Eliminate all ignition sources. Isolate hazard area and restrict access. Stop leak only if safe to do so. Notify appropriate environmental agency(ies). Work upwind of spill if it is safe to do so. Dike and contain land spills; contain spills to water by booming. Do not wash spills into sewers or other public water systems. For large spills remove by mechanical means and place in containers. Adsorb residue or small spills with adsorbent material and remove to non-leaking containers for disposal. After area has been cleaned up to the satisfaction of regulatory authorities, flush area with water to remove trace residue. Dispose of recovered material as noted under Disposal Considerations.

7. HANDLING AND STORAGE

Handling: Flammable. Fixed equipment as well as transfer containers and equipment should be grounded to prevent accumulation of static charge. Avoid breathing vapours and prolonged or repeated contact with skin. Do not cut, drill, grind, weld or perform similar operations on or near containers. Empty containers are hazardous, may contain flammable/explosive dusts, residues or vapours. Launder contaminated clothing prior to reuse. Wash with soap and water prior to eating, drinking, smoking, applying cosmetics or using toilet facilities. Use good personal hygiene.

Storage: Tank storage should be done according to NFPA Code 30 for crude oils.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

The following information, while appropriate for this product, is general in nature. The selection of personal protective equipment will vary depending on the conditions of use.

OCCUPATIONAL EXPOSURE LIMITS (Current ACGIH TLV/TWA unless otherwise noted):
The exposure limits listed here are provided for guidance only. Consult local, provincial and territorial authorities for specific values.

Xylene: 100 ppm (STEL: 150 ppm)
Gasoline: 300 ppm (STEL: 500 ppm)
Diesel fuel, as total hydrocarbons (skin): 100 mg/m3
Benzene (skin) : 0.5 ppm (STEL: 2.5 ppm)
Benzene: Shell internal standard is 0.5 ppm or 1.6 mg/m3 (8-12 hour time-weighted average limit), 2.5 ppm or 8 mg/m3 (15-minute short term limit)
Ethyl benzene: 100 ppm (STEL: 125 ppm)
Skin Notation: Absorption through skin, eyes and mucous membranes may contribute significantly to the total exposure.

Mechanical Ventilation: Use explosion-proof ventilation as required to control vapour concentrations. Concentrations in air should be maintained below the occupational exposure limit if unprotected personnel are involved. Make up air should always be supplied to balance air exhausted (either generally or locally). Local ventilation recommended where general ventilation is ineffective in controlling airborne concentrations below the recommended occupational exposure limit. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper confined space entry procedure must be followed including ventilation and testing of tank atmosphere.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Chemical safety goggles and/or full face shield to protect eyes and face, if product is handled such that it could be splashed into eyes.

Skin Protection: Avoid contact with skin. Impervious gloves (viton, nitrile) should be worn at all times when handling this material. In confined spaces or where the risk of skin exposure is much higher, impervious clothing should be worn. Use protective clothing and gloves manufactured from nitrile.

Respiratory Protection: Avoid breathing vapour or mists. If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. Depending on airborne concentration, use either a NIOSH-approved chemical cartridge respirator with organic vapour cartridges in combination with a P95 particulate filter or use a NIOSH-approved supplied-air respirator, either self-contained or airline, operated in positive pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Appearance:	Dark Brown
Odour:	Hydrocarbon Odour
Odour Threshold:	Not available
Boiling Point:	35 - 930 °C
Density:	910 - 930 kg/m3 @ 15 °C
Specific Gravity (Water = 1):	0.91 - 0.93
pH:	Not available
Flash Point:	PMCC 26 °C
Lower Flammable Limit:	Not available
Upper Flammable Limit:	Not available
Autoignition Temperature:	Not available
Viscosity:	350 mm2/s @ pipeline reference temperature
Evaporation Rate (n-BuAc = 1):	Not available
Partition Coefficient (log K_{OW}):	Not available

Water Solubility: Insoluble

10. STABILITY AND REACTIVITY

Chemically Stable: Yes
Hazardous Polymerization: No
Sensitive to Mechanical Impact: No
Sensitive to Static Discharge: Yes
Hazardous Decomposition Products: When heated to decomposition, may emit toxic and corrosive fumes of sulphur oxides, as well as CO, CO2, uncombusted hydrocarbons and soot.
Incompatible Materials: Avoid strong oxidizing agents.
Conditions of Reactivity: Avoid excessive heat, formation of vapours or mists.

11. TOXICOLOGICAL INFORMATION

Ingredient (or Product if not specified)	Toxicological Data
Residues (Petroleum), Vacuum	
Distillates (petroleum), petroleum residues vacuum	LD50 Oral Rat = 4320 mg/kg LD50 Dermal Rat > 2000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Natural Gas Condensates (C2 to C20)	LC50 Inhalation Rat > 5200 mg/m3 for 4hours LD50 Oral Rat = 14000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Naphtha (Petroleum), Hydrotreated Light	LD50 Oral Rat > 5000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Distillates (Petroleum), Straight-run Middle	LC50 Inhalation Rat 1700 mg/m3 for 4hours
Naphtha (petroleum), heavy straight-run	LC50 Inhalation Rat > 5000 mg/m3 for 4hours
Naphtha, heavy hydrocracked	LC50 Inhalation Rat > 5240 mg/m3 for 4hours LD50 Oral Rat > 5000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Toluene	LD50 Oral Rat 5580 mg/kg LC50 Inhalation Rat 26700 ppm for 1 hour LD50 Dermal Rabbit 12400 mg/kg
n-Hexane	LD50 Oral Rat > 8 mL/kg LD50 Dermal Rat > 4 mL/kg LC50 Inhalation Rat = 54090 - 57000 ppm for 4 hours
Benzene	LD50 Oral Rat 690 - 3400 mg/kg LC50 Inhalation Rat 13700 ppm for 4 hours LD50 Dermal Rabbit > 8260 mg/kg
Xylene (Mixed Isomers)	LD50 Oral Rat = 4300 mg/kg LC50 Inhalation Rat = 6700 ppm for 4 hours LD50 Dermal Rabbit > 2000 mg/kg
Ethylbenzene	LD50 Oral Rat = 3500 mg/kg LC50 Inhalation Rat = 4000 ppm for 4 hours LD50 Dermal Rabbit = 17.8 mL/kg

Routes of Exposure: Exposure will most likely occur through skin contact or inhalation.
Irritancy: Based on the ingredients, this product is expected to be irritating to skin.

Chronic Effects: Prolonged or repeated contact may cause various forms of dermatitis including folliculitis and oil acne.

Feto/Teratogenicity: High exposures to xylene in some animal studies, often at levels toxic to the mother, have affected embryo/fetal development. Other animal and human studies have not shown this effect.

Pre-existing Conditions: Pre-existing skin disorders may be aggravated by exposure to components of this product.

Carcinogenicity and Mutagenicity: Carcinogenic hazard. This product may contain a variety of polycyclic aromatic hydrocarbons (PAH), some of which are associated with the potential of inducing skin cancer. Increasing amounts of PAH may be released if this product is heated above 200 C. A component of this product has produced mutagenic effects. This product contains benzene. Repeated exposure to benzene concentrations greater than the recommended TLV/TWA may reduce the cellular components of peripheral blood and bone marrow. Epidemiological studies indicate that long term inhalation of benzene vapour can cause leukaemia in man. Benzene has also produced chromosomal aberrations in peripheral blood lymphocytes. IARC has listed Ethylbenzene among those materials for which there is limited evidence for carcinogenicity in animals and inadequate evidence in humans. As a result, Ethylbenzene is classified by IARC as a possible human carcinogen (i.e. IARC 2b)

12. ECOLOGICAL INFORMATION

Environmental Effects: The immediate effect of a release is the physical impairment of the environment from the coating of surfaces, resulting in the disruption of oxygen, water and light to flora and fauna. In the event of a release, the light fraction will vaporize and cause exposure via breathing and body contact. May cause physical fouling of aquatic and avian organisms. Prolonged exposure may result in the partitioning of light-end hydrocarbon fractions into the water and gas phases of the subsurface soil environment with potential to adversely affect soil and groundwater quality.

Biodegradability: Not readily biodegradable.

13. DISPOSAL CONSIDERATIONS

Waste management priorities (depending on volumes and concentration of waste) are: 1. recycle (reprocess), 2. energy recovery 3. incineration, 4. disposal at a licenced waste disposal facility. Do not attempt to combust waste on-site. Incinerate at a licenced waste disposal site with approval of environmental authority. Landfill adsorbed material in a government approved site.

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification:

UN Number	UN1268
Proper Shipping Name	PETROLEUM DISTILLATES, N.O.S.
Hazard Class	Class 3 Flammable Liquids
Packing Group	PG II
Shipping Description	PETROLEUM DISTILLATES, N.O.S. Class 3 UN1268 PG II

15. REGULATORY INFORMATION

This product has been classified in accordance with the hazard criteria of the *Controlled Products Regulations* (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Class:	Class B2 Flammable Liquid Class D2A Embryo/Fetotoxicity Class D2A Carcinogenicity Class D2A Mutagenicity Class D2B Skin Irritation
DSL/NDSL Status:	This product, or all components, are listed on the Domestic Substances List, as required under the Canadian Environmental Protection Act.
Other Regulatory Status:	The regulatory information is not intended to be comprehensive. Other regulations may apply to this material. For purposes of TSCA, the product is a mixture of certain blending components, all of which are on the TSCA inventory. Individual shipments of this product will not necessarily contain all of the blending components listed in Section 2 above.

16. OTHER INFORMATION

LABEL STATEMENTS

Hazard Statement :	Flammable Liquid. Irritating to skin. A component in this product has been classified by IARC as carcinogenic to humans (Group 1). May affect fetal development. This product contains a component that has produced mutagenic effects.
Handling Statement:	Eliminate all ignition sources. Avoid inhalation of vapours. Wear suitable gloves and eye protection. Bond and ground transfer containers and equipment to avoid static accumulation. Empty containers are hazardous, may contain flammable / explosive dusts, liquid residue or vapours. Keep away from sparks and open flames.
First Aid Statement :	Wash contaminated skin with soap and water. Flush eyes with water. If overcome by vapours remove to fresh air. Do not induce vomiting. Obtain medical attention.
Revisions:	This is a new MSDS.

Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name : **Albian Residual Blend**
Product Code : 001D1781
Uses : Refinery Feedstock.

Manufacturer/Supplier : **Motiva Enterprises LLC**
PO BOX 4540
Houston TX 77210-4540
USA
SDS Request : (+1) 8772767285

Emergency Telephone Number
Spill Information : +1- 877-242-7400
Health Information : +1- 877-504-9351

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity	CAS No.	Concentration
Petroleum, Crude Oil	8002-05-9	100.00 %

Contains Benzene, CAS # 71-43-2.
Contains Ethylbenzene, CAS # 100-41-4.
Contains n-Hexane, CAS # 110-54-3.
Contains Naphthalene, CAS # 91-20-3.
Contains hydrogen sulphide, CAS # 7783-06-4.
Hydrogen sulphide may be present both in the liquid and the vapour. Composition is complex and varies with the source of the crude oil.
Raw petroleum extracted in its natural state from the ground (excluding hydrocarbons from shale) and containing predominantly aliphatic, alicyclic and aromatic hydrocarbons. It may also contain small amounts of nitrogen, oxygen and sulphur compounds.

3. HAZARDS IDENTIFICATION

Emergency Overview

Appearance and Odour : Brown to black. Viscous liquid. Potential smell of rotten eggs and sulphur..

Health Hazards : Harmful: may cause lung damage if swallowed. Vapours may cause drowsiness and dizziness. A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome). Hydrogen sulphide is highly toxic and may be fatal if inhaled. Repeated exposure may cause skin dryness or cracking.

Safety Hazards : Flammable liquid. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Electrostatic

		charges may be generated during handling. Electrostatic discharge may cause fire. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and potentially toxic sulphur oxides may be present.
Environmental Hazards	:	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Health Hazards

Inhalation : Vapours may cause drowsiness and dizziness. Hydrogen sulphide is highly toxic and may be fatal if inhaled. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and other hazardous vapours may evolve and collect in the headspace of storage tanks, transport vessels and other enclosed containers.

Eye Contact : Moderately irritating to eyes.

Ingestion : Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.Harmful: may cause lung damage if swallowed.

Other Information : A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome).

Signs and Symptoms : Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.

Environmental Hazards : Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Additional Information : This product is intended for use in closed systems only.

4. FIRST-AID MEASURES

General Information	:	Vaporisation of H2S that has been trapped in clothing can be dangerous to rescuers. Maintain respiratory protection to avoid contamination from the victim to rescuer. Mechanical ventilation should be used to resuscitate if at all possible.
Inhalation	:	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact	:	Flush eyes with water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision, or swelling persist transport to the nearest medical facility for additional treatment.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Give nothing by mouth. Do not induce vomiting. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Advice to Physician	:	Hydrogen sulphide (H2S) - CNS asphyxiant. May cause rhinitis, bronchitis and occasionally pulmonary oedema after severe exposure. CONSIDER: Oxygen therapy. Consult a Poison Control Center for guidance. Exposure to hydrogen sulphide at concentrations above the recommended occupational exposure standard may cause headache, dizziness, irritation of the eyes, upper respiratory tract, mouth and digestive tract, convulsions, respiratory paralysis, unconsciousness and even death. Call a doctor or poison control center for guidance. Potential for chemical pneumonitis.

5. FIRE-FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	< 23 °C / 73 °F
Upper / lower Flammability or Explosion limits	:	0.6 - 8 %(V)
Auto ignition temperature	:	> 220 °C / 428 °F
Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Oxides of nitrogen. Oxides of sulphur. Unidentified organic and inorganic compounds. Flammable vapours may be present even at temperatures below the flash point. The

vapour is heavier than air, spreads along the ground and distant ignition is possible. Carbon monoxide may be evolved if incomplete combustion occurs. Hydrogen sulphide (H2S) and toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning.

Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.
Protective Equipment for Firefighters	:	Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
Additional Advice	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately.

6. ACCIDENTAL RELEASE MEASURES

Observe the relevant local and international regulations. Remove contaminated clothing. Evacuate the area of all non-essential personnel. Avoid contact with skin, eyes and clothing. Ventilate contaminated area thoroughly. Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal.

Protective measures	:	May ignite on surfaces at temperatures above auto-ignition temperature. Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Clean Up Methods	:	For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an

appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.

Additional Advice : Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26. U.S. regulations may require reporting releases of this material to the environment which exceed the reportable quantity (refer to Chapter 15) to the National Response Center at (800) 424-8802. Under Section 311 of the Clean Water Act (CWA) this material is considered an oil. As such, spills into surface waters must be reported to the National Response Center at (800) 424-8802. This material is covered by EPA's Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Petroleum Exclusion. Therefore, releases to the environment may not be reportable under CERCLA. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet.

7. HANDLING AND STORAGE

General Precautions : Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Prevent spillages. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols.

Handling : When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Never siphon by mouth. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Avoid exposure. Use only non-sparking tools. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Bulk storage tanks should be diked (bunded). Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges. These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck

operations, and mechanical movements. These activities may lead to static discharge e.g. spark formation. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/s until fill pipe submerged to twice its diameter, then <= 7 m/s). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Storage : Drum and small container storage: Keep containers closed when not in use. Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers.
Packaged product must be kept tightly closed and stored in a diked (bunded) well-ventilated area, away from, ignition sources and other sources of heat. Take suitable precautions when opening sealed containers, as pressure can build up during storage. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions.
Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.

Product Transfer : Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes.
Avoid splash filling. Keep containers closed when not in use. Do not use compressed air for filling, discharging or handling. Contamination resulting from product transfer may give rise to light hydrocarbon vapour in the headspace of tanks that have previously contained gasoline. This vapour may explode if there is a source of ignition. Partly filled containers present a greater hazard than those that are full, therefore handling, transfer and sampling activities need special care.
Refer to guidance under Handling section.

Recommended Materials : For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), polyvinyl chloride (PVC), polyvinyl fluoride (PVDF), and fluoroelastomers (FKM), e.g. Viton, which have been specifically tested for compatibility with this product. For container linings, or coatings, use Epoxy (amine-cured), or Epoxy Novolac, or Phenolic Epoxy. For seals and gaskets use: fluoroelastomers (FKM), e.g. Viton A, B, or F, or Neoprene

(CR), or nitrile (NBR, HNBR), or graphite, or expanded PTFE (e.g. Gore-Tex).

Unsuitable Materials : Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyisobutylene. However, some may be suitable for glove materials.

Container Advice : Do not cut, drill, grind, weld or perform similar operations on or near containers. Containers, even those that have been emptied, can contain explosive vapours.

Additional Information : Ensure that all local regulations regarding handling and storage facilities are followed. Hydrogen sulphide (H2S) and toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning. Hydrogen sulphide (H2S or Sour Gas) may be present when loading and unloading transport vessels. Stay upwind and away from newly opened hatches and allow to vent thoroughly before handling material. Steam may be used to vent hatches. Keep all sources of ignition away from loading area.
Use hydrogen sulphide monitors for detection.
See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). CENELEC CLC/TR 50404 (Electrostatics – Code of practice for the avoidance of hazards due to static electricity).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
n-hexane	ACGIH	TWA	50 ppm		
n-hexane	ACGIH	SKIN_DES			Can be absorbed through the skin.
n-hexane	OSHA Z1	PEL	500 ppm	1,800 mg/m3	
Benzene	ACGIH	TWA	0.5 ppm		
Benzene	ACGIH	STEL	2.5 ppm		
Benzene	ACGIH	SKIN_DES			Can be absorbed through the skin.

Benzene	OSHA	TWA	1 ppm		
Benzene	OSHA	STEL	5 ppm		
Benzene	OSHA	OSHA_ACT	0.5 ppm		
Benzene	SHELL IS	TWA	0.5 ppm	1.6 mg/m3	
Benzene	SHELL IS	STEL	2.5 ppm	8 mg/m3	
Benzene	OSHA Z2	TWA	10 ppm		
Benzene	OSHA Z2	Ceiling	25 ppm		
Benzene	OSHA Z2	MAX. CONC	50 ppm		
Naphthalene	ACGIH	TWA	10 ppm		
Naphthalene	ACGIH	STEL	15 ppm		
Naphthalene	ACGIH	SKIN_DES			Can be absorbed through the skin.
Naphthalene	OSHA Z1	PEL	10 ppm	50 mg/m3	
Ethylbenzene	ACGIH	TWA	20 ppm		
Ethylbenzene	OSHA Z1	PEL	100 ppm	435 mg/m3	
Ethylbenzene	OSHA Z1				Listed.
Hydrogen Sulphide	ACGIH	TWA	1 ppm		
Hydrogen Sulphide	ACGIH	STEL	5 ppm		
Hydrogen Sulphide	OSHA Z2	Ceiling	20 ppm		
Hydrogen Sulphide	OSHA Z2	MAX. CONC	50 ppm		

Additional Information : Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.
SHELL IS is the Shell Internal Standard. Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Biological Exposure Index (BEI)

Material	Determinant	Sampling Time	BEI	Reference
Benzene	t,t-Muconic acid in Creatinine in urine	Sampling time: End of shift.	500 µg/g	ACGIH BEL (2011)
Benzene	S-Phenylmercapturic acid in Creatinine in urine	Sampling time: End of shift.	25 µg/g	ACGIH BEL (2011)
Ethylbenzene	Sum of mandelic acid and phenylglyoxylic acid in Creatinine in urine	Sampling time: End of shift at end of work week.	0.7 g/g	ACGIH BEL (2011)
Ethylbenzene	Ethyl benzene in End-exhaled air	Sampling time: Not critical.		ACGIH BEL (2011)
n-hexane	2,5-Hexanedion, without hydrolysis in Urine	Sampling time: End of shift at end of work week.	0.4 mg/l	ACGIH BEL (2011)

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use. Firewater monitors and deluge systems are recommended. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping. Define procedures for safe handling and maintenance of controls. Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g.

		personal protective equipment, local exhaust ventilation. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	Respirator selection, use and maintenance should be in accordance with the requirements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC. Longer term protection: Nitrile rubber. Incidental contact/Splash protection: Neoprene rubber. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognise that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time may be acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced.
Eye Protection	:	Chemical splash goggles (chemical monogoggles).
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory. Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/ Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour. Take appropriate measures to fulfil the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Chapter 6. If necessary, prevent undissolved material from

being discharged to waste water. Waste water should be treated in a municipal or industrial waste water treatment plant before discharge to surface water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Brown to black. Viscous liquid.
Odour	:	Potential smell of rotten eggs and sulphur..
pH	:	Not applicable
Initial Boiling Point and Boiling Range	:	10 - 400 °C / 50 - 752 °F
Freezing Point	:	Data not available
Flash point	:	< 23 °C / 73 °F
Upper / lower Flammability or Explosion limits	:	0.6 - 8 %(V)
Auto-ignition temperature	:	> 220 °C / 428 °F
Vapour pressure	:	Typical 10 - 70 kPa
Specific gravity	:	Data not available
Water solubility	:	Insoluble.
Solubility in other solvents	:	Data not available
Kinematic viscosity	:	3 - 1,000 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Electrical conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.
Other Information	:	Not applicable.
Molecular weight	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions of use.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases including carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.

Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute Oral Toxicity : Low toxicity: LD50 > 5000 mg/kg , Rat

Acute Dermal Toxicity : Low toxicity: LD50 >2000 mg/kg , Rabbit

Acute Inhalation Toxicity : Extremely toxic: LC100 = 600ppm(v) / 30 min, Man (Hydrogen Sulphide)
Low toxicity by inhalation. (Petroleum, Crude Oil)

Skin Irritation : Not irritating to skin. Prolonged/repeated contact may cause defatting of the skin which can lead to dermatitis.

Eye Irritation : Expected to be moderately irritating to eyes (but insufficient to classify).

Respiratory Irritation : Not expected to be a respiratory irritant.

Sensitisation : Not expected to be a sensitiser.

Repeated Dose Toxicity : Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.

Mutagenicity : Not expected to be mutagenic.

Carcinogenicity : Causes cancer in laboratory animals.
Known human carcinogen. May cause leukaemia (AML - acute myelogenous leukemia).

Material	:	**Carcinogenicity Classification**
Crude Oil	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Crude Oil	:	GHS / CLP: No carcinogenicity classification
Hydrogen Sulphide	:	GHS / CLP: No carcinogenicity classification
n-hexane	:	GHS / CLP: No carcinogenicity classification
Benzene	:	ACGIH Group A1: Confirmed human carcinogen.
Benzene	:	NTP: Known To Be Human Carcinogen.
Benzene	:	IARC 1: Carcinogenic to humans.
Benzene	:	GHS / CLP: Carcinogenicity Category 1A
Naphthalene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Naphthalene	:	NTP: Reasonably Anticipated to be a Human Carcinogen.
Naphthalene	:	IARC 2B: Possibly carcinogenic to humans.
Naphthalene	:	GHS / CLP: Carcinogenicity Category 2
Ethylbenzene	:	ACGIH Group A3: Confirmed animal carcinogen with unknown relevance to humans.
Ethylbenzene	:	IARC 2B: Possibly carcinogenic to humans.
Ethylbenzene	:	GHS / CLP: No carcinogenicity classification

Reproductive and Developmental Toxicity : Not expected to impair fertility. Not expected to be a developmental toxicant.

Additional Information : Classifications by other authorities under varying regulatory frameworks may exist.
Can cause liver damage. (Hydrogen Sulphide)
H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200

ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.
May cause MDS (Myelodysplastic Syndrome). (Benzene)

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute Toxicity : Expected to be harmful: LL/EL/IL50 1-10 mg/l (to aquatic organisms) LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Chronic Toxicity

Fish : Data not available

Aquatic crustacea : Data not available

Mobility : If the product enters soil, one or more constituents will or may be mobile and may contaminate groundwater. Contains volatile constituents. Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. Floats on water and forms a slick.

Persistence/degradability : Major constituents are inherently biodegradable, but contains components that may persist in the environment.

Bioaccumulation : Contains constituents with the potential to bioaccumulate.

Other Adverse Effects : Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal : Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.

Container Disposal : Send to drum recoverer or metal reclaimer. Drain container

thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.

Local Legislation : Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be in compliance.

14. TRANSPORT INFORMATION

US Department of Transportation Classification (49CFR)

Identification number	UN 1267
Proper shipping name	Petroleum crude oil
Class / Division	3
Packing group	I
Emergency Response Guide No .	128

IMDG

Identification number	UN 3494
Proper shipping name	PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Class / Division	3
Subsidiary class/Division	6.1
Packing group	I
Marine Pollutant:	Yes

IATA (Country variations may apply)

Identification number	UN 3494
Proper shipping name	Petroleum sour crude oil, flammable, toxic
Class / Division	3
Subsidiary class/Division	6.1
Packing group	I

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Federal Regulatory Status

Material Safety Data Sheet

Notification Status

EINECS	All components listed or polymer exempt.
DSL	All components listed.
TSCA	All components listed.

Comprehensive Environmental Release, Compensation & Liability Act (CERCLA)

Albian Residual Blend (8002-05-9)	Reportable quantity: 1 lbs
Crude Oil (8002-05-9)	Reportable quantity: 100 lbs
Hydrogen Sulphide (7783-06-4)	Reportable quantity: 100 lbs
n-hexane (110-54-3)	Reportable quantity: 5000 lbs
Benzene (71-43-2)	Reportable quantity: 10 lbs
Naphthalene (91-20-3)	Reportable quantity: 100 lbs
Ethylbenzene (100-41-4)	Reportable quantity: 1000 lbs

Shell classifies this material as an "oil" under the CERCLA Petroleum Exclusion, therefore releases to the environment are not reportable under CERCLA.
The components with RQs are given for information.

Clean Water Act (CWA) Section 311

Hydrogen Sulphide (7783-06-4)	Reportable quantity: 100 lbs
Benzene (71-43-2)	Reportable quantity: 10 lbs
Naphthalene (91-20-3)	Reportable quantity: 100 lbs
Ethylbenzene (100-41-4)	Reportable quantity: 1000 lbs

SARA Toxic Release Inventory (TRI) (313)

Crude Oil (8002-05-9)	100.00%
Hydrogen Sulphide (7783-06-4)	10.00%
n-hexane (110-54-3)	9.99%
Benzene (71-43-2)	8.99%
Naphthalene (91-20-3)	0.99%

Ethylbenzene (100-41-4) 0.99%

SARA Extremely Hazardous Substances (302/304)

Hydrogen Sulphide (7783-06-4) Reportable quantity: 100 lbs
Hydrogen Sulphide (7783-06-4) Threshold Planning Quantity: 500 lbs

State Regulatory Status

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)

This product contains a chemical known to the State of California to cause cancer.
Known to the State of California to cause birth defects or other reproductive harm.

New Jersey Right-To-Know Chemical List

Crude Oil (8002-05-9) 100.00%
Listed.
Hydrogen Sulphide (7783-06-4) 10.00%
Listed.
n-hexane (110-54-3) 9.99%
Listed.
Benzene (71-43-2) 8.99%
Listed.
Naphthalene (91-20-3) 0.99%
Listed.
Ethylbenzene (100-41-4) 0.99%
Listed.

Pennsylvania Right-To-Know Chemical List

Crude Oil (8002-05-9) 100.00%
Listed.
Environmental hazard.
Hydrogen Sulphide (7783-06-4) 10.00%
Environmental hazard.
Listed.
n-hexane (110-54-3) 9.99%
Listed.
Benzene (71-43-2) 8.99%
Environmental hazard.
Listed.
Special hazard.
Naphthalene (91-20-3) 0.99%
Environmental hazard.
Listed.
Ethylbenzene (100-41-4) 0.99%
Environmental hazard.
Listed.

16. OTHER INFORMATION

NFPA Rating (Health, Fire, Reactivity) : 1, 3, 0

Material Safety Data Sheet

SDS Version Number	:	1.1
SDS Effective Date	:	02/13/2014
SDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
SDS Regulation	:	The content and format of this MSDS is in accordance with the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
SDS Distribution	:	The information in this document should be made available to all who may handle the product.
Disclaimer	:	The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

Material Safety Data Sheet

According to OSHA Hazard Communication Standard, 29 CFR 1910.1200

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Albian Heavy Synthetic

Product code : 001B3607
Chemical nature : Crude oil produced by an upgrading process and containing predominantly aliphatic, alicyclic and aromatic hydrocarbons. It may also contain small amounts of nitrogen, oxygen and sulphur compounds.

Manufacturer or supplier's details

Manufacturer/Supplier : **Motiva Enterprises LLC**
PO BOX 4540
Houston TX 77210-4540
USA
SDS Request : (+1) 8772767285
Customer Service :

Emergency telephone number

Spill Information : +1-877-504-9351
Health Information : +1-877-242-7400

Recommended use of the chemical and restrictions on use

Recommended use : Refinery Feedstock.

Restrictions on use : This product must not be used in applications other than those listed in Section 1 without first seeking the advice of the supplier.

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	liquid
Colour	Brown to black
Odour	Potential smell of rotten eggs and sulphur.
Health Hazards	Harmful: May cause lung damage if swallowed. Vapours may cause drowsiness and dizziness. A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). Highly toxic and may be fatal if inhaled. (Hydrogen Sulfide) Repeated exposure may cause skin dryness or cracking May cause MDS (Myelodysplastic Syndrome).
Safety Hazards	Flammable liquid. The vapour is heavier than air, spreads along the ground and distant ignition is possible.Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire.Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and potentially toxic sulphur oxides may be present.

Environmental Hazards	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Other Hazards
Flammable liquid
Carcinogen

Other hazards which do not result in classification
None known.

Additional Information
The vapour is heavier than air, spreads along the ground and distant ignition is possible. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and potentially toxic sulphur oxides may be present.

The following percentage of the mixture consists of ingredient(s) with unknown acute oral toxicity:
< 5 %

Potential Health Effects

Inhalation	:	Highly toxic and may be fatal if inhaled. (Hydrogen Sulfide) Vapours may cause drowsiness and dizziness.
Skin	:	Repeated exposure may cause skin dryness or cracking
Eyes	:	Moderately irritating to eyes.
Ingestion	:	Harmful: May cause lung damage if swallowed.
Chronic Exposure	:	A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia).
Symptoms of Overexposure	:	Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache and nausea. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of

consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.

Environmental Effects

Environmental Effects : Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature : Crude oil produced by an upgrading process and containing predominantly aliphatic, alicyclic and aromatic hydrocarbons. It may also contain small amounts of nitrogen, oxygen and sulphur compounds.

Hazardous components

Chemical Name	CAS-No.	Concentration [%]
crude oil	8002-05-9	0 - 100
	Not Assigned	0 - 100

Hydrogen sulphide may be present both in the liquid and the vapour. Composition is complex and varies with the source of the crude oil and the contributing process plants at that time., Refer to Chapter 8 for Occupational Exposure Guidelines.

Further information

Contains:

Chemical Name	Identification number	Classification	Concentration [%]
n-Hexane	110-54-3, 203-777-6	Flammable liquids: Category 2, H225 Skin corrosion/irritation: Category 2, H315 Aspiration hazard: Category 1, H304 Specific target organ toxicity - repeated exposure: Category 1 Specific target organ toxicity - single exposure: Category 3, H336 Reproductive toxicity: Category 2, H361 Hazardous to the aquatic environment: Category 2, H411	0 < 2

Ethylbenzene	100-41-4, 202-849-4	Flammable liquids: Category 2, H225 Acute toxicity: Category 4, H332 Skin corrosion/irritation: Category 2, H315 Serious eye damage/eye irritation: Category 2, H319 Aspiration hazard: Category 1, H304 Specific target organ toxicity - single exposure: Category 3, H335 Specific target organ toxicity - repeated exposure: Category 2, H373	0 < 0.5
benzene	71-43-2, 200-753-7	Flammable liquids: Category 2, H225 Skin corrosion/irritation: Category 2, H315 Serious eye damage/eye irritation: Category 2, H319 Germ cell mutagenicity: Category 1B, H340 Specific target organ toxicity - repeated exposure: Category 1, H372 Aspiration hazard: Category 1, H304	0 < 0.5
Cumene	98-82-8, 202-704-5		0 < 0.5
Naphthalene	91-20-3, 202-049-5		0 < 0.5
Hydrogen Sulphide	7783-06-4, 231-977-3	Flammable gas.: Category 1, H220 Acute toxicity: Category 1, H330 Chronic aquatic toxicity: Category 1, H400	0 < 0.01

Further information

NFPA Rating (Health, Fire, Reactivity) 1, 3, 0

SECTION 4. FIRST AID MEASURES

General advice : Vaporisation of H2S that has been trapped in clothing can be

dangerous to rescuers. Maintain respiratory protection to avoid contamination from the victim to rescuer. Mechanical ventilation should be used to resuscitate if at all possible.

If inhaled	:	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
In case of skin contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
In case of eye contact	:	Flush eyes with water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision, or swelling persist transport to the nearest medical facility for additional treatment.
If swallowed	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Give nothing by mouth. Do NOT induce vomiting. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Most important symptoms and effects, both acute and delayed	:	Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache and nausea. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.
Protection of first-aiders	:	When administering first aid, ensure that you are wearing the

appropriate personal protective equipment according to the incident, injury and surroundings.

Immediate medical attention, special treatment	:	Hydrogen sulphide (H2S) - CNS asphyxiant. May cause rhinitis, bronchitis and occasionally pulmonary oedema after severe exposure. CONSIDER: Oxygen therapy. Consult a Poison Control Center for guidance. Exposure to hydrogen sulphide at concentrations above the recommended oc cupational exposure standard may cause headache, dizziness, irritation of the eyes, upper respiratory tract, mouth and digestive tract, convulsions, respiratory paralysis, unconsciousness and even death. Call a doctor or poison control center for guidance. Potential for chemical pneumonitis.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable extinguishing media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.
Specific hazards during firefighting	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Oxides of nitrogen Oxides of sulphur. Unidentified organic and inorganic compounds. Flammable vapours may be present even at temperatures below the flash point. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Carbon monoxide may be evolved if incomplete combustion occurs. Hydrogen sulphide (H2S) and other toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning.
Specific extinguishing methods	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Further information	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately.
Special protective equipment	:	Proper protective equipment including chemical resistant

for firefighters	gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained.
Environmental precautions	:	Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapor or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Methods and materials for containment and cleaning up	:	For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely For small liquid spills (< 1 drum), transfer by mechanical means to a labeled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely Remove contaminated soil and dispose of safely.

Observe all relevant local and international regulations.

Additional advice	:	For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26. U.S. regulations may require reporting releases of this material to the environment which exceed the reportable quantity (refer to Chapter 15) to the National Response Center at (800) 424-8802. Under Section 311 of the Clean Water Act (CWA) this material

is considered an oil. As such, spills into surface waters must be reported to the National Response Center at (800) 424-8802.
This material is covered by EPA's Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Petroleum Exclusion. Therefore, releases to the environment may not be reportable under CERCLA.

SECTION 7. HANDLING AND STORAGE

General Precautions	:	Avoid breathing of or direct contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Prevent spillages. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols.
Precautions for safe handling	:	When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Never siphon by mouth. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Avoid exposure. Use only non-sparking tools. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Bulk storage tanks should be diked (bunded).
Avoidance of contact	:	Strong oxidising agents.
Product Transfer	:	Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Avoid splash filling Keep containers closed when not in use. Do not use compressed air for filling discharge or handling. Contamination resulting from product transfer may give rise to light hydrocarbon vapour in the headspace of tanks that have previously contained gasoline. This vapour may explode if there is a source of ignition. Partly filled containers present a greater hazard than those that are full, therefore handling, transfer and sampling activities need special care.

Storage

Other data	:	Drum and small container storage:

Keep containers closed when not in use.
Drums should be stacked to a maximum of 3 high.
Use properly labeled and closable containers.
Packaged product must be kept tightly closed and stored in a diked (bunded) well-ventilated area, away from, ignition sources and other sources of heat.
Take suitable precautions when opening sealed containers, as pressure can build up during storage.
Tank storage:
Tanks must be specifically designed for use with this product.
Bulk storage tanks should be diked (bunded).
Locate tanks away from heat and other sources of ignition.
Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions.
Electrostatic charges will be generated during pumping.
Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk.
The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable.
Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.

Packaging material : Suitable material: For containers, or container linings use mild steel, stainless steel.
Unsuitable material: Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene.

Container Advice : Do not cut, drill, grind, weld or perform similar operations on or near containers.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
n-Hexane	110-54-3	TWA	50 ppm	ACGIH
benzene	71-43-2	TWA	0.5 ppm	ACGIH
		STEL	2.5 ppm	ACGIH
		TWA	10 ppm	OSHA Z-2
		CEIL	25 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		PEL	1 ppm	OSHA CARC
		STEL	5 ppm	OSHA CARC

Biological occupational exposure limits

Component	CAS-No.	Control parameters	Biological specimen	Sampling time	Permissible concentration	Basis
n-Hexane	110-54-3	2,5-Hexanedione	Urine	End of shift at end of workweek	0.4 mg/l	ACGIH BEI
benzene	71-43-2	S-Phenylmercapturic acid	Urine	End of shift (As soon as possible after exposure ceases)	0.025 mg/g	ACGIH BEI
Remarks: Creatinine						
benzene		t,t-Muconic acid	Urine	End of shift (As soon as possible after exposure ceases)	0.5 mg/g	ACGIH BEI
Remarks: Creatinine						
Ethylbenzene	100-41-4	Sum of mandelic acid and phenyl glyoxylic acid	Urine	End of shift at end of workweek	700 mg/g	ACGIH BEI
Remarks: Creatinine						
Ethylbenzene		Ethylbenzene	In end-exhaled air	Not critical		ACGIH BEI

Monitoring Methods

Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory.
Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available.

National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods
http://www.cdc.gov/niosh/
Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods
http://www.osha.gov/

Appropriate engineering controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include:

Use sealed systems as far as possible.
Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits.
Local exhaust ventilation is recommended.
Eye washes and showers for emergency use.
Firewater monitors and deluge systems are recommended.
Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned.
Practice good housekeeping.
Define procedures for safe handling and maintenance of controls.
Educate and train workers in the hazards and control measures relevant to normal activities associated with this product.
Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation.
Drain down system prior to equipment break-in or maintenance.
Retain drain downs in sealed storage pending disposal or for subsequent recycle.

Personal protective equipment

Protective measures

Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory protection : Respirator selection, use and maintenance should be in accordance with the requirements of the OSHA Respiratory Protection Standard, 29 CFR 1910.134.

Hand protection
Remarks : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection. PVC. Longer term protection: Nitrile rubber. Incidental contact/Splash protection: Neoprene rubber. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognize that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time maybe acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced.

Eye protection	:	Wear goggles for use against liquids and gas.
Skin and body protection	:	Wear chemical resistant gloves/gauntlets, boots, and apron.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	Brown to black
Odour	:	Potential smell of rotten eggs and sulphur.
Flash point	:	<= 23 °C / <= 73 °F Method: Unspecified
Flammability (solid, gas)	:	Not applicable
Vapour pressure	:	Data not available
Density	:	888.9 kg/m3 (15.0 °C / 59.0 °F) Method: Unspecified
Auto-ignition temperature	:	> 220 °C / 428 °F
Viscosity		
Viscosity, kinematic	:	3 - 1,000 mm2/s (40 °C / 104 °F) Method: Unspecified
Explosive properties	:	Classification Code: NOT CLASS: Not classified
Oxidizing properties	:	Not applicable
Conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semiconductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Oxidises on contact with air.
Chemical stability	:	Stable under normal conditions of use.

Conditions to avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Incompatible materials	:	Strong oxidising agents.
Hazardous decomposition products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases including carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

SECTION 11. TOXICOLOGICAL INFORMATION

Basis for assessment	:	Information given is based on data on the components and the toxicology of similar products.Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute toxicity

Product:

Acute oral toxicity	:	LD 50 rat: > 5,000 mg/kg Remarks: Low toxicity:
Acute inhalation toxicity	:	Remarks: Expected to be of low toxicity if inhaled. Man: Exposure time: 30 min Remarks: Contains hydrogen sulphide. Extremely toxic: LC100 = 600ppm(v)
Acute dermal toxicity	:	LD 50 Rabbit: > 2,000 mg/kg Remarks: Low toxicity:
Acute toxicity (other routes of administration)	:	Remarks: Not expected to be a respiratory irritant.

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

Product:

Test Method: Skin sensitisation

Remarks: Not expected to be a sensitiser.

Test Method: Respiratory sensitisation
Remarks: Not expected to be a sensitiser.

Germ cell mutagenicity

Product:

Remarks: Not expected to be mutagenic.

Carcinogenicity

Product:

Remarks: Causes cancer in laboratory animals.

Remarks: Known human carcinogen., May cause leukaemia (AML - acute myelogenous leukaemia).

Other Carcinogenicity Classification:

IARC	Group 2B: Possibly carcinogenic to humans	
	Ethylbenzene	100-41-4
	Naphthalene	91-20-3
	Group 1: Carcinogenic to humans	
	benzene	71-43-2
	Group 3: Not classifiable as to its carcinogenicity to humans	
	crude oil	8002-05-9
ACGIH	Confirmed human carcinogen	
	benzene	71-43-2
	Confirmed animal carcinogen with unknown relevance to humans.	
	Ethylbenzene	100-41-4
	Not classifiable as a human carcinogen.	
	Naphthalene	91-20-3
OSHA	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.	
NTP	Reasonably anticipated to be a human carcinogen	
	Naphthalene	91-20-3

Reproductive toxicity

Product:

Remarks: Not expected to impair fertility., Not expected to be a developmental toxicant.

STOT - single exposure

Product:

Remarks: High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

STOT - repeated exposure

no data available

Aspiration toxicity

no data available

Further information

Product:

Remarks: Classifications by other authorities under varying regulatory frameworks may exist.

Remarks: H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.

Remarks: Contains Benzene, CAS # 71-43-2., May cause MDS (Myelodysplastic Syndrome).

SECTION 12. ECOLOGICAL INFORMATION

Basis for assessment : Ecotoxicological data have not been determined specifically for this product.
Information given is based on a knowledge of the components and the ecotoxicology of similar products.
Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Ecotoxicity

Product:

Toxicity to fish (Chronic toxicity) : Remarks: NOEC/NOEL expected to be > 0.1 - <= 1.0 mg/l (based on modeled data)

Toxicity to crustacean (Chronic toxicity) : Remarks: NOEC/NOEL expected to be > 0.1 - <= 1.0 mg/l (based on modeled data)

Persistence and degradability

Product:

Biodegradability : Remarks: Major constituents are inherently biodegradable, but

contains components that may persist in the environment., The volatile constituents will oxidize rapidly by photochemical reactions in air.

Bioaccumulative potential

Product:

Bioaccumulation : Remarks: Contains constituents with the potential to bioaccumulate.

Mobility in soil

Product:

Mobility : Remarks: If the product enters soil, one or more constituents will or may be mobile and may contaminate groundwater., Contains volatile components., Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day., Floats on water and forms a slick.

Other adverse effects

no data available

Product:

Additional ecological information : Films formed on water may affect oxygen transfer and damage organisms.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Recover or recycle if possible.
It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.
Do not dispose into the environment, in drains or in water courses
Do not dispose of tank water bottoms by allowing them to drain into the ground.
Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.

Contaminated packaging : Send to drum recoverer or metal reclaimer.
Drain container thoroughly.
After draining, vent in a safe place away from sparks and fire.
Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums.
Do not pollute the soil, water or environment with the waste container.
Comply with any local recovery or waste disposal regulations.

Local legislation
Remarks : Disposal should be in accordance with applicable regional, national, and local laws and regulations.
Local regulations may be more stringent than regional or national requirements and must be complied with.

SECTION 14. TRANSPORT INFORMATION

National Regulations

49 CFR

UN/ID/NA number	:	UN 1267
Proper shipping name	:	PETROLEUM CRUDE OIL
Class	:	3
Packing group	:	I
Labels	:	3
Marine pollutant	:	no
Remarks	:	This material is an 'OIL' under 49 CFR Part 130 when transported in a container of 3500 gallon capacity or greater.

International regulation

IATA-DGR

UN/ID No.	:	UN 3494
Proper shipping name	:	PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Class	:	3
Subsidiary risk	:	6.1
Packing group	:	I
Labels	:	3 (6.1)

IMDG-Code

UN number	:	UN 3494
Proper shipping name	:	PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Class	:	3
Subsidiary risk	:	6.1
Packing group	:	I
Labels	:	3 (6.1)
Marine pollutant	:	yes

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

Special precautions for user

Remarks : Special Precautions: Refer to Chapter 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.

Additional Information : MARPOL Annex 1 rules apply for bulk shipments by sea.

SECTION 15. REGULATORY INFORMATION

OSHA Hazards : Flammable liquid, Carcinogen

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Benzene	71-43-2	10	*
Hydrogen Sulfide	7783-06-4	100	*
Naphthalene	91-20-3	100	*
Ethylbenzene	100-41-4	1000	*
n-Hexane	110-54-3	5000	*

*: Calculated RQ exceeds reasonably attainable upper limit.

CERCLA Reportable Quantity

Calculated RQ exceeds reasonably attainable upper limit.

CERCLA Reportable Quantity

Shell classifies this material as an "oil" under the CERCLA Petroleum Exclusion, therefore releases to the environment are not reportable under CERCLA.

CERCLA Reportable Quantity

The components with RQs are given for information.

SARA 304 Extremely Hazardous Substances Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Hydrogen Sulphide	7783-06-4	100	*

*: Calculated RQ exceeds reasonably attainable upper limit.

SARA 311/312 Hazards : Fire Hazard

SARA 302 : SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

Hydrogen Sulphide	7783-06-4	0.01 %

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

n-Hexane	110-54-3	2 %
benzene	71-43-2	0.5 %
Naphthalene	91-20-3	0.5 %
crude oil	8002-05-9	100 %
Hydrogen Sulphide	7783-06-4	0.01 %

Clean Water Act

The following Hazardous Substances are listed under the U.S. CleanWater Act, Section 311, Table 116.4A:

Hydrogen Sulphide	7783-06-4	0.01 %

benzene	71-43-2	0.5 %
Toluene	108-88-3	1 %

The following Hazardous Chemicals are listed under the U.S. CleanWater Act, Section 311, Table 117.3:

Toluene	108-88-3	1 %
benzene	71-43-2	0.5 %
Hydrogen Sulphide	7783-06-4	0.01 %

This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

US State Regulations

Pennsylvania Right To Know

crude oil	8002-05-9	90 - 100 %
	Not Assigned	90 - 100 %
n-Hexane	110-54-3	1 - 5 %
benzene	71-43-2	0.1 - 1 %
Hydrogen Sulphide	7783-06-4	0 - 0.1 %

New Jersey Right To Know

crude oil	8002-05-9	90 - 100 %
	Not Assigned	90 - 100 %
n-Hexane	110-54-3	1 - 5 %
benzene	71-43-2	0.1 - 1 %
Hydrogen Sulphide	7783-06-4	0 - 0.1 %

California Prop 65

WARNING! This product contains a chemical known to the State of California to cause cancer.

benzene 71-43-2

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

benzene 71-43-2

The components of this product are reported in the following inventories:

TSCA All components are listed on the TSCA Inventory.

SECTION 16. OTHER INFORMATION

Abbreviations and Acronyms : The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).

Further information

NFPA Rating (Health, Fire, Reactivity) 1, 3, 0

This product is intended for use in closed systems only.

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Shell Canada Limited
Material Safety Data Sheet

Effective Date: 2010-02-15
Supersedes: 2007-02-23


Class B2 Flammable Liquid


Class D2B Skin Irritation


Class D2A Carcinogenicity

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT:	**ALBIAN VACUUM GASOIL BLEND**
SYNONYMS:	AVB Synthetic crude oil is a mixture of paraffins, naphthenes, aromatics and sulphur compounds
PRODUCT USE:	Base product for Petroleum Refining.
PRODUCT CODE:	**873-331**

SUPPLIER
Shell Canada Limited (SCL)
P.O. Box 100, Station M
400-4th Ave. S.W.
Calgary, AB Canada
T2P 2H5

TELEPHONE NUMBERS	
Shell Emergency Number	1-800-661-7378
CANUTEC 24 HOUR EMERGENCY NUMBER	1-613-996-6666
For general information:	1-800-661-1600
	www.shell.ca

This MSDS was prepared by the Toxicology and Product Stewardship Section of Shell Canada Limited.
*An asterisk in the product name designates a trade-mark of Shell Brands International AG. Used under license.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	CAS Number	% Range	WHMIS Controlled
Distillates (petroleum), petroleum residues vacuum	68955-27-1	80 - 90	Yes
Naphtha (Petroleum), Hydrotreated Light	64742-49-0	10 - 20	Yes

See Section 8 for Occupational Exposure Guidelines.

3. HAZARDS IDENTIFICATION

Physical Description: Viscous Liquid Dark Hydrocarbon Odour
Routes of Exposure: Exposure will most likely occur through skin contact or inhalation.
Hazards:

Flammable Liquid.
Irritating to skin.
May cause cancer.

Exposure to vapours may cause irritation of the eyes.
Inhalation of oil mist or vapours from hot oil may cause irritation of the upper respiratory tract.

Handling: Eliminate all ignition sources.
Avoid inhalation of vapours.
Wear suitable gloves and eye protection.
Bond and ground transfer containers and equipment to avoid static accumulation.
Empty containers are hazardous, may contain flammable / explosive dusts, liquid residue or vapours. Keep away from sparks and open flames.

For further information on health effects, see Section 11.

4. FIRST AID MEASURES

Eyes: Flush eyes with water for at least 15 minutes while holding eyelids open. If irritation occurs and persists, obtain medical attention.

Skin: Wash contaminated skin with mild soap and water for at least 15 minutes. If irritation occurs and persists, obtain medical attention.

Ingestion: Do not induce vomiting; get medical help immediately.

Inhalation: Remove victim from further exposure and restore breathing, if required. Obtain medical attention.

Notes to Physician: Treatment of exposure should be directed at the control of symptoms and the clinical condition.

5. FIRE FIGHTING MEASURES

Extinguishing Media: Dry Chemical
Carbon Dioxide
Foam
Water Fog

Firefighting Instructions: Flammable. Do not use a direct stream of water as it may spread fire. Clear area of unprotected personnel. Vapours may travel along ground and flashback along vapour trail may occur. Containers exposed to intense heat from fires should be cooled with water to prevent vapour pressure buildup, which could result in container rupture. Delayed lung damage can be experienced after exposure to combustion products, sometimes hours after the exposure. Do not enter confined fire space without adequate protective clothing and an approved positive pressure self-contained breathing apparatus. Fight fire from maximum distance.

Hazardous Combustion Products: A complex mixture of airborne solid, liquid, particulates and gases will evolve when this material undergoes pyrolysis or combustion. Carbon monoxide, carbon dioxide, oxides of nitrogen and oxides of sulphur may be formed on combustion.

6. ACCIDENTAL RELEASE MEASURES

Issue warning "Flammable". See Section 8 for advice on personal protective equipment. Eliminate all ignition sources. Isolate hazard area and restrict access. Stop leak only if safe to do so. Notify appropriate environmental agency(ies). Work upwind of spill if it is safe to do so. Dike and contain land spills; contain

spills to water by booming. Do not wash spills into sewers or other public water systems. For large spills remove by mechanical means and place in containers. Adsorb residue or small spills with adsorbent material and remove to non-leaking containers for disposal. After area has been cleaned up to the satisfaction of regulatory authorities, flush area with water to remove trace residue. Dispose of recovered material as noted under Disposal Considerations.

7. HANDLING AND STORAGE

Handling: Flammable. Fixed equipment as well as transfer containers and equipment should be grounded to prevent accumulation of static charge. Avoid breathing vapours and prolonged or repeated contact with skin. Do not cut, drill, grind, weld or perform similar operations on or near containers. Empty containers are hazardous, may contain flammable/explosive dusts, residues or vapours. Launder contaminated clothing prior to reuse. Wash with soap and water prior to eating, drinking, smoking, applying cosmetics or using toilet facilities. Use good personal hygiene.

Storage: Tank storage should be done according to NFPA Code 30 for crude oils.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

The following, while appropriate for this product, is general in nature. The selection of personal protective equipment will vary depending on the conditions of use.

OCCUPATIONAL EXPOSURE LIMITS (Current ACGIH TLV/TWA unless otherwise noted):
North American exposure limits have not been established for the product. Consult local and provincial authorities for acceptable values.
Polycyclic Aromatic Hydrocarbons (PAH): Shell Canada's internal guideline is 0.02 mg/m3 as an OEL (8-hour TWA).
Petroleum Distillates (Carbon range C9 to C20): Shell Canada's internal guideline is 100 mg/m3 total hydrocarbon as an OEL (8-hour TWA).
Naphtha (Carbon range C3 to C11): Shell Canada's internal guideline is 900 mg/m3 total hydrocarbon as an OEL (8-hour TWA).

Mechanical Ventilation: Use explosion-proof ventilation as required to control vapour concentrations. Concentrations in air should be maintained below the occupational exposure limit if unprotected personnel are involved. Make up air should always be supplied to balance air exhausted (either generally or locally). Local ventilation recommended where general ventilation is ineffective in controlling airborne concentrations below the recommended occupational exposure limit. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper confined space entry procedure must be followed including ventilation and testing of tank atmosphere.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Chemical safety goggles and/or full face shield to protect eyes and face, if product is handled such that it could be splashed into eyes.

Skin Protection: Avoid contact with skin. Impervious gloves should be worn at all times when handling this product. In confined spaces or where the risk of skin exposure is much higher, impervious clothing should be worn. Use protective clothing and gloves manufactured from nitrile.

Respiratory Avoid breathing vapour or mists. If exposure exceeds occupational exposure limits, use

Protection: an appropriate NIOSH-approved respirator. Depending on airborne concentration, use either a NIOSH-approved chemical cartridge respirator with organic vapour cartridges in combination with a P95 particulate filter or use a NIOSH-approved supplied-air respirator, either self-contained or airline, operated in positive pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Appearance:	Dark
Odour:	Hydrocarbon Odour
Odour Threshold:	Not available
Boiling Point:	-25 - 600 °C
Density:	940 kg/m3 @ 15 °C
Specific Gravity (Water = 1):	0.94
pH:	Not available
Flash Point:	< 0 °C
Lower Flammable Limit:	Not available
Upper Flammable Limit:	Not available
Auto-ignition Temperature:	Not available
Viscosity:	350 cSt @ 6 °C
Evaporation Rate (n-BuAc = 1):	Not available
Partition Coefficient (log K_{OW}):	Not available
Water Solubility:	Insoluble
Other Solvents:	Hydrocarbon Solvents

10. STABILITY AND REACTIVITY

Chemically Stable:	Yes
Hazardous Polymerization:	No
Sensitive to Mechanical Impact:	No
Sensitive to Static Discharge:	Yes
Hazardous Decomposition Products:	When heated to decomposition, may emit toxic and corrosive fumes of sulphur oxides, as well as CO, CO2, uncombusted hydrocarbons and soot.
Incompatible Materials:	Avoid strong oxidizing agents.
Conditions of Reactivity:	Avoid excessive heat, formation of vapours or mists.

11. TOXICOLOGICAL INFORMATION

Ingredient (or Product if not specified)	Toxicological Data
Distillates (petroleum), petroleum residues vacuum	LD50 Oral Rat = 4320 mg/kg LD50 Dermal Rat > 2000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Naphtha (Petroleum), Hydrotreated Light	LD50 Oral Rat > 5000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg

Routes of Exposure: Exposure will most likely occur through skin contact or inhalation.
Irritancy: Based on the ingredients, this product is expected to be irritating to skin.

Chronic Effects: Prolonged or repeated contact may cause various forms of dermatitis including folliculitis and oil acne. Prolonged exposure to high vapour concentration can cause headache, dizziness, nausea, blurred vision and central nervous system depression. Long term intensive exposure to oil mist may cause benign lung fibrosis.

Pre-existing Conditions: Pre-existing skin disorders may be aggravated by exposure to components of this product.

Carcinogenicity and Mutagenicity: Carcinogenic hazard. According to the International Agency for Research on Cancer (IARC) this product is considered to be possibly carcinogenic to humans. This product may contain a variety of polycyclic aromatic hydrocarbons (PAH), some of which are associated with the potential of inducing skin cancer. Increasing amounts of PAH may be released if this product is heated above 200 C. A component of this product has produced mutagenic effects.

12. ECOLOGICAL INFORMATION

Environmental Effects: The immediate effect of a release is the physical impairment of the environment from the coating of surfaces, resulting in the disruption of oxygen, water and light to flora and fauna. May cause physical fouling of aquatic and avian organisms. Prolonged exposure may result in the partitioning of light-end hydrocarbon fractions into the water and gas phases of the subsurface soil environment with potential to adversely affect soil and groundwater quality.

Biodegradability: Not readily biodegradable.

13. DISPOSAL CONSIDERATIONS

Waste management priorities (depending on volumes and concentration of waste) are: 1. recycle (reprocess), 2. energy recovery 3. incineration, 4. disposal at a licenced waste disposal facility. Do not attempt to combust waste on-site. Incinerate at a licenced waste disposal site with approval of environmental authority. Landfill adsorbed material in a government approved site.

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification:

UN Number	UN1268
Proper Shipping Name	PETROLEUM DISTILLATES, N.O.S.
Hazard Class	Class 3 Flammable Liquids
Packing Group	PG I
Shipping Description	PETROLEUM DISTILLATES, N.O.S. Class 3 UN1268 PG I

15. REGULATORY INFORMATION

This product has been classified in accordance with the hazard criteria of the *Controlled Products Regulations* (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Class: Class B2 Flammable Liquid
Class D2B Skin Irritation

Class D2A Carcinogenicity

DSL/NDSL Status: This product, or all components, are listed on the Domestic Substances List, as required under the Canadian Environmental Protection Act.

Other Regulatory Status: The regulatory information is not intended to be comprehensive. Other regulations may apply to this material. For purposes of TSCA, the product is a mixture of certain blending components, all of which are on the TSCA Inventory. Individual shipments of this product will not necessarily contain all of the blending components listed in Section 2 above.

16. OTHER INFORMATION

LABEL STATEMENTS

Hazard Statement : Flammable Liquid.
Irritating to skin.
May cause cancer.

Handling Statement: Eliminate all ignition sources.
Avoid inhalation of vapours.
Wear suitable gloves and eye protection.
Bond and ground transfer containers and equipment to avoid static accumulation.
Empty containers are hazardous, may contain flammable / explosive dusts, liquid residue or vapours. Keep away from sparks and open flames.

First Aid Statement : Wash contaminated skin with soap and water.
Flush eyes with water.
If overcome by vapours remove to fresh air.
Do not induce vomiting.
Obtain medical attention.

Revisions: This MSDS has been reviewed and updated. Changes have been made to: Section 11 Section 15

Section 1: IDENTIFICATION

Product Name:	Access Western Blend
Synonyms:	AWB.
Product Use:	Refinery feedstock.
Restrictions on Use:	Not available.
Manufacturer/Supplier:	Access Pipeline Inc. Suite 1510, 540 – 5th Avenue S.W. Calgary, AB T2P 0M2
Emergency Phone:	1-866-987-3899; Canutec: (613) 996-6666 or Cellular *666
Date of Preparation of SDS:	February 24, 2014

Section 2: HAZARD(S) IDENTIFICATION

GHS INFORMATION

Classification:
Flammable Liquids, Category 2
Skin Irritation, Category 2
Germ Cell Mutagenicity, Category 1B
Carcinogenicity, Category 1A
Toxic to Reproduction, Category 2
Specific Target Organ Toxicity (Single Exposure), Category 3 - Narcotic Effects
Specific Target Organ Toxicity (Repeated Exposure), Category 1

LABEL ELEMENTS

Hazard Pictogram(s):

Signal Word: Danger

Hazard Statements:
Highly flammable liquid and vapor.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
Suspected of damaging fertility or the unborn child.
May cause drowsiness or dizziness.
Causes damage to organs through prolonged or repeated exposure.

Precautionary Statements

Prevention:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, sparks, open flames, and hot surfaces. – No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical, ventilating, and lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe mist, vapors, or spray.

Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves, protective clothing and eye protection.

Response: If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Call a poison center or doctor if you feel unwell.
If skin irritation occurs: Get medical advice/attention.
Wash contaminated clothing before reuse.
In case of fire: Use dry chemical, CO2, water spray or regular foam to extinguish.

Storage: Store in a well-ventilated place. Keep container tightly closed.
Keep cool.
Store locked up.

Disposal: Dispose of contents/container in accordance with applicable regional, national and local laws and regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients with Unknown Toxicity: None.

This material is considered hazardous by the OSHA Hazard Communication Standard, (29 CFR 1910.1200).

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient(s)	Common name / Synonyms	CAS No.	% wt./wt.
Petroleum	Not available.	8002-05-9	100
Sulfur	Not available.	7704-34-9	1 - 5

Section 4: FIRST-AID MEASURES

Inhalation: If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center or doctor if you feel unwell. If breathing or the heart stops, trained personnel should immediately begin artificial respiration (AR) or cardiopulmonary resuscitation (CPR) respectively. Get medical attention immediately.

Acute and delayed symptoms and effects: May cause drowsiness or dizziness. May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. This product contains small amounts of Hydrogen sulphide which may accumulate in confined spaces. Inhalation of Hydrogen sulphide may cause loss of sense of smell, major irritation of the respiratory tract, headache, nausea, vomiting, dizziness, and fluid buildup in the lungs (pulmonary edema), which can be fatal. At 300 ppm unconsciousness may occur after 20

minutes. From 300 to 500 ppm, death can occur within 1 to 4 hours of continuous exposure. At 500 ppm the respiratory system is paralyzed, the victim collapses almost instantaneously, and death can occur after exposure of only 30 to 60 minutes. Above 500 ppm Hydrogen sulphide may cause immediate loss of consciousness; death is rapid, and possibly immediate.

Eye Contact: If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a poison center or doctor if you feel unwell.

Acute and delayed symptoms and effects: May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin Contact: If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a poison center or doctor if you feel unwell. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Acute and delayed symptoms and effects: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: If swallowed: Call a poison center or doctor if you feel unwell. If vomiting occurs naturally, have victim lean forward to reduce the risk of aspiration. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If breathing or the heart stops, trained personnel should immediately begin artificial respiration (AR) or cardiopulmonary resuscitation (CPR) respectively. Get medical attention immediately.

Acute and delayed symptoms and effects: May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show the label or SDS where possible).

Note to Physicians: Symptoms may not appear immediately. For inhalation of Hydrogen Sulphide, consider oxygen.

Section 5: FIRE-FIGHTING MEASURES

FLAMMABILITY AND EXPLOSION INFORMATION

Highly flammable liquid and vapor. Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water. When heated, this material may evolve toxic and flammable Hydrogen sulphide.

If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Fire involving Tanks or Car/Trailer Loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Sensitivity to Mechanical Impact: This material is not sensitive to mechanical impact.
Sensitivity to Static Discharge: This material is sensitive to static discharge.

MEANS OF EXTINCTION

Suitable Extinguishing Media: Small Fire: Dry chemical, CO2, water spray or regular foam.

Large Fire: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk.

Unsuitable Extinguishing Media: Do not use straight streams. CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

Products of Combustion: Oxides of carbon. Oxides of sulphur. Aldehydes.

Protection of Firefighters: Fire may produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or suffocation. Runoff from fire control or dilution water may cause pollution. Hydrogen sulphide is heavier than air and may collect in low lying areas and confined spaces. Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

Section 6: ACCIDENTAL RELEASE MEASURES

Emergency Procedures: As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded.

Personal Precautions: Do not touch or walk through spilled material. Use personal protection recommended in Section 8. Don full-face, positive pressure, self-contained breathing apparatus.

Environmental Precautions: Prevent entry into waterways, sewers, basements or confined areas.

Methods for Containment: Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors.

Methods for Clean-Up: Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Other Information: See Section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Handling:

Do not swallow. Do not breathe mist, vapors, or spray. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat, sparks, open flames, and hot surfaces. – No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Harmful concentrations of hydrogen sulfide (H2S) gas can accumulate in excavations and low-lying areas as well as the vapour space of storage and bulk transport compartments. See Section 8 for information on Personal Protective Equipment.

Storage:

Store in a well-ventilated place. Keep container tightly closed. Store locked up. Store away from incompatible materials. See Section 10 for information on Incompatible Materials. Keep out of the reach of children. Head spaces in storage containers may contain toxic Hydrogen sulphide gas. Structural materials and lighting and ventilation systems should be corrosion resistant.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines
Component

Petroleum [CAS No. 8002-05-9]

ACGIH: A2; Exposure by all routes should be carefully controlled to levels as low as possible (2009); For Mineral oil, excluding metal working fluids; Poorly and mildly refined

OSHA: 500 ppm (TWA), 2000 mg/m³ (TWA);
400 ppm (TWA) [Vacated];

Sulfur [CAS No. 7704-34-9]

ACGIH: 10 mg/m³ (TWA); Inhalable. 3 mg/m³ (Respirable.); For Particles (Insoluble or Poorly Soluble) Not Otherwise Specified

OSHA: 15 mg/m³ (Total dust) (TWA), 5 mg/m³ (Respirable fraction) (TWA); For Particulates Not Otherwise Regulated (PNOR).

Hexane [CAS No. 110-54-3]

ACGIH: 50 ppm (TWA); Skin, BEI (1996)

OSHA: 500 ppm (TWA), 1800 mg/m³ (TWA); Skin.
50 ppm (TWA) [Vacated];

Benzene [CAS No. 71-43-2]

ACGIH: 0.5 ppm (TWA); 2.5 ppm (STEL); Skin; A1; BEI (1996)

OSHA: 1 ppm (TWA); 5 ppm (STEL);

Toluene [CAS No. 108-88-3]

ACGIH: 20 ppm (TWA); A4; BEI (2006)

OSHA: 200 ppm (TWA); 300 ppm (C); 500 ppm (Peak) (Maximum duration: 10 minutes.)
100 ppm (TWA); 150 ppm (STEL) [Vacated];

Ethylbenzene [CAS No. 100-41-4]

ACGIH: 20 ppm (TWA); A3; BEI (2010)
OSHA: 100 ppm (TWA), 435 mg/m³ (TWA);
125 ppm (STEL) [Vacated];

Xylene [CAS No. 1330-20-7]

ACGIH: 100 ppm (TWA); 150 ppm (STEL); A4; BEI (1992)
OSHA: 100 ppm (TWA), 435 mg/m³ (TWA);
150 ppm (STEL) [Vacated]; For Xylenes.

Hydrogen sulphide [CAS No. 7783-06-4]

ACGIH: 1 ppm (TWA); 5 ppm (STEL); (2009);
OSHA: 20 ppm (C); 50 ppm (Peak) (Maximum duration: 10 mins. once only if no other meas. exp. occurs.)
10 ppm (TWA); 15 ppm (STEL) [Vacated];

TLV: Threshold Limit Value
TWA: Time-Weighted Average
STEL: Short-Term Exposure Limit
C: Ceiling

Engineering Controls: Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapour, gas, etc.) below recommended exposure limits. Use explosion-proof electrical, ventilating, and lighting equipment.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye/Face Protection: Wear safety glasses. Use equipment for eye protection that meets the standards referenced by CSA Standard CAN/CSA-Z94.3-92 and OSHA regulations in 29 CFR 1910.133 for Personal Protective Equipment.

Hand Protection: Wear protective gloves. Consult manufacturer specifications for further information.

Skin and Body Protection: Wear protective clothing. Flame resistant clothing that meets the NFPA 2112 and CAN/CGSB 155.20 standards is recommended in areas where material is stored or handled.

Respiratory Protection: If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate NIOSH/MSHA approved air-purifying respirator that meets the requirements of CSA Standard CAN/CSA-Z94.4-11, with organic vapor cartridge, or self-contained breathing apparatus must be used. Supplied air breathing apparatus must be used when oxygen concentrations are

	low or if airborne concentrations exceed the limits of the air-purifying respirators.
General Hygiene Considerations:	Handle according to established industrial hygiene and safety practices.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Brown liquid.
Colour:	Brown.
Odour:	Petroleum.
Odour Threshold:	0.0047 ppm, (Hydrogen sulphide)
Physical State:	Liquid.
pH:	Not available.
Melting Point / Freezing Point:	Not available.
Initial Boiling Point:	36.4 °C (97.5 °F)
Boiling Range:	36.4 to 288.4 °C (97.5 to 551.1 °F)
Flash Point:	< -15 °C (5 °F) (PMCC)
Evaporation Rate:	Not available.
Flammability (solid, gas):	Not applicable.
Lower Flammability Limit:	1.1 % (Hexane)
Upper Flammability Limit:	7.5 % (Hexane)
Vapor Pressure:	61.5 kPa at 37.8 °C (100 °F) (Reid Vapour Pressure)
Vapor Density:	Not available.
Relative Density:	0.9 to 1 (Water = 1) at 15 °C (59 °F)
Solubilities:	Insoluble in water.
Partition Coefficient: n-Octanol/Water:	Not available.
Auto-ignition Temperature:	Not available.
Decomposition Temperature:	Not available.
Viscosity:	90 to 100 cSt at 30 °C (86 °F)
Percent Volatile, wt. %:	Not available.
VOC content, wt. %:	Not available.
Density:	900 to 1000 kg/m³
Coefficient of Water/Oil Distribution:	Not available.

Section 10: STABILITY AND REACTIVITY

Reactivity: Contact with incompatible materials. Sources of ignition. Exposure to heat.

Chemical Stability: Stable under normal storage conditions.

Possibility of Hazardous Reactions: None known.

Conditions to Avoid: Contact with incompatible materials. Sources of ignition. Exposure to heat.

Incompatible Materials: Strong acids. Strong oxidizers. Halogens.

Hazardous Decomposition Products: Hazardous sulphur dioxide, and related oxides of sulphur may be generated upon combustion.

Section 11: TOXICOLOGICAL INFORMATION

EFFECTS OF ACUTE EXPOSURE

Product Toxicity

Oral: Not available.

Dermal: Not available.

Inhalation: Not available.

Component Toxicity

Component	CAS No.	LD_{50} oral	LD_{50} dermal	LC_{50}
Petroleum	8002-05-9	4300 mg/kg (rat)	Not available.	Not available.
Sulfur	7704-34-9	> 8437 mg/kg (rat)	Not available.	Not available.
Hexane	110-54-3	25000 mg/kg (rat)	Not available.	48000 ppm (rat); 4H
Benzene	71-43-2	930 mg/kg (rat)	> 9400 µl/kg (rabbit)	10000 ppm (rat); 7H
Toluene	108-88-3	600 mg/kg (rat)	14.1 mL/kg (rabbit)	49000 mg/m³ (rat); 4H
Ethylbenzene	100-41-4	3500 mg/kg (rat)	17800 µl/kg (rabbit)	Not available.
Xylene	1330-20-7	4300 mg/kg (rat)	> 1700 mg/kg (rabbit)	5000 ppm (rat); 4H
Hydrogen sulphide	7783-06-4	Not available.	Not available.	444 ppm (rat); 4H

Likely Routes of Exposure: Eye contact. Skin contact. Inhalation. Ingestion. Skin absorption.

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Liver. Reproductive system. Nervous system.

Symptoms (including delayed and immediate effects)

Inhalation: May cause drowsiness or dizziness. May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. This product

contains small amounts of Hydrogen sulphide which may accumulate in confined spaces. Inhalation of Hydrogen sulphide may cause loss of sense of smell, major irritation of the respiratory tract, headache, nausea, vomiting, dizziness, and fluid buildup in the lungs (pulmonary edema), which can be fatal. At 300 ppm unconsciousness may occur after 20 minutes. From 300 to 500 ppm, death can occur within 1 to 4 hours of continuous exposure. At 500 ppm the respiratory system is paralyzed, the victim collapses almost instantaneously, and death can occur after exposure of only 30 to 60 minutes. Above 500 ppm Hydrogen sulphide may cause immediate loss of consciousness; death is rapid, and possibly immediate.

Eye: May cause eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Skin Sensitization: Not available.

Respiratory Sensitization: Not available.

Medical Conditions Aggravated By Exposure: Not available.

EFFECTS OF CHRONIC EXPOSURE (from short and long-term exposure)

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Liver. Kidneys. Reproductive system. Nervous system.

Chronic Effects: Hazardous by OSHA/WHMIS criteria. May cause chronic effects. Prolonged or repeated contact may dry skin and cause irritation. High vapour concentrations, generally greater than 10% by volume, may sensitize the heart and lead to lethal cardiac arrhythmias. Repeated dermal application of crude oils in rats produced systemic toxicity in blood, liver, thymus and bone marrow. Chronic inhalation of n-Hexane may cause peripheral nerve disorders and central nervous system effectsReports of chronic poisoning with Benzene, Toluene, Ethylbenzene or Xylene describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated exposure of the eyes to high concentrations of Xylenes vapour may cause reversible eye damage. Chronic inhalation exposure to xylene causes mid-frequency hearing loss in laboratory animals. Xylene reacts synergistically with n-hexane to enhance hearing loss. Hydrogen sulphide may reduce lung function; cause neurological effects such as headaches, nausea, depression and personality changes; eye and mucous membrane irritation: damage to cardiovascular system.

Carcinogenicity: May cause cancer. Lifetime skin painting studies in animals with whole crude oils and crude oil fractions have produced tumours in animals following prolonged and repeated skin contact. Chronic exposure to

benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumour composed of cells of the type normally found in the bone marrow).

Component Carcinogenicity

Component	ACGIH	IARC	NTP	OSHA	Prop 65
Petroleum	A2	Group 3	List 1	OSHA Carcinogen.	Listed.
Benzene	A1	Group 1	List 1	OSHA Carcinogen.	Listed.
Toluene	A4	Group 3	Not listed.	Not listed.	Not listed.
Ethylbenzene	A3	Group 2B	Not listed.	OSHA Carcinogen.	Listed.
Xylene	A4	Group 3	Not listed.	Not listed.	Not listed.

Mutagenicity: May cause genetic defects.

Reproductive Effects: Suspected of damaging fertility or the unborn child. Studies exist which report a link to crude oil and reproductive effects including menstrual disorders.

Developmental Effects

Teratogenicity: Not available.

Embryotoxicity: Possible risk of harm to the unborn child. Repeated dermal application of crude oils to pregnant rats produced maternal toxicity and fetal developmental toxicity and fetal tumours. Benzene and Xylene have caused adverse fetal effects in laboratory animals. Exposure to Toluene may affect the developing fetus.

Toxicologically Synergistic Materials: Xylene reacts synergistically with n-hexane to enhance hearing loss.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Petroleum: 21 and 41 mg/l, 96 hr., Rainbow trout;

Petroleum: 2.7 and 4.1 mg/l, 96 hr., Mysid;

Petroleum: 122 and 528 ml/kg, 96 hr., Algae.

Persistence / Degradability: Not available.

Bioaccumulation / Accumulation: Not available.

Mobility in Environment: Not available.

Other Adverse Effects: Not available.

Section 13: DISPOSAL CONSIDERATIONS

Disposal Instructions: Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: TRANSPORT INFORMATION

U.S. Department of Transportation (DOT)

Proper Shipping Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

Class: 3

UN Number: UN1267

Packing Group: I

Label Code:

Canada Transportation of Dangerous Goods (TDG)

Proper Shipping Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

Class: 3

UN Number: UN1267

Packing Group: I

Label Code:

Section 15: REGULATORY INFORMATION

Chemical Inventories

US (TSCA)

The components of this product are in compliance with the chemical notification requirements of TSCA.

Canada (DSL)

The components of this product are in compliance with the chemical notification requirements of the NSN Regulations under CEPA, 1999.

Federal Regulations

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

WHMIS Classification:

Class B2 - Flammable Liquids.
Class D2A - Carcinogenicity.
Class D2A - Embryotoxicity.
Class D2A - Mutagenicity.
Class D2A - Chronic toxic effects.
Class D2B - Skin irritant.

Hazard Symbols:

United States

This SDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SARA Title III

Component	Section 302 (EHS) TPQ (lbs.)	Section 304 EHS RQ (lbs.)	CERCLA RQ (lbs.)	Section 313	RCRA CODE	CAA 112(r) TQ (lbs.)
Hexane	Not listed.	Not listed.	5000	313	Not listed.	Not listed.
Benzene	Not listed.	Not listed.	10	313	U019	Not listed.
Toluene	Not listed.	Not listed.	1000	313	U220	Not listed.
Ethylbenzene	Not listed.	Not listed.	1000	313	Not listed.	Not listed.
Xylene	Not listed.	Not listed.	100	313	U239	Not listed.
Hydrogen sulphide	500	100	100	313s	U135	10000

State Regulations

Massachusetts

US Massachusetts Commonwealth's Right-to-Know Law (Appendix A to 105 Code of Massachusetts Regulations Section 670.000)

Component	CAS No.	RTK List
Petroleum	8002-05-9	Listed.
Sulfur	7704-34-9	Listed.
Hexane	110-54-3	Listed.
Benzene	71-43-2	E
Toluene	108-88-3	Listed.
Ethylbenzene	100-41-4	Listed.
Xylene	1330-20-7	Listed.
Hydrogen sulphide	7783-06-4	E

Note: E = Extraordinarily Hazardous Substance

New Jersey

US New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Component	CAS No.	RTK List
Petroleum	8002-05-9	SHHS
Sulfur	7704-34-9	Listed.
Hexane	110-54-3	SHHS
Benzene	71-43-2	SHHS
Toluene	108-88-3	SHHS
Ethylbenzene	100-41-4	SHHS
Xylene	1330-20-7	SHHS
Hydrogen sulphide	7783-06-4	SHHS

Note: SHHS = Special Health Hazard Substance

Pennsylvania

US Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Component	CAS No.	RTK List
Petroleum	8002-05-9	Listed.
Sulfur	7704-34-9	Listed.
Hexane	110-54-3	Listed.

Benzene	71-43-2	ES
Toluene	108-88-3	E
Ethylbenzene	100-41-4	E
Xylene	1330-20-7	E
Hydrogen sulphide	7783-06-4	E

Note: E = Environmental Hazard; S = Special Hazardous Substance

California

California Prop 65: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Component	**Type of Toxicity**
Petroleum	cancer
Benzene	cancer; developmental, male
Toluene	developmental; female
Ethylbenzene	cancer

Section 16: OTHER INFORMATION

Disclaimer:

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for his own particular use.

Date of Preparation of SDS: February 24, 2014

SDS Expiry Date (Canada): February 23, 2017

Version: 1.0

GHS SDS Prepared by: **Deerfoot Consulting Inc.**

Phone: (403) 720-3700

Material Safety Data Sheet

SUNCOR BHB

OS0000000006

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	SUNCOR BHB
Manufacturer or supplier's details		SUNCOR ENERGY INC. P.O. Box 2844, 150 - 6th Avenue South-West Calgary Alberta T2P 3E3 Canada
Emergency telephone number		Suncor Energy: +1 403-296-3000; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Refinery Feedstock
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Form	liquid
Colour	black
Odour	hydrocarbon-like
Hazard Summary	Flammable liquid Irritating to eyes and skin. May cause sensitisation by skin contact. Contains material that may adversely affect the developing foetus. Contains material that may cause adverse reproductive effects. Contains material which may cause cancer based on animal data.

Potential Health Effects

Primary Routes of Entry	:	Inhalation Eye contact Skin Absorption Skin contact Ingestion
Target Organs	:	Respiratory system Central nervous system Eyes Skin
Inhalation	:	Inhalation of high vapour concentrations may cause

symptoms like headache, dizziness, tiredness, nausea and vomiting.
Inhalation may cause central nervous system effects.

Skin : May cause allergic skin reaction.
May cause skin irritation.

Eyes : May cause eye irritation.

Ingestion : Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
Aspiration hazard if swallowed - can enter lungs and cause damage.

Aggravated Medical Condition : None known.

Carcinogenicity:

IARC
Group 1: Carcinogenic to humans
Benzene 71-43-2
1,3-BUTADIENE 106-99-0
Group 2B: Possibly carcinogenic to humans
Ethylbenzene 100-41-4

OSHA
OSHA specifically regulated carcinogen
Benzene 71-43-2
1,3-BUTADIENE 106-99-0

NTP
Known to be human carcinogen
Benzene 71-43-2
1,3-BUTADIENE 106-99-0

ACGIH
Confirmed human carcinogen
Benzene 71-43-2

Suspected human carcinogen
1,3-BUTADIENE 106-99-0

Confirmed animal carcinogen with unknown relevance to humans
Ethylbenzene 100-41-4

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
Bitumens	128683-24-9	60 - 80 %
Natural gas condensates	68919-39-1	0 - 40 %
Naphtha (oil sand), hydrotreated	128683-33-0	0 - 40 %
pentane	109-66-0	10 - 15 %
2-methylbutane	78-78-4	10 - 15 %
n-hexane	110-54-3	5 - 10 %

n-heptane	142-82-5	5 - 10 %
n-octane	111-65-9	5 - 10 %
butane	106-97-8	3 - 7 %
isobutane	75-28-5	1 - 5 %
sulfur	7704-34-9	<= 3.5 %
xylene	1330-20-7	0.5 - 1.5 %
benzene	71-43-2	0.5 - 1.5 %
1,3-butadiene	106-99-0	0.1 - 1 %
methylcyclohexane	108-87-2	1 - 5 %
cyclohexane	110-82-7	1 - 5 %
cyclopentane	287-92-3	1 - 5 %
methylcyclopentane	96-37-7	1 - 5 %
trimethylbenzene	25551-13-7	1 - 5 %
toluene	108-88-3	1 - 5 %
ethylbenzene	100-41-4	0.1 - 1 %

Contains trace amounts of Polycyclic aromatic hydrocarbons, some of which are suspected carcinogens., Product may contain trace amounts of hydrogen sulphide

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash contaminated clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Rinse mouth with water.
Never give anything by mouth to an unconscious person.
DO NOT induce vomiting unless directed to do so by a physician or poison control center.
Seek medical advice.

Most important symptoms and effects, both acute and delayed : First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Carbon dioxide (CO2)
Foam
Dry chemical

Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), sulphur oxides (SOx), sulphur compounds (H2S), hydrocarbons, smoke and irritating vapours as products of incomplete combustion.
Specific extinguishing methods	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Persons with a history of skin sensitisation problems or asthma, allergies, chronic or recurrent respiratory disease should not be employed in any process in which this mixture is being used. Smoking, eating and drinking should be prohibited in the application area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest. Keep away from heat and sources of ignition. Keep container closed when not in use.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct

sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
xylene	1330-20-7	TWA	100 ppm	ACGIH
		STEL	150 ppm	ACGIH
		TWA	100 ppm	ACGIH
		STEL	150 ppm	ACGIH
benzene	71-43-2	TWA	0.5 ppm 1.6 mg/m3	CA AB OEL
		STEL	2.5 ppm 8 mg/m3	CA AB OEL
		TWA	0.5 ppm	CA BC OEL
		STEL	2.5 ppm	CA BC OEL
		TWA	0.5 ppm	CA ON OEL
		STEL	2.5 ppm	CA ON OEL
		TWAEV	1 ppm 3 mg/m3	CA QC OEL
		STEV	5 ppm 15.5 mg/m3	CA QC OEL
		TWA	0.5 ppm	ACGIH
		STEL	2.5 ppm	ACGIH
		TWA	0.1 ppm	NIOSH REL
		ST	1 ppm	NIOSH REL
		TWA	10 ppm	OSHA Z-2
		CEIL	25 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		PEL	1 ppm	OSHA CARC
		STEL	5 ppm	OSHA CARC
		TWA	0.5 ppm	ACGIH
		STEL	2.5 ppm	ACGIH
		TWA	0.1 ppm	NIOSH REL
		ST	1 ppm	NIOSH REL
		TWA	10 ppm	OSHA Z-2
		CEIL	25 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		PEL	1 ppm	OSHA CARC
		STEL	5 ppm	OSHA CARC
butane	106-97-8	TWA	1,000 ppm	CA AB OEL
		TWA	600 ppm	CA BC OEL
		STEL	750 ppm	CA BC OEL
		TWAEV	800 ppm 1,900 mg/m3	CA QC OEL
		TWA	800 ppm 1,900 mg/m3	NIOSH REL
		TWA	800 ppm 1,900 mg/m3	OSHA P0

		TWA	800 ppm 1,900 mg/m3	NIOSH REL
		TWA	800 ppm 1,900 mg/m3	OSHA P0
Bitumens	128683-24-9	TWA	5 mg/m3	
pentane	109-66-0	TWAEV	120 ppm 350 mg/m3	CA QC OEL
		TWA	120 ppm 350 mg/m3	NIOSH REL
		C	610 ppm 1,800 mg/m3	NIOSH REL
		TWA	1,000 ppm 2,950 mg/m3	OSHA Z-1
		TWA	600 ppm 1,800 mg/m3	OSHA P0
		STEL	750 ppm 2,250 mg/m3	OSHA P0
		TWA	120 ppm 350 mg/m3	NIOSH REL
		C	610 ppm 1,800 mg/m3	NIOSH REL
		TWA	1,000 ppm 2,950 mg/m3	OSHA Z-1
		TWA	600 ppm 1,800 mg/m3	OSHA P0
		STEL	750 ppm 2,250 mg/m3	OSHA P0
isobutane	75-28-5	TWA	800 ppm 1,900 mg/m3	NIOSH REL
		TWA	800 ppm 1,900 mg/m3	NIOSH REL
2-methylbutane	78-78-4	TWA	600 ppm 1,770 mg/m3	CA AB OEL
n-hexane	110-54-3	TWA	50 ppm 176 mg/m3	CA AB OEL
		TWA	20 ppm	CA BC OEL
		TWAEV	50 ppm 176 mg/m3	CA QC OEL
		TWA	50 ppm	ACGIH
		TWA	50 ppm 180 mg/m3	NIOSH REL
		TWA	500 ppm 1,800 mg/m3	OSHA Z-1
		TWA	50 ppm 180 mg/m3	OSHA P0
		TWA	50 ppm	ACGIH
		TWA	50 ppm 180 mg/m3	NIOSH REL
		TWA	500 ppm 1,800 mg/m3	OSHA Z-1
		TWA	50 ppm 180 mg/m3	OSHA P0
1,3-butadiene	106-99-0	TWA	2 ppm 4.4 mg/m3	CA AB OEL
		TWA	2 ppm	CA BC OEL

		TWAEV	2 ppm 4.4 mg/m3	CA QC OEL
		TWA	2 ppm	ACGIH
		TWA	1 ppm	OSHA Z-1
		STEL	5 ppm	OSHA Z-1
		PEL	1 ppm	OSHA CARC
		STEL	5 ppm	OSHA CARC
		TWA	2 ppm	ACGIH
		TWA	1 ppm	OSHA Z-1
		STEL	5 ppm	OSHA Z-1
		PEL	1 ppm	OSHA CARC
		STEL	5 ppm	OSHA CARC
n-heptane	142-82-5	TWA	400 ppm	CA BC OEL
		STEL	500 ppm	CA BC OEL
		TWAEV	400 ppm 1,640 mg/m3	CA QC OEL
		STEV	500 ppm 2,050 mg/m3	CA QC OEL
		TWA	85 ppm 350 mg/m3	NIOSH REL
		C	440 ppm 1,800 mg/m3	NIOSH REL
		TWA	500 ppm 2,000 mg/m3	OSHA Z-1
		TWA	400 ppm 1,600 mg/m3	OSHA P0
		STEL	500 ppm 2,000 mg/m3	OSHA P0
		TWA	85 ppm 350 mg/m3	NIOSH REL
		C	440 ppm 1,800 mg/m3	NIOSH REL
		TWA	500 ppm 2,000 mg/m3	OSHA Z-1
		TWA	400 ppm 1,600 mg/m3	OSHA P0
		STEL	500 ppm 2,000 mg/m3	OSHA P0
n-octane	111-65-9	TWA	300 ppm 1,400 mg/m3	CA AB OEL
		TWAEV	300 ppm 1,400 mg/m3	CA QC OEL
		STEV	375 ppm 1,750 mg/m3	CA QC OEL
		TWA	300 ppm	ACGIH
		TWA	75 ppm 350 mg/m3	NIOSH REL
		C	385 ppm 1,800 mg/m3	NIOSH REL
		TWA	500 ppm 2,350 mg/m3	OSHA Z-1
		TWA	300 ppm 1,450 mg/m3	OSHA P0
		STEL	375 ppm 1,800 mg/m3	OSHA P0

		TWA	300 ppm	ACGIH
		TWA	75 ppm 350 mg/m3	NIOSH REL
		C	385 ppm 1,800 mg/m3	NIOSH REL
		TWA	500 ppm 2,350 mg/m3	OSHA Z-1
		TWA	300 ppm 1,450 mg/m3	OSHA P0
		STEL	375 ppm 1,800 mg/m3	OSHA P0
methylcyclohexane	108-87-2	TWA	400 ppm 1,610 mg/m3	CA AB OEL
		TWA	400 ppm	CA BC OEL
		TWAEV	400 ppm 1,610 mg/m3	CA QC OEL
		TWA	400 ppm	ACGIH
		TWA	400 ppm 1,600 mg/m3	NIOSH REL
		TWA	500 ppm 2,000 mg/m3	OSHA Z-1
		TWA	400 ppm 1,600 mg/m3	OSHA P0
		TWA	400 ppm	ACGIH
		TWA	400 ppm 1,600 mg/m3	NIOSH REL
		TWA	500 ppm 2,000 mg/m3	OSHA Z-1
		TWA	400 ppm 1,600 mg/m3	OSHA P0
cyclohexane	110-82-7	TWA	100 ppm 344 mg/m3	CA AB OEL
		TWA	100 ppm	CA BC OEL
		TWAEV	300 ppm 1,030 mg/m3	CA QC OEL
		TWA	100 ppm	ACGIH
		TWA	300 ppm 1,050 mg/m3	NIOSH REL
		TWA	300 ppm 1,050 mg/m3	OSHA Z-1
		TWA	300 ppm 1,050 mg/m3	OSHA P0
		TWA	100 ppm	ACGIH
		TWA	300 ppm 1,050 mg/m3	NIOSH REL
		TWA	300 ppm 1,050 mg/m3	OSHA Z-1
		TWA	300 ppm 1,050 mg/m3	OSHA P0
cyclopentane	287-92-3	TWA	600 ppm 1,720 mg/m3	CA AB OEL
		TWA	600 ppm	CA BC OEL
		TWAEV	600 ppm 1,720 mg/m3	CA QC OEL
		TWA	600 ppm	ACGIH

		TWA	600 ppm 1,720 mg/m3	NIOSH REL
		TWA	600 ppm 1,720 mg/m3	OSHA P0
		TWA	600 ppm	ACGIH
		TWA	600 ppm 1,720 mg/m3	NIOSH REL
		TWA	600 ppm 1,720 mg/m3	OSHA P0
trimethylbenzene	25551-13-7	TWA	25 ppm 123 mg/m3	CA AB OEL
		TWAEV	25 ppm 123 mg/m3	CA QC OEL
		TWA	25 ppm	ACGIH
		TWA	25 ppm 125 mg/m3	OSHA P0
		TWA	25 ppm	ACGIH
		TWA	25 ppm 125 mg/m3	OSHA P0
toluene	108-88-3	TWA	50 ppm 188 mg/m3	CA AB OEL
		TWA	20 ppm	CA BC OEL
		TWAEV	50 ppm 188 mg/m3	CA QC OEL
		TWA	20 ppm	ACGIH
		TWA	100 ppm 375 mg/m3	NIOSH REL
		ST	150 ppm 560 mg/m3	NIOSH REL
		TWA	200 ppm	OSHA Z-2
		CEIL	300 ppm	OSHA Z-2
		Peak	500 ppm	OSHA Z-2
		TWA	100 ppm 375 mg/m3	OSHA P0
		STEL	150 ppm 560 mg/m3	OSHA P0
		TWA	20 ppm	ACGIH
		TWA	100 ppm 375 mg/m3	NIOSH REL
		ST	150 ppm 560 mg/m3	NIOSH REL
		TWA	200 ppm	OSHA Z-2
		CEIL	300 ppm	OSHA Z-2
		Peak	500 ppm	OSHA Z-2
		TWA	100 ppm 375 mg/m3	OSHA P0
		STEL	150 ppm 560 mg/m3	OSHA P0
ethylbenzene	100-41-4	TWA	100 ppm 434 mg/m3	CA AB OEL
		STEL	125 ppm 543 mg/m3	CA AB OEL
		TWA	20 ppm	CA BC OEL
		STEV	125 ppm 543 mg/m3	CA QC OEL

		TWAEV	100 ppm 434 mg/m3	CA QC OEL
		TWA	100 ppm	ACGIH
		STEL	125 ppm	ACGIH
		TWA	100 ppm 435 mg/m3	NIOSH REL
		ST	125 ppm 545 mg/m3	NIOSH REL
		TWA	100 ppm 435 mg/m3	OSHA Z-1
		TWA	100 ppm 435 mg/m3	OSHA P0
		STEL	125 ppm 545 mg/m3	OSHA P0
		TWA	100 ppm	ACGIH
		STEL	125 ppm	ACGIH
		TWA	100 ppm 435 mg/m3	NIOSH REL
		ST	125 ppm 545 mg/m3	NIOSH REL
		TWA	100 ppm 435 mg/m3	OSHA Z-1
		TWA	100 ppm 435 mg/m3	OSHA P0
		STEL	125 ppm 545 mg/m3	OSHA P0
hydrogen sulphide	7783-06-4	TWA	10 ppm 14 mg/m3	CA AB OEL
		(c)	15 ppm 21 mg/m3	CA AB OEL
		C	10 ppm	CA BC OEL
		TWA	10 ppm	CA ON OEL
		STEL	15 ppm	CA ON OEL
		TWAEV	10 ppm 14 mg/m3	CA QC OEL
		STEV	15 ppm 21 mg/m3	CA QC OEL
		TWA	1 ppm	ACGIH
		STEL	5 ppm	ACGIH
		C	10 ppm 15 mg/m3	NIOSH REL
		CEIL	20 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		TWA	10 ppm 14 mg/m3	OSHA P0
		STEL	15 ppm 21 mg/m3	OSHA P0
		TWA	1 ppm	ACGIH
		STEL	5 ppm	ACGIH
		C	10 ppm 15 mg/m3	NIOSH REL
		CEIL	20 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		TWA	10 ppm 14 mg/m3	OSHA P0

		STEL	15 ppm 21 mg/m3	OSHA P0

Biological occupational exposure limits

Component	CAS-No.	Control parameters	Biological specimen	Sampling time	Permissible concentration	Basis
Toluene	108-88-3	Toluene	In blood	Prior to last shift of workweek	0.02 mg/l	ACGIH BEI
Toluene		Toluene	Urine	End of shift (As soon as possible after exposure ceases)	0.03 mg/l	ACGIH BEI
Toluene	108-88-3	Toluene	In blood	Prior to last shift of workweek	0.02 mg/l	ACGIH BEI
		Toluene	Urine	End of shift (As soon as possible after exposure ceases)	0.03 mg/l	ACGIH BEI

Engineering measures : Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : Wear a NIOSH-approved respirator/breathing apparatus in situations where there may be potential for airborne exposure.

Hand protection
Material : neoprene, nitrile.
Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing problems.
Ensure that eyewash stations and safety showers are close to

the workstation location.

Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use. No special protective equipment required.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	black
Odour	:	hydrocarbon-like
Odour Threshold	:	No data available
pH	:	No data available
Melting point/range	:	No data available
Initial boiling point and boiling range	:	> 31 °C (88 °F) Method: ASTM D-86
Flash point	:	< -35 °C (-31 °F) Method: ASTM D 93, closed cup
Fire Point	:	No data available
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Easily ignites under almost all normal temperature conditions. Extremely flammable in presence of open flames, sparks, shocks, heat, oxidizing materials. Vapours are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks), and may travel considerable distance to sources of ignition and flash back.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	40 - 50 kPa (37.8 °C / 100.0 °F) Method: ASTM D6377
Relative vapour density	:	No data available
Density	:	915 - 940 kg/m3 (15.56 °C / 60.01 °F)
Solubility(ies)		

Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	Pow: estimated < 1
Viscosity		
Viscosity, kinematic	:	estimated 63.5 mm2/s (40 °C / 104 °F)
		estimated 268.5 mm2/s (15.5 °C / 59.9 °F) Method: ASTM D 445
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Vapours may form explosive mixtures with air. Runoff to sewer may create fire or explosion hazard. Liquid may accumulate static charge.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents.
Hazardous decomposition products	:	May release COx, SOx, H2S, hydrocarbons, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Components:

Natural gas condensates:

Acute oral toxicity	:	LD50 Rat: 14,000 mg/kg,
Acute inhalation toxicity	:	LC50 Rat: > 5.2 mg/l Exposure time: 4 h

pentane:
Acute oral toxicity : LD50 Rat: > 2,000 mg/kg,

Acute inhalation toxicity : LC50 Rat: 364 mg/l
Exposure time: 4 h

2-methylbutane:
Acute inhalation toxicity : LC50 Rat: 280 mg/l
Exposure time: 4 h

n-hexane:
Acute oral toxicity : LD50 Rat: 15,840 mg/kg,

Acute inhalation toxicity : LC50 Rat: 48000 ppm
Exposure time: 4 h

Acute dermal toxicity : LD50 Rabbit: > 3,295 mg/kg,

butane:
Acute inhalation toxicity : LC50 Rat: 658 mg/l
Exposure time: 4 h
Test atmosphere: gas

isobutane:
Acute inhalation toxicity : LC50 Rat: 658,000 mg/m3
Exposure time: 4 h
Test atmosphere: gas

xylene:
Acute oral toxicity : LD50 Rat: 4,300 mg/kg,

Acute inhalation toxicity : LC50 Rat: 5000 ppm
Exposure time: 4 h
Test atmosphere: vapour

Acute dermal toxicity : LD50 Rabbit: > 1,700 mg/kg,

benzene:
Acute oral toxicity : LD50 Rat: 930 mg/kg,

Acute inhalation toxicity : LC50 Rat: 13700 ppm
Exposure time: 4 h
Test atmosphere: vapour

Acute dermal toxicity : LD50 Rabbit: > 8,240 mg/kg,

toluene:
Acute oral toxicity : LD50 Rat: 636 mg/kg,

Acute inhalation toxicity	:	LC50 Rat: 7585 ppm Exposure time: 4 h Test atmosphere: vapour
Acute dermal toxicity	:	LD50 Rabbit: 12,125 mg/kg,

ethylbenzene:

Acute oral toxicity	:	LD50 Rat: 3,500 mg/kg,
Acute inhalation toxicity	:	LC50 Rat: 4000 ppm Exposure time: 4 h Test atmosphere: vapour
Acute dermal toxicity	:	LD50 Rabbit: 15,380 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Components:

2-methylbutane:
Result: Mild skin irritation

sulfur:
Result: Moderate skin irritant

xylene:
Result: Skin irritation

benzene:
Result: Moderate skin irritant

toluene:
Result: Moderate skin irritant

ethylbenzene:
Result: Moderate skin irritant

Serious eye damage/eye irritation

Product:

Remarks: No data available

Components:

2-methylbutane:
Result: Mild eye irritation

sulfur:
Result: Moderate eye irritation

benzene:
Result: Moderate eye irritation

toluene:
Result: Mild eye irritation

ethylbenzene:
Result: Mild eye irritation

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

Bitumens:
Natural gas condensates:
Naphtha (oil sand), hydrotreated:
pentane:
2-methylbutane:
n-hexane:
n-heptane:
n-octane:
butane:
isobutane:
sulfur:
xylene:
benzene:
1,3-butadiene:
methylcyclohexane:
cyclohexane:
cyclopentane:
methylcyclopentane:
trimethylbenzene:
toluene:
ethylbenzene:

STOT - single exposure

No data available

STOT - repeated exposure

No data available

Aspiration toxicity

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Components:
n-hexane :

Toxicity to fish	:	LC50 (Fish): 4.12 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia (water flea)): 3.87 mg/l Exposure time: 48 h

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

No data available

Bioaccumulative potential

Product:

Partition coefficient: n-octanol/water	:	Pow: estimated < 1

Components:
pentane :

Partition coefficient: n-octanol/water	:	log Pow: 3.39

butane :

Partition coefficient: n-octanol/water	:	log Pow: 2.89

isobutane :

Partition coefficient: n-octanol/water	:	log Pow: 2.76

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR

UN/ID No.	:	1993
Proper shipping name	:	Flammable liquid, n.o.s. (Naphtha)
Class	:	3
Packing group	:	I
Labels	:	3
Packing instruction (cargo aircraft)	:	361

IMDG-Code

UN number	:	1993
Proper shipping name	:	FLAMMABLE LIQUID, N.O.S. (Naphtha)
Class	:	3
Packing group	:	I
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

49 CFR

UN/ID/NA number	:	1993
Proper shipping name	:	Flammable liquids, n.o.s. (Naphtha)
Class	:	3
Packing group	:	I
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

TDG

UN number	:	1993

Proper shipping name	:	FLAMMABLE LIQUID, N.O.S. (Naphtha)
Class	:	3
Packing group	:	I
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

OSHA Hazards	:	Flammable liquid, Skin sensitiser, Moderate eye irritant, Carcinogen, Moderate skin irritant
WHMIS Classification	:	B2: Flammable liquid D2A: Very Toxic Material Causing Other Toxic Effects D2B: Toxic Material Causing Other Toxic Effects Flammable liquid Teratogen Carcinogen Moderate eye irritant Skin sensitiser Mutagen Moderate skin irritant

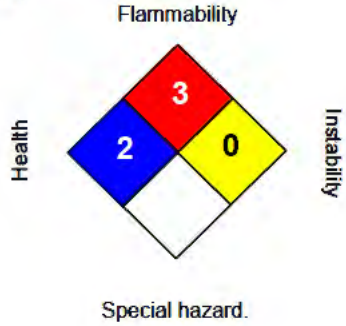
The components of this product are reported in the following inventories:

DSL All components of this product are on the Canadian DSL.

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	2*
FLAMMABILITY	3
PHYSICAL HAZARD	0
PERSONAL PROTECTION	H

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SECTION 1 – MATERIAL IDENTIFICATION

Material Name: HEAVY CRUDE OIL/DILUENT MIX
Synonyms: Bow River (BR); Cold Lake Blend (CLB); Christina Lake Dil-bit Blend (CDB), Christina Lake Blend (CSB); Western Canadian Blend (WCB); Western Canadian Select (WCS); Wabasca Heavy (WH)
Use: Process stream, fuels and lubricants production
WHMIS Classification: Class B, Div. 2, Class D, Div. 2, Sub-Div. A and B
NFPA: **Fire**: 2 **Reactivity**: 0 **Health**: 3
TDG Shipping Name: Petroleum Crude Oil
TDG Class: 3 **UN**: 1267
TDG Packing Group: II (boiling point 35 deg. C or above, and flash point less than 23 deg. C)
Manufacturer/Supplier: CENOVUS ENERGY INC.
500 Centre Street SE, PO Box 766
Calgary, AB T2P 0M5
Emergency Telephone: 1-877-458-8080, CANUTEC 1-613-996-6666 (Canada)
Chemical Description: A naturally occurring mixture of paraffins, naphthalenes, aromatic hydrocarbons and small amounts of sulphur and nitrogen compounds mixed with condensate

SECTION 2 – HAZARDOUS INGREDIENTS OF MATERIAL

Hazardous Ingredients	Approximate Concentrations (%)	C.A.S. Nos.	LD50/LC50 Specify Species & Route	Exposure Limits
Bitumen	50 – 90	8052-42-4		5 mg/m^3 (OEL, PEL oil mist)
Hydrocarbon Diluent	10 – 50	N.Av.	N.Av.	900 mg/m^3 (OEL)*
Benzene	0.03 - 0.3	71-43-2	LD50, rat, oral, 930 mg/kg LC50, rat, 4 hr, 13200 ppm	0.5 ppm (OEL, TLV) 10 ppm (PEL)
Hydrogen Sulphide§	<0.1	7783-06-04	LC50, rat, 4 hrs, 444 ppm	10 ppm (OEL), 1 ppm (TLV), 20 ppm (PEL-C)

OEL = AB Occupational Exposure Limit; TLV = ACGIH Threshold Limit Value; PEL = OSHA Permissible Exposure Limit; C = Ceiling; *OEL for gasoline; §Hydrogen Sulfide in liquid, vapour phase may contain higher concentrations

SECTION 3 – PHYSICAL DATA FOR MATERIAL

Physical State: Liquid
Specific Gravity: 0.91 – 0.94
Vapour Density (air=1): 2.5 -5.0 (estimated)
Percent Volatiles, (v/v): 15 - 30 (estimated)
pH: N.Av.
Vapour Pressure, Reid (kPa): 76 @ 38ºC
Odour Threshold (ppm): N.Av.
Evaporation Rate: N.Av.
Boiling Pt. (deg.C): 35 – 180ºC
Freezing Pt. (deg.C): <20
Coefficient of Water/Oil Distribution: <0.1
Odour & Appearance: Brown/black liquid, hydrocarbon odour
(N.Av. = not available N.App. = not applicable)

SECTION 4 – FIRE AND EXPLOSION

Flammability: Yes **Conditions**: Material will ignite at normal temperatures.
Means of Extinction: Foam, CO_2, dry chemical. Explosive accumulations can build up in areas of poor ventilation.
Special Procedures: Use water spray to cool fire-exposed containers, and to disperse vapors if spill has not ignited. Cut off fuel and allow flame to burn out.
Flash Point (deg.C) & Method: <-35 (PMCC)
Upper Explosive Limit (% by vol.): 8 (estimated)
Lower Explosive Limit (% by vol.): 0.8 (estimated)
Auto-Ignition Temp. (deg.C): 250 (estimated)
Sensitivity to Impact: No
Sensitivity to Static Discharge: Yes, at normal temperatures
TDG Flammability Classification: 3
Hazardous Combustion Products: Carbon monoxide, carbon dioxide, sulphur oxides

SECTION 5 – REACTIVITY DATA

Chemical Stability: Stable **Conditions**: Heat
Incompatibility: Yes **Substances**: Oxidizing agents (e.g. chlorine)
Reactivity: Yes **Conditions**: Heat, strong sunlight
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, sulphur oxides

SECTION 6 – TOXICOLOGICAL PROPERTIES OF PRODUCT

Routes of Entry:
Skin Absorption : Yes **Skin Contact**: Yes **Eye Contact**: Yes
Inhalation: **Acute**: Yes **Chronic**: Yes **Ingestion**: Yes
Effects of Acute Exposure: Vapour may cause irritation of eyes, nose and throat, dizziness and drowsiness. Contact with skin may cause irritation and possibly dermatitis. Contact of liquid with eyes may cause severe irritation/burns.
Effects of Chronic Exposure: Due to presence of benzene, long term exposure may increase the risk of anemia and leukemia. Repeated skin contact may increase the risk of skin cancer.
Sensitization to Product: No.
Exposure Limits of Product: 0.5 ppm (OEL for benzene)
Irritancy: Yes
Synergistic Materials: None reported
Carcinogenicity: Yes **Reproductive Effects**: Possibly **Teratogenicity**: Possibly **Mutagenicity**: Possibly

SECTION 7 – PREVENTIVE MEASURES

Personal Protective Equipment: Use positive pressure self-contained breathing apparatus, supplied air breathing apparatus or cartridge air purifying respirator approved for organic vapours where concentrations may exceed exposure limits (note: cartridge respirator not suitable for hydrogen sulfide, oxygen deficiency or IDLH situations) – see also Storage below).
Gloves: Viton (nitrile adequate for short exposure to liquid)
Eye: Chemical splash goggles. **Footwear**: As per safety policy **Clothing**: As per fire protection policy
Engineering Controls: Use only in well ventilated areas. Mechanical ventilation required in confined areas. Equipment must be explosion proof.
Leaks & Spills: Stop leak if safe to do so. Use personal protective equipment. Use water spray to cool containers. Remove all ignition sources. Provide explosion-proof clearing ventilation, if possible. Prevent from entering confined spaces. Dyke and pump into containers for recycling or disposal. Notify appropriate regulatory authorities.
Waste Disposal: Contact appropriate regulatory authorities for disposal requirements.
Handling Procedures & Equipment: Avoid contact with liquid. Avoid inhalation. Bond and ground all transfers. Avoid sparking conditions.
Storage Requirements: Store in a cool, dry, well ventilated area away from heat, strong sunlight, and ignition sources.
Special Shipping Provisions: N.App.

Caution: Hydrogen sulfide may accumulate in headspaces of tanks and other equipment, even when concentrations in the liquid product are low. Overexposure to hydrogen sulphide may cause dizziness, headache, nausea and possibly unconsciousness and death. Factors increasing this risk include heating, agitation and contact of the liquid with acids or acid salts. Assess the exposure risk by gas monitoring. Wear air supplying breathing apparatus if necessary.

SECTION 8 – FIRST AID MEASURES

Skin: Flush skin with water, removing contaminated clothing. Get medical attention if irritation persists or large area of contact. Decontaminate clothing before re-use.

Eye: Immediately flush with large amounts of lukewarm water for 15 minutes, lifting upper and lower lids at intervals. Seek medical attention if irritation persists.

Inhalation: Ensure own safety. Remove victim to fresh air. Give oxygen, artificial respiration, or CPR if needed. Seek medical attention immediately.

Ingestion: Give 2-3 glasses of milk or water to drink. DO NOT INDUCE VOMITING. Keep warm and at rest. Get immediate medical attention.

SECTION 9 – PREPARATION DATE OF MSDS

Prepared By: Cenovus Energy Inc. Health and Safety
Phone Number: 1-403-766-2000
Preparation Date: April 10, 2013

1. Product and company identification

Product name

Canad an Heavy O

Th s mater a can conta n hydrogen su f de (H_2S), a very tox c and extreme y f ammab e gas.

Note: Re eased eve s of hydrogen su f de (H2S) are dependent on a var ety of factors and cannot be fu y pred cted based on d sso ved H2S eve s.

Crude o s a natura y occurr ng comp ex m xture of hydrocarbons whose exact compos t on and phys ca propert es can vary w de y depend ng upon ts source.

MSDS #

0000003736

Code

0000003736

Product use

Ref nery feedstock
For spec f c app cat on adv ce see appropr ate Techn ca Data Sheet or consu t our company representat ve.

Synonyms

Crude o ; Petro eum d st ate; PETROLEUM OIL, Canad an Heavy O , D b t, D synb t

Supplier

BP Canada Energy Trad ng Company
240 - 4th Avenue S.W.
P.O. Box 200
Ca gary, A berta
T2P 2H8
Canada

EMERGENCY HEALTH INFORMATION:

1 (800) 447-8735
Outs de the US: + 1 703 527 3887(CHEMTREC)

EMERGENCY SPILL INFORMATION:

1 (613) 996-6666 CANUTEC (Canada)

OTHER PRODUCT INFORMATION

1 (866) 4 BP - MSDS
(866-427-6737 To Free - North Amer ca)
ema : bpcares@bp.com

2. Hazards identification

Physical state

V scous qu d.

Color

Brown.

Emergency overview

DANGER !

FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF ABSORBED THROUGH SKIN.
INHALATION CAUSES HEADACHES, DIZZINESS, DROWSINESS AND NAUSEA AND MAY LEAD TO UNCONSCIOUSNESS.
CAUSES EYE AND SKIN IRRITATION.
MAY CAUSE RESPIRATORY TRACT IRRITATION.
HARMFUL OR FATAL IF SWALLOWED.
CAN ENTER LUNGS AND CAUSE DAMAGE.
CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.
CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER.
CONTAINS MATERIAL WHICH MAY CAUSE HERITABLE GENETIC EFFECTS.
ASPIRATION HAZARD.
BIRTH HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE BIRTH DEFECTS

F ammab e qu d. Harmfu n contact w th sk n and f swa owed. Pro onged or repeated contact can defat the sk n and ead to rr tat on and/or dermat t s. Asp rat on hazard f swa owed. Can enter ungs and cause damage. Keep away from heat, sparks and f ame. Avo d exposure - obta n spec a nstruct ons before use. Do not breathe vapor or m st. Do not ngest. If ngested, do not nduce vom t ng. Do not get n eyes. Avo d contact w th sk n and c oth ng. Conta ns mater a wh ch can cause cancer. R sk of cancer depends on durat on and eve of exposure. Conta ns mater a wh ch may cause her tab e genet c effects. Conta ns mater a wh ch can cause b rth defects. Use on y w th adequate vent at on. Keep conta ner t ght y c osed and sea ed unt ready

for use. Wash thorough y after hand ng.

Routes of entry Derma contact. Eye contact. Inha at on. Ingest on.

Potential health effects

Eyes Causes eye rr tat on.

Skin Causes sk n rr tat on. Pro onged or repeated contact can defat the sk n and ead to rr tat on and/or dermat t s. See tox co og ca nformat on (Sect on 11) .

Inhalation Vapors may cause drows ness and d zz ness. Can cause centra nervous system (CNS) depress on. May cause resp ratory tract rr tat on.

Ingestion Harmfu f swa owed. Asp rat on hazard f swa owed. Can enter ungs and cause damage.

See toxicological information (Section 11)

3. Composition/information on ingredients

Conta ns 20-30% D uent. (typ ca va ue)

Ingredient name	CAS #	%
Crude O : comp ex hydrocarbon m xture compr s ng ma n y of a phat c, naphthen c and aromat c hydrocarbons.	8002-05-9	60 - 80
.		
Natura gas condensates (petro eum)	64741-47-5	0 - 30
Naphtha (petro eum), ght stra ght-run.	64741-46-4	0 - 20
Naphtha (petro eum), heavy stra ght-run.	64741-41-9	0 - 20
Naphtha (petro eum), hydrotreated ght	64742-49-0	0 - 20
naphtha (petro eum), hydrotreated heavy	64742-48-9	0 - 20
D st ates (petro eum), hydrotreated m dd e	64742-46-7	0 - 10
Pentane	109-66-0	0 - 10
Butane	106-97-8	0 - 5
Hexane, other somers	None ass gned.	0 - 5
n-hexane	110-54-3	0 - 5
Heptane	142-82-5	0 - 5
methy cyc ohexane	108-87-2	0 - 5
Benzene	71-43-2	0 - 1
To uene	108-88-3	0 - 1
xy ene	1330-20-7	0 - 1
Ethy benzene	100-41-4	0 - 1
2-methy butane	78-78-4	0 - 1
Cyc ohexane	110-82-7	0 - 1
Octane	111-65-9	0 - 1
Po ycyc c aromat c hydrocarbons (PAHs)	m xture	0 - 0.1
Hydrogen Su f de	7783-06-4	0 - 0.1

4. First aid measures

Eye contact In case of contact, mmed ate y f ush eyes w th p enty of water for at east 15 m nutes. Get med ca attent on.

Skin contact Immed ate y wash exposed sk n w th soap and water. Remove contam nated c oth ng and shoes. C ean shoes thorough y before reuse. Wash contam nated c oth ng before reuse. Get med ca attent on.

Inhalation If nha ed, remove to fresh a r. If t s suspected that fumes are st present, the rescuer shou d wear an appropr ate mask or se f-conta ned breath ng apparatus. If not breath ng, g ve art f c a resp rat on. If breath ng s d ff cu t, g ve oxygen. Get med ca attent on mmed ate y.

Ingestion Asp rat on hazard f swa owed. Can enter ungs and cause damage. Do not nduce vom t ng. Never g ve anyth ng by mouth to an unconsc ous person. Get med ca attent on mmed ate y.

5. Fire-fighting measures

Flammability of the product F ammab e qu d.

Flash point C osed cup: -50 to 100°C (-58 to 212°F) [Pensky-Martens.]

Explosion limits Lower: 0.6%
Upper: 8%

Fire/explosion hazards In a f re or f heated, a pressure ncrease w occur and the conta ner may burst, w th the r sk of a subsequent exp os on. Runoff to sewer may create f re or exp os on hazard.

Unusual fire/explosion hazards

Exp os ve n the presence of the fo ow ng mater a s or cond t ons: open f ames, sparks and stat c d scharge and heat.

Extinguishing media

Suitable

Use dry chem ca , CO_2, water spray (fog) or foam.

Not suitable

Do not use water jet.

Fire-fighting procedures

Prompt y so ate the scene by remov ng a persons from the v c n ty of the nc dent f there s a f re. No act on sha be taken nvo v ng any persona r sk or w thout su tab e tra n ng. Move conta ners from f re area f th s can be done w thout r sk. Use water spray to keep f re-exposed conta ners coo . F re water contam nated w th th s mater a must be conta ned and prevented from be ng d scharged to any waterway, sewer or dra n.

Hazardous combustion products

Combust on products may nc ude the fo ow ng:
carbon ox des (CO, CO_2) (carbon monox de, carbon d ox de)
su fur ox des (SO_2, SO_3 etc.)
Hydrogen Su f de (H2S)

Protective clothing (fire)

F re-f ghters shou d wear appropr ate protect ve equ pment and se f-conta ned breath ng apparatus (SCBA) w th a fu face-p ece operated n pos t ve pressure mode.

6. Accidental release measures

Personal precautions

No act on sha be taken nvo v ng any persona r sk or w thout su tab e tra n ng. Keep unnecessary and unprotected personne from enter ng. Do not touch or wa k through sp ed mater a . Shut off a gn t on sources. No f ares, smok ng or f ames n hazard area. Do not breathe vapor or m st. Prov de adequate vent at on. Wear appropr ate resp rator when vent at on s nadequate. Put on appropr ate persona protect ve equ pment (see Sect on 8).

Environmental precautions

Avo d d spersa of sp ed mater a and runoff and contact w th so , waterways, dra ns and sewers. Inform the re evant author t es f the product has caused env ronmenta po ut on (sewers, waterways, so or a r). Water po ut ng mater a . May be harmfu to the env ronment f re eased n arge quant t es.

Methods for cleaning up

Large spill

Stop eak f w thout r sk. Move conta ners from sp area. Approach re ease from upw nd. Prevent entry nto sewers, water courses, basements or conf ned areas. Wash sp ages nto an eff uent treatment p ant or proceed as fo ows. Conta n and co ect sp age w th non-combust b e, absorbent mater a e.g. sand, earth, verm cu te or d atomaceous earth and p ace n conta ner for d sposa accord ng to oca regu at ons (see sect on 13). Use spark-proof too s and exp os on-proof equ pment. D spose of v a a censed waste d sposa contractor. Contam nated absorbent mater a may pose the same hazard as the sp ed product. Note: see sect on 1 for emergency contact nformat on and sect on 13 for waste d sposa .

Small spill

Stop eak f w thout r sk. Move conta ners from sp area. D ute w th water and mop up f water-so ub e. A ternat ve y, or f water- nso ub e, absorb w th an nert dry mater a and p ace n an appropr ate waste d sposa conta ner. Use spark-proof too s and exp os on-proof equ pment. D spose of v a a censed waste d sposa contractor.

7. Handling and storage

Handling

Put on appropr ate persona protect ve equ pment (see Sect on 8). Workers shou d wash hands and face before eat ng, dr nk ng and smok ng. Do not get n eyes or on sk n or c oth ng. Do not breathe vapor or m st. Do not ngest. Avo d re ease to the env ronment. Use on y w th adequate vent at on. Wear appropr ate resp rator when vent at on s nadequate. Do not enter storage areas and conf ned spaces un ess adequate y vent ated. Store and use away from heat, sparks, open f ame or any other gn t on source. Use exp os on-proof e ectr ca (vent at ng, ght ng and mater a hand ng) equ pment. Use non-spark ng too s. Take precaut onary measures aga nst e ectrostat c d scharges. To avo d f re or exp os on, d ss pate stat c e ectr c ty dur ng transfer by ground ng and bond ng conta ners and equ pment before transferr ng mater a .

Storage

Store n accordance w th oca regu at ons. Store n a segregated and approved area. Store away from d rect sun ght n a dry, coo and we -vent ated area, away from ncompat b e mater a s (see sect on 10). E m nate a gn t on sources. Separate from ox d z ng mater a s. Keep conta ner t ght y c osed and sea ed unt ready for use. Conta ners that have been opened must be carefu y resea ed and kept upr ght to prevent eakage. Do not store n un abe ed conta ners. Use appropr ate conta nment to avo d env ronmenta contam nat on.

Other information

Do not enter storage tanks w thout breath ng apparatus un ess the tank has been we vent ated and the tank atmosphere has been shown to conta n hydrocarbon vapor concentrat ons of ess than 1% of the ower f ammab ty m t and an oxygen concentrat on of at east 20% vo ume.

L ght hydrocarbon vapors can bu d up n the headspace of tanks. These can cause f ammab ty/exp os on hazards even at temperatures be ow the norma f ash po nt (note: f ash po nt must not be regarded as a re ab e nd cator of the potent a f ammab ty of vapor n tank headspaces). Tank headspaces shou d a ways be regarded as potent a y f ammab e and care shou d be taken to avo d stat c e ectr ca d scharge and a gn t on sources dur ng f ng, u ag ng and samp ng from storage tanks.

Th s mater a can conta n hydrogen su ph de (H_2S), an extreme y tox c and f ammab e gas. Vapors conta n ng hydrogen su f de may accumu ate dur ng storage or transport and may a so be vented dur ng f ng of tanks. Hydrogen su f de has a typ ca "bad egg" sme but at h gh concentrat ons the sense of sme s rap d y ost, therefore do not re y on sense of sme for detect ng hydrogen su f de. Use spec a y des gned measur ng nstruments for determ n ng ts concentrat on.

8. Exposure controls/personal protection

Occupational exposure limits

Ingredient name	Occupational exposure limits
Crude o	**CA Alberta Provincial (Canada).** OEL: 5 mg/m³ 8 hour(s). Form: O m st, m nera STEL: 10 mg/m³ 15 m nute(s). Form: O m st, m nera
Natura gas condensates (petro eum)	**Alberta OH&S (Canada).** OEL: 5 mg/m³ STEL: 10 mg/m³ 15 m nute(s). **British Columbia OH&S (Canada).** EL: 5 mg/m³ STEL: 10 mg/m³ 15 m nute(s).
Naphtha (petro eum), ght stra ght-run.	**ACGIH TLV (United States).** STEL: 1480 mg/m³ 15 m nute(s). Form: Gaso ne (Recommended) STEL: 500 ppm 15 m nute(s). Form: Gaso ne (Recommended) TWA: 890 mg/m³ 8 hour(s). Form: Gaso ne (Recommended) TWA: 300 ppm 8 hour(s). Form: Gaso ne (Recommended) TWA: 100 ppm 8 hour(s). Form: Stoddard So vent (Recommended) TWA: 525 mg/m³ 8 hour(s). Form: Stoddard So vent (Recommended) **OSHA PEL (United States).** TWA: 2900 mg/m³ 8 hour(s). Form: Stoddard So vent (Recommended)
naphtha (petro eum), hydrotreated heavy	**ACGIH TLV (United States).** TWA: 300 ppm
D st ates (petro eum), hydrotreated m dd e	**ACGIH (United States).** TWA: 5 mg/m³ 8 hour(s). Form: O m st, m nera **OSHA (United States).** TWA: 5 mg/m³ 8 hour(s). Form: O m st, m nera
Pentane	**ACGIH TLV (Canada).** TWA: 600 ppm 8 hour(s). **CA British Columbia Provincial (Canada).** TWA: 600 ppm 8 hour(s). Issued/Rev sed: 8/2004 **CA Ontario Provincial (Canada).** TWA: 600 ppm 8 hour(s). Issued/Rev sed: 9/1998 STEL: 2210 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2010 TWA: 1770 mg/m³ 8 hour(s). Issued/Rev sed: 7/2010 STEL: 750 ppm 15 m nute(s). Issued/Rev sed: 7/2010 **CA Quebec Provincial (Canada).** TWAEV: 350 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000 TWAEV: 120 ppm 8 hour(s). Issued/Rev sed: 1/2000 **CA Alberta Provincial (Canada).** 8 hrs OEL: 600 ppm 8 hour(s). Issued/Rev sed: 4/2004 8 hrs OEL: 1770 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
Hydrogen Su f de	**Alberta OH&S (Canada).** CEIL: 15 ppm OEL: 10 ppm 8 hour(s). **British Columbia OH&S (Canada).** CEIL: 10 ppm **CA Alberta Provincial (Canada).** C: 21 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2009 C: 15 ppm 15 m nute(s). Issued/Rev sed: 7/2009 8 hrs OEL: 10 ppm 8 hour(s). Issued/Rev sed: 4/2004

8 hrs OEL: 14 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
CA British Columbia Provincial (Canada).
C: 10 ppm 15 m nute(s). Issued/Rev sed: 8/2004

CA Ontario Provincial (Canada).
TWA: 10 ppm 8 hour(s). Issued/Rev sed: 1/1990
STEL: 15 ppm 15 m nute(s). Issued/Rev sed: 1/1990
CA Quebec Provincial (Canada).
TWAEV: 10 ppm 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 14 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
STEV: 15 ppm 15 m nute(s). Issued/Rev sed: 1/2000
STEV: 21 mg/m³ 15 m nute(s). Issued/Rev sed: 1/2000

Hexane, other somers

ACGIH TLV (United States).
TWA: 500 ppm 8 hour(s).
STEL: 1000 ppm 15 m nute(s).

n-hexane

CA Alberta Provincial (Canada). Absorbed through skin.
8 hrs OEL: 176 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 50 ppm 8 hour(s). Issued/Rev sed: 4/2004
CA British Columbia Provincial (Canada). Absorbed through skin.
TWA: 20 ppm 8 hour(s). Issued/Rev sed: 8/2004
CA Ontario Provincial (Canada). Absorbed through skin.
TWA: 50 ppm 8 hour(s). Issued/Rev sed: 9/1998
CA Quebec Provincial (Canada). Absorbed through skin.
TWAEV: 176 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 50 ppm 8 hour(s). Issued/Rev sed: 1/2000

Heptane

CA Alberta Provincial (Canada).
15 m n OEL: 2050 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2009
15 m n OEL: 500 ppm 15 m nute(s). Issued/Rev sed: 7/2009
8 hrs OEL: 1640 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 400 ppm 8 hour(s). Issued/Rev sed: 4/2004
CA British Columbia Provincial (Canada).
STEL: 500 ppm 15 m nute(s). Issued/Rev sed: 8/2004
TWA: 400 ppm 8 hour(s). Issued/Rev sed: 8/2004
CA Ontario Provincial (Canada).
STEL: 2050 mg/m³ 15 m nute(s). Issued/Rev sed: 9/1994
STEL: 500 ppm 15 m nute(s). Issued/Rev sed: 9/1994
TWA: 1640 mg/m³ 8 hour(s). Issued/Rev sed: 9/1994
TWA: 400 ppm 8 hour(s). Issued/Rev sed: 9/1994
CA Quebec Provincial (Canada).
STEV: 2050 mg/m³ 15 m nute(s). Issued/Rev sed: 1/2000
STEV: 500 ppm 15 m nute(s). Issued/Rev sed: 1/2000
TWAEV: 1640 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 400 ppm 8 hour(s). Issued/Rev sed: 1/2000

methy cyc ohexane

CA Alberta Provincial (Canada).
8 hrs OEL: 1610 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 400 ppm 8 hour(s). Issued/Rev sed: 4/2004
CA British Columbia Provincial (Canada).
TWA: 400 ppm 8 hour(s). Issued/Rev sed: 8/2004
CA Ontario Provincial (Canada).
TWA: 1610 mg/m³ 8 hour(s). Issued/Rev sed: 9/1994
TWA: 400 ppm 8 hour(s). Issued/Rev sed: 9/1994
CA Quebec Provincial (Canada).
TWAEV: 1610 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 400 ppm 8 hour(s). Issued/Rev sed: 1/2000

Butane

CA Alberta Provincial (Canada).
8 hrs OEL: 1000 ppm 8 hour(s). Issued/Rev sed: 7/2009
CA British Columbia Provincial (Canada).
STEL: 750 ppm 15 m nute(s). Issued/Rev sed: 7/2005
TWA: 600 ppm 8 hour(s). Issued/Rev sed: 7/2005
CA Quebec Provincial (Canada).
TWAEV: 1900 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 800 ppm 8 hour(s). Issued/Rev sed: 1/2000
CA Ontario Provincial (Canada).
TWA: 800 ppm 8 hour(s). Issued/Rev sed: 7/2010

Benzene

CA Alberta Provincial (Canada). Absorbed through skin.
15 m n OEL: 8 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2009
15 m n OEL: 2.5 ppm 15 m nute(s). Issued/Rev sed: 7/2009
8 hrs OEL: 1.6 mg/m³ 8 hour(s). Issued/Rev sed: 7/2009
8 hrs OEL: 0.5 ppm 8 hour(s). Issued/Rev sed: 7/2009
CA British Columbia Provincial (Canada). Absorbed through skin.
STEL: 2.5 ppm 15 m nute(s). Issued/Rev sed: 8/2004
TWA: 0.5 ppm 8 hour(s). Issued/Rev sed: 8/2004

CA Ontario Provincial (Canada). Absorbed through skin.
STEL: 2.5 ppm 15 m nute(s). Issued/Rev sed: 7/2010
TWA: 0.5 ppm 8 hour(s). Issued/Rev sed: 7/2010
CA Quebec Provincial (Canada).
STEV: 15.5 mg/m³ 15 m nute(s). Issued/Rev sed: 1/2000
STEV: 5 ppm 15 m nute(s). Issued/Rev sed: 1/2000
TWAEV: 3 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 1 ppm 8 hour(s). Issued/Rev sed: 1/2000

To uene

CA Alberta Provincial (Canada). Absorbed through skin.
8 hrs OEL: 188 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 50 ppm 8 hour(s). Issued/Rev sed: 4/2004
CA British Columbia Provincial (Canada).
TWA: 20 ppm 8 hour(s). Issued/Rev sed: 5/2007
CA Ontario Provincial (Canada).
TWA: 20 ppm 8 hour(s). Issued/Rev sed: 11/2006
CA Quebec Provincial (Canada). Absorbed through skin.
TWAEV: 188 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 50 ppm 8 hour(s). Issued/Rev sed: 1/2000

xy ene

CA Alberta Provincial (Canada).
15 m n OEL: 651 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2009
15 m n OEL: 150 ppm 15 m nute(s). Issued/Rev sed: 7/2009
8 hrs OEL: 434 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 100 ppm 8 hour(s). Issued/Rev sed: 4/2004
CA British Columbia Provincial (Canada).
STEL: 150 ppm 15 m nute(s). Issued/Rev sed: 8/2004
TWA: 100 ppm 8 hour(s). Issued/Rev sed: 8/2004
CA Quebec Provincial (Canada).
STEV: 651 mg/m³ 15 m nute(s). Issued/Rev sed: 1/2000
STEV: 150 ppm 15 m nute(s). Issued/Rev sed: 1/2000
TWAEV: 434 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 100 ppm 8 hour(s). Issued/Rev sed: 1/2000
CA Ontario Provincial (Canada).
STEL: 651 mg/m³ 15 m nute(s). Issued/Rev sed: 5/1996
STEL: 150 ppm 15 m nute(s). Issued/Rev sed: 5/1996
TWA: 434 mg/m³ 8 hour(s). Issued/Rev sed: 5/1996
TWA: 100 ppm 8 hour(s). Issued/Rev sed: 5/1996

Ethy benzene

CA Alberta Provincial (Canada).
8 hrs OEL: 100 ppm 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 434 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004
15 m n OEL: 543 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2009
15 m n OEL: 125 ppm 15 m nute(s). Issued/Rev sed: 7/2009
CA British Columbia Provincial (Canada).
TWA: 100 ppm 8 hour(s). Issued/Rev sed: 8/2004
STEL: 125 ppm 15 m nute(s). Issued/Rev sed: 8/2004
CA Ontario Provincial (Canada).
TWA: 100 ppm 8 hour(s). Issued/Rev sed: 1/2002
STEL: 125 ppm 15 m nute(s). Issued/Rev sed: 1/2002
CA Quebec Provincial (Canada).
TWAEV: 100 ppm 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 434 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
STEV: 125 ppm 15 m nute(s). Issued/Rev sed: 1/2000
STEV: 543 mg/m³ 15 m nute(s). Issued/Rev sed: 1/2000

2-methy butane

CA British Columbia Provincial (Canada).
TWA: 600 ppm 8 hour(s). Issued/Rev sed: 8/2004
CA Ontario Provincial (Canada).
TWA: 600 ppm 8 hour(s). Issued/Rev sed: 9/1998
STEL: 2210 mg/m³ 15 m nute(s). Issued/Rev sed: 7/2010
TWA: 1770 mg/m³ 8 hour(s). Issued/Rev sed: 7/2010
STEL: 750 ppm 15 m nute(s). Issued/Rev sed: 7/2010
CA Alberta Provincial (Canada).
8 hrs OEL: 600 ppm 8 hour(s). Issued/Rev sed: 4/2004
8 hrs OEL: 1770 mg/m³ 8 hour(s). Issued/Rev sed: 4/2004

Cyc ohexane

Alberta OH&S (Canada).
TWA: 300 ppm 8 hour(s).
British Columbia OH&S (Canada).
TWA: 100 ppm 8 hour(s).
CA Alberta Provincial (Canada).
8 hrs OEL: 344 mg/m³ 8 hour(s). Issued/Rev sed: 7/2009
8 hrs OEL: 100 ppm 8 hour(s). Issued/Rev sed: 7/2009
CA British Columbia Provincial (Canada).

TWA: 100 ppm 8 hour(s). Issued/Rev sed: 8/2004

CA Ontario Provincial (Canada).
TWA: 100 ppm 8 hour(s). Issued/Rev sed: 1/2002

CA Quebec Provincial (Canada).
TWAEV: 1030 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 300 ppm 8 hour(s). Issued/Rev sed: 1/2000

Octane

CA Alberta Provincial (Canada). Skin sensitizer.
8 hrs OEL: 1400 mg/m³ 8 hour(s). Issued/Rev sed: 7/2009
8 hrs OEL: 300 ppm 8 hour(s). Issued/Rev sed: 4/2004

CA British Columbia Provincial (Canada).
TWA: 300 ppm 8 hour(s). Issued/Rev sed: 8/2004

CA Ontario Provincial (Canada).
TWA: 300 ppm 8 hour(s). Issued/Rev sed: 3/1999

CA Quebec Provincial (Canada).
STEV: 1750 mg/m³ 15 m nute(s). Issued/Rev sed: 1/2000
STEV: 375 ppm 15 m nute(s). Issued/Rev sed: 1/2000
TWAEV: 1400 mg/m³ 8 hour(s). Issued/Rev sed: 1/2000
TWAEV: 300 ppm 8 hour(s). Issued/Rev sed: 1/2000

Po ycyc c aromat c hydrocarbons (PAHs)

ACGIH TLV (United States).
TWA: 0.2 mg/m³ 8 hour(s). Form: Benzene-so ub e

OSHA PEL (United States).
TWA: 0.2 mg/m³ 8 hour(s). Form: Benzene-so ub e

Wh e spec f c OELs for certa n components may be shown n th s sect on, other components may be present n any m st, vapor or dust produced. Therefore, the spec f c OELs may not be app cab e to the product as a who e and are prov ded for gu dance on y.

Control Measures

Use on y w th adequate vent at on. Use process enc osures, oca exhaust vent at on or other eng neer ng contro s to keep worker exposure to a rborne contam nants be ow any recommended or statutory m ts. The eng neer ng contro s a so need to keep gas, vapor or dust concentrat ons be ow any ower exp os ve m ts. Use exp os on-proof vent at on equ pment.

Hygiene measures

Wash hands, forearms and face thorough y after hand ng chem ca products, before eat ng, smok ng and us ng the avatory and at the end of the work ng per od. Appropr ate techn ques shou d be used to remove potent a y contam nated c oth ng. Wash contam nated c oth ng before reus ng.

Personal protection

Eyes

Avo d contact w th eyes. Safety g asses w th s de sh e ds or chem ca gogg es.

Skin and body

Do not get on sk n or c oth ng. Wear c oth ng and footwear that cannot be penetrated by chem ca s or o .

Respiratory

Use adequate vent at on. Do not breathe vapor or m st. If vent at on s nadequate, use a NIOSH-cert f ed resp rator w th an organ c vapor cartr dge and P95 part cu ate f ter. If operat ng cond t ons cause h gh vapor concentrat ons or the TLV s exceeded, use NIOSH-cert f ed, supp ed-a r resp rator.

Hands

Wear chem ca res stant g oves.

The correct cho ce of protect ve g oves depends upon the chem ca s be ng hand ed, the cond t ons of work and use, and the cond t on of the g oves (even the best chem ca y res stant g ove w break down after repeated chem ca exposures). Most g oves prov de on y a short t me of protect on before they must be d scarded and rep aced. Because spec f c work env ronments and mater a hand ng pract ces vary, safety procedures shou d be deve oped for each ntended app cat on. G oves shou d therefore be chosen n consu tat on w th the supp er/manufacturer and w th a fu assessment of the work ng cond t ons.

Consu t your superv sor or Standard Operat ng Procedure (S.O.P) for spec a hand ng nstruct ons.

9. Physical and chemical properties

Physical state

V scous qu d.

Color

Brown.

Odor

Pungent.

Odor threshold

Not ava ab e.

Flash point

C osed cup: -50 to 100°C (-58 to 212°F) [Pensky-Martens.]

Explosion limits

Lower: 0.6%
Upper: 8%

Specific gravity	Not ava ab e.
Density	750 to 1000 kg/m^3 (0.75 to 1 g/cm^3) at 15°C
pH	Not ava ab e.
Viscosity	K nemat c: <7 mm^2/s (<7 cSt) at 40°C
Boiling point / Range	-10 to 800°C (14 to 1472°F)
Melting point / Range	Not ava ab e.
Vapor pressure	39.894 to 698.138 kPa (300 to 5250 mm Hg)
Vapor density	Not ava ab e.
Evaporation rate	Not ava ab e.
Solubility	nso ub e n water.
LogK_{ow}	>3

10. Stability and reactivity

Stability and reactivity	The product s stab e.
Possibility of hazardous reactions	Under norma cond t ons of storage and use, hazardous react ons w not occur.
Conditions to avoid	Not ava ab e.
Incompatibility with various substances	React ve or ncompat b e w th the fo ow ng mater a s: ox d z ng mater a s.
Hazardous decomposition products	Under norma cond t ons of storage and use, hazardous decompos t on products shou d not be produced. Decompos t on products may nc ude the fo ow ng mater a s: carbon ox des (CO, CO_2) (carbon monox de, carbon d ox de) su fur ox des (SO_2, SO_3 etc.) Hydrogen Su f de (H2S)
Hazardous polymerization	Under norma cond t ons of storage and use, hazardous po ymer zat on w not occur.

11. Toxicological information

Classification

Product/ingredient name	IARC	NTP	OSHA
Ethy benzene	2B	-	-
xy ene	3	-	-
To uene	3	-	-
Benzene	1	Proven.	+
Po ycyc c aromat c hydrocarbons (PAHs)	-	Poss b e	-

IARC :
1 - Carc nogen c to human.
2B - Poss b e carc nogen to human.
3 - Not c ass f ab e as a human carc nogen.

NTP :
Proven - Known to be human carc nogens.
Poss b e - Reasonab y ant c pated to be human carc nogens.

OSHA :
+ Potent a occupat ona carc nogen

Other information

Asp rat on of th s mater a nto the ungs can cause chem ca pneumon a and can be fata .
Asp rat on nto the ungs can occur wh e vom t ng after ngest on of th s mater a .

From sk n-pa nt ng stud es n aboratory an ma s, t has been conc uded that most, f not a , petro eum crudes, regard ess of source, possess carc nogen c act v ty to some degree. Th s means that workers who pract ce poor persona hyg ene and who are repeated y exposed by d rect sk n contact to crude o over many years may potent a y be at r sk of deve op ng sk n cancer. However, nterm ttent or occas ona sk n contact w th petro eum crude o s s not expected to have ser ous hea th effects as ong as good persona hyg ene measures such as those out ned n th s mater a safety data sheet are fo owed. Crude o has not been dent f ed as a carc nogen by NTP, IARC or OSHA.

Exposure to sun ght may ncrease the degree of sk n rr tat on.

Crude o adm n stered ora y or derma y to pregnant rats dur ng gestat on produced ncreased numbers of resorpt ons and decreases n feta we ght at materna y tox c doses. Repeated exposures to some crude o s n rats have produced effects on the b ood, ver and thymus.

Hydrogen su f de (H2S) gas may accumu ate n storage tanks of bu k transport compartments conta n ng th s mater a . Contact w th eyes causes pa nfu conjunct v t s, sens t v ty to ght, tear ng and c oud ng of v s on. Inha at on of ow concentrat ons causes a runny nose w th a oss of sense of sme , abored breath ng and shortness of breath. D rect contact w th sk n causes pa n and redness. Other symptoms of exposure nc ude profuse sa vat on, nausea, vom t ng, d arrhea, g dd ness, headache, d zz ness, confus on, rap d breath ng, rap d heart rate, sweat ng, weakness, sudden co apse, unconsc ousness and death due to resp ratory para ys s.

Card ac neuro og ca effects have a so been reported. Pro onged breath ng (greater than one hour) of concentrat ons of H2S around 50 ppm can produce eye and resp ratory tract rr tat on. Leve s of 250 to 600 ppm w resu t n f u d n the ungs, and concentrat ons around 1,000 ppm w cause unconsc ousness and death n a short per od of t me. S nce the sense of sme rap d y becomes nsens t ve to th s tox c, co or ess gas, odor cannot be re ed upon as an nd cator of concentrat ons of the gas. A ways exerc se caut on when work ng around c osed conta ners.

Benzene: Acute tox c ty of benzene resu ts pr mar y from depress on of the centra nervous system (CNS). Inha at on of concentrat ons over 50 ppm can produce headache, ass tude, wear ness, d zz ness, drows ness, or exc tat on. Exposure to very h gh eve s can resu t n unconsc ousness and death.

Benzene: Long-term overexposure to benzene has been assoc ated w th certa n types of eukem a n humans. In add t on, the Internat ona Agency for Research on Cancer (IARC), the Nat ona Tox co ogy Program, and OSHA cons der benzene to be a human carc nogen. Chron c exposures to h gh eve s of benzene have been reported to cause adverse b ood effects nc ud ng anem a. Benzene exposure can occur by nha at on and absorpt on through the sk n.
Inha at on and forced feed ng stud es of benzene n aboratory an ma s have produced a carc nogen c response n a var ety of organs, nc ud ng poss b y eukem a, other adverse effects on the b ood, chromosoma changes and some effects on the mmune system. Exposure to benzene at eve s up to 300 ppm d d not produce b rth defects n an ma stud es; however, exposure to h gher dosage eve s resu ted n a reduct on of body we ght of the rat pups (fetotox c ty). Changes n the testes have been observed n m ce exposed to benzene at 300 ppm, but reproduct ve performance was not a tered n rats exposed to benzene at the same eve . Asp rat on of th s mater a nto the ungs can cause chem ca pneumon a and can be fata . Asp rat on nto the ungs can occur wh e vom t ng after ngest on of th s mater a .

To uene: Asp rat on of th s mater a nto the ungs can cause chem ca pneumon a and can be fata . Asp rat on nto the ungs can occur wh e vom t ng after ngest on of th s mater a . De berate nha at on of h gh concentrat ons of to uene has been nked to damage of the bra n, ver and k dney. Inha at on of very h gh concentrat ons of to uene, such as n cases of so vent abuse, has resu ted n sudden death wh ch may be a resu t of card ac arrhythm a or centra nervous system depress on. Menta and/or growth retardat on has been reported n ch dren of women who de berate y nha e to uene dur ng pregnancy (usua y at thousands of ppm). Feta deve opmenta tox c ty was observed when pregnant rats were exposed to to uene at eve s of 1500 ppm. Materna tox c ty was a so observed at th s concentrat on. Pro onged, h gh eve exposure to to uene n aboratory an ma s has resu ted n hear ng oss. Exposure stud es n rats have resu ted n adverse effects on the k dney, ver and centra nervous system. Stud es n occupat ona y exposed nd v dua s nd cate that to uene exposure has been assoc ated w th mpa red co or v s on and decreased performance n some neurobehav ora tests. There are occupat ona stud es wh ch report an assoc at on between nha at on exposure to to uene and adverse effects on reproduct on nc ud ng spontaneous abort on. The methodo ogy of these stud es and the re ab ty of the resu ts have been quest oned. In a two-generat on study n rats, nha at on of to uene at eve s up to 2000 ppm d d not produce adverse effects on fert ty or reproduct ve performance.

Xy enes: Xy ene has been reported to cause centra nervous system effects at concentrat ons above the recommended exposure m t. Xy ene vapor becomes rr tat ng at re at ve y h gh eve s. In one study, eye rr tat on was reported at exposures of 460 ppm and n one person at 230 ppm after 15 m nutes. In another study, no one reported eyes, nose and throat rr tat on at m xed xy ene exposures up to 230 ppm for 30 m nutes. Derma LD50 s expected to be greater than 10g/kg n rabb ts, based on test resu ts from s m ar mater a s.

M xed xy enes caused s ght hear ng oss n rats exposed to 800 ppm n the a r for 14 hours/day for s x weeks. There s no nformat on ava ab e for ower concentrat ons; however, s m ar chem ca s that have caused these hear ng effects at s m ar concentrat ons have not caused effects at ower concentrat ons.

Pregnant an ma s exposed to xy ene or ts somers have been reported to cause deve opment tox c ty n rodents when exposed by nha at on. The deve opmenta effects observed cons sted of de ayed deve opment and m nor ske eta var at ons, but no ma format ons. Because of the h gh exposure eve s used n these stud es, we do not be eve that these resu ts mp y an ncreased r sk of reproduct ve tox c ty to workers exposed to xy ene eve s at or be ow the exposure m ts.

Xy ene and ts somers are not genotox c.

Techn ca grade xy ene has been tested n a Nat ona Tox co ogy Program carc nogen c ty study n rats and m ce dosed ora y for two years. There was no ev dence of carc nogen c ty.
NTP a so exposed ma e and fema e rats and m ce by nha at on to 0, 75, 250, or 750 ppm ethy benzene for 2 years. There was a stat st ca y s gn f cant ncrease n the number of k dney tumors n ma e and fema e rats at 750 ppm. There were a so ncreased nc dences of ung tumors n ma e m ce and ver tumors n fema e m ce that were stat st ca y s gn f cant at 750 ppm. Except for the ma e rat k dney tumors, the nc dence of the tumors were w th n the range observed for non-exposed an ma s from other stud es conducted by NTP. The s gn f cance of these f nd ngs to humans s unknown. Ethy benzene produced m xed resu ts n n v tro genotox c ty stud es, wh ch were not conf rmed when tested n v vo. The Internat ona Agency for Research on Cancer (IARC) has eva uated ethy benzene and found t to be poss b y carc nogen c to humans (Group 2B).

Th s product conta ns n-hexane. Overexposure to n-hexane may cause progress ve and potent a y rrevers b e damage to the per phera nervous system, part cu ar y n the arms and egs. An ma stud es have a so shown that n-hexane overexposure may cause test cu ar njury. However, an ma stud es conducted w th commerc a hexane, conta n ng 53% n-hexane, showed ne ther per phera nervous system damage nor test cu ar njury at nha at on exposures up to 9000 ppm.

Th s mater a may conta n s gn f cant quant t es of po ycyc c aromat c hydrocarbons (PCAs), some of wh ch have been shown by exper menta stud es to nduce sk n cancer.

Potential chronic health effects

Carcinogenicity Conta ns mater a wh ch can cause cancer. R sk of cancer depends on durat on and eve of exposure.

Mutagenicity Conta ns mater a wh ch may cause her tab e genet c effects.

Teratogenicity Conta ns mater a wh ch can cause b rth defects.

Fertility effects No known s gn f cant effects or cr t ca hazards.

Reproductive effects No known s gn f cant effects or cr t ca hazards.

Medical conditions aggravated by over-exposure Pre-ex st ng d sorders nvo v ng any target organs ment oned n th s MSDS as be ng at r sk may be aggravated by over-exposure to th s product.

12. Ecological information

Ecotoxicity

No test ng has been performed by the manufacturer.

Persistence/degradability Inherent y b odegradab e

Mobility Sp ages may penetrate the so caus ng ground water contam nat on. Th s mater a may accumu ate n sed ments.

Bioaccumulative potential Th s product s not expected to b oaccumu ate through food cha ns n the env ronment.

Other ecological information Sp s may form a f m on water surfaces caus ng phys ca damage to organ sms. Oxygen transfer cou d a so be mpa red.

13. Disposal considerations

Waste information The generat on of waste shou d be avo ded or m n m zed wherever poss b e. S gn f cant quant t es of waste product res dues shou d not be d sposed of v a the fou sewer but processed n a su tab e eff uent treatment p ant. D spose of surp us and non-recyc ab e products v a a censed waste d sposa contractor. D sposa of th s product, so ut ons and any by-products shou d at a t mes comp y w th the requ rements of env ronmenta protect on and waste d sposa eg s at on and any reg ona oca author ty requ rements. Waste packag ng shou d be recyc ed. Inc nerat on or andf shou d on y be cons dered when recyc ng s not feas b e. Th s mater a and ts conta ner must be d sposed of n a safe way. Care shou d be taken when hand ng empt ed conta ners that have not been c eaned or r nsed out. Empty conta ners or ners may reta n some product res dues. Vapor

from product res dues may create a h gh y f ammab e or exp os ve atmosphere ns de the conta ner. Do not cut, we d or gr nd used conta ners un ess they have been c eaned thorough y nterna y. Avo d d spersa of sp ed mater a and runoff and contact w th so , waterways, dra ns and sewers.

NOTE: The generator of waste has the responsibility for proper waste identification (based on characteristic(s) or listing), transportation and disposal

14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Class	Packing group	Additional information
DOT Classification	UN 1267	PETROLEUM CRUDE OIL	3	I	-
TDG Classification	UN 1267	PETROLEUM CRUDE OIL	3	I	-
IMDG Classification	UN 1267	PETROLEUM CRUDE OIL. Mar ne po utant	3	I	**Emergency schedules (EmS)** F-E, S-E
IATA/ICAO Classification	UN 1267	PETROLEUM CRUDE OIL	3	I	-

15. Regulatory information

WHMIS (Canada)

C ass B-2: F ammab e qu d
C ass D-2A: Mater a caus ng other tox c effects (Very tox c).
C ass D-2B: Mater a caus ng other tox c effects (Tox c).

Th s product has been c ass f ed n accordance w th the hazard cr ter a of the Contro ed Products Regu at ons and the MSDS conta ns a the nformat on requ red by the Contro ed Products Regu at ons.

Other regulations

Canada inventory: A components are sted or exempted.

United States inventory (TSCA 8b): A components are sted or exempted.

REACH Status: For the REACH status of th s product p ease consu t your company contact, as dent f ed n Sect on 1.

Australia inventory (AICS): Not determ ned.

China inventory (IECSC): Not determ ned.

Japan inventory (ENCS): Not determ ned.

Korea inventory (KECI): Not determ ned.

Philippines inventory (PICCS): At east one component s not sted.

16. Other information

Label requirements

DANGER !

FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF ABSORBED THROUGH SKIN.
INHALATION CAUSES HEADACHES, DIZZINESS, DROWSINESS AND NAUSEA AND MAY LEAD TO UNCONSCIOUSNESS.
CAUSES EYE AND SKIN IRRITATION.
MAY CAUSE RESPIRATORY TRACT IRRITATION.
HARMFUL OR FATAL IF SWALLOWED.
CAN ENTER LUNGS AND CAUSE DAMAGE.
CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.
CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER.

CONTAINS MATERIAL WHICH MAY CAUSE HERITABLE GENETIC EFFECTS.
ASPIRATION HAZARD
BIRTH HAZARD - CONTAINS MATERIAL WHICH MAY CAUSE BIRTH DEFECTS

History

Date of issue	12/14/2011.
Date of previous issue	No prev ous va dat on.
Prepared by	Product Stewardsh p

Indicates information that has changed from previously issued version.

Notice to reader

All reasonably practicable steps have been taken to ensure this data sheet and the health safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from BP Group.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use other than the stated product use of the material from any failure to adhere to recommendations or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken. You can contact the BP Group to ensure that this document is the most current available. Alteration of this document is strictly prohibited.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER	Petroleum Crude Oil—Canadian Heavy Sweet (CHS)	
OTHER MEANS OF IDENTIFICATION	UN-Number	UN1267
	Synonyms	CHS, Mix of Heavy and Sweet Blend
	Chemical Category	Crude oils—extremely flammable
RECOMMENDED USE	No information available	
RESTRICTIONS OF USE	No information available	
SUPPLIER INFORMATION	Enbridge Pipelines Inc. 10201 Jasper Avenue Edmonton, Alberta T5J3N7 Canada TEL: 1-780-420-5210	
EMERGENCY CONTACT INFORMATION	CHEMTREC	1-800-424-9300 for US 703-527-3887 outside US
	CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION	
Skin Irritation	Category 3
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
Natural Gas Condensates (petroleum)	64741-47-5	45-100	
Petroleum Distallates (naptha)	8002-05-9	45-100	
Asphalt	8052-42-4	70-80	
Natural Gas Condensate	68919-39-1	0-25	
Ethane	74-84-0	0-15	
Propane	74-98-6	0-15	
Pentane	109-66-0	0-15	
2-Methylbutane	78-78-4	0-10	
Butane	106-97-8	0-10	
Heptane	142-82-5	0-10	
Hexane	110-54-3	0-10	
Octane	111-65-9	0-10	
Nonane	111-84-2	0-5	
Isobutane	75-28-5	0-5	
Decane	124-18-5	0-5	
Benzene	71-43-2	0-2	
Xylene	1330-20-7	0-2	
Toluene	108-88-3	0-2	
Ethylbenzene	100-41-4	0-2	
Methylcyclohexane	108-87-2	0-2	
Methylcyclopentane	96-37-7	0-2	
Cyclohexane	110-82-7	0-1	
Cyclopentane	287-92-3	0-1	
1,2,4-Trimethylbenzene	95-63-6	0-1	
Hydrogen Sulfide	7783-06-4	0-1	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

	Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/ attention.
	Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.
MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED	Refer to Section 11 - Toxicological Information	
INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY	Note to the Physician	• Aspiration hazard. Symptoms may be delayed. • Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias. • Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA	Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
	Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.
FIREFIGHTING PROCEDURES		• FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. • FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out. • Stay upwind. • Ventilate closed spaces before entering. • Fire fighters should wear complete protective clothing including self-contained breathing apparatus. • FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. • FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions. • Move containers from fire area if you can do it without risk. • LARGE FIRES: Use water spray or fog; do not use straight streams. • LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn. • LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (C_2O). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen.
- Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.
Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS	• Avoid runoff to waterways, sewers. Do NOT wash away to sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP	Methods for Containment	• Stop leak if you can do it without risk. • Contain and recover liquid when possible. • A vapor suppressing foam may be used to reduce vapors. • Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming. • Use water spray to reduce vapors or divert vapor cloud drift. • A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.
	Methods for Cleaning Up	• Clean up spill immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING	Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges.

	Handling	• Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. • Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	Storage	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
Petroleum distillate (naphtha)	–	–	TWA 350 mg/m³ IDLH 1100 ppm Ceiling 1800 mg/m³
Asphalt	TLV 0.5 mg/m³		Ceiling 5 mg/m³
Ethane	TLV 1000 ppm (listed under Aliphatic hydrocarbon gases: Alkane C1-C4	–	

Propane	TLV 1000 ppm (listed under Aliphatic hydrocarbon gases: Alkane C1-C4	TWA 1000 ppm TWA 1800 mg/m^3	TWA 1000 ppm TWA 1800 mg/m^3
Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m3 IDLH 1500 ppm
2-Methylbutane	TWA 600 ppm	–	–
Butane	STEL 1000 ppm		TWA 800 PPM TWA 1900 mg/m^3
Heptane	TLV 400 ppm TLV 1640 mg/m^3 STEL 500 ppm STEL 2000 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 85 ppm TWA 350 mg/m^3 Ceiling 440 ppm Ceiling 1800 mg/m^3 IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm
Octane	TLV 300 ppm TLV 1401 mg/m^3	PEL 500 ppm PEL 2350 mg/m^3	TWA 75 ppm TWA 350 mg/m^3 Ceiling 385 ppm Ceiling 1800 mg/m^3 IDLH 1000 ppm
Nonane	TLV 200 ppm TLV 1050 mg/m^3	–	TWA 200 ppm TWA 1050 mg/m^3
Isobutane	TWA 1000 ppm	–	–
Decane	–	–	–
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m^3 STEL 150 ppm STEL 651 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 150 ppm STEL 655 mg/m^3 IDLH 900 ppm

Toluene	TLV 20 ppm TLV 75 mg/m³	PEL 200 ppm STEL 300 mg/m³	TWA 100 ppm TWA 375 mg/m³ STEL 150 ppm STEL 560 mg/m³ IDLH 500 ppm
Ethylbenzene	TLV 20 ppm TLV 87 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 125 ppm STEL 545 mg/m³ IDLH 800 ppm
MethylCyclohexane	TLV 400 ppm TLV 1610 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 400 ppm TWA 1600 mg/m³ IDLH 1200 ppm
Cyclohexane	TLV 100 ppm TLV 334 mg/m³	PEL 300 ppm PEL 1050 mg/m³	TWA 300 ppm TWA 1050 mg/m³ IDLH 1300 ppm
Cyclopentane	TLV 600 ppm	–	TWA 600 ppm TWA 1720 mg/m³
1,2,4-Trimethylbenzene	TWA 25 ppm	-	TWA 25 ppm TWA 125 mg/m³
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m³ STEL 5 ppm STEL 7 mg/m³	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m³ IDLH 100 ppm

APPROPRIATE ENGINEERING CONTROLS	• Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.	
INDIVIDUAL PROTECTION MEASURES	Eye and Face	• Wear face shield and eye protection.
	Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
	Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN149. Use a NIOSH/MSHA or European Standard EN149 approved respirator if exposure limits are exceeded or symptoms are experienced.
	General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION	Physical State	Liquid	Odor	Petroleum l ke odor
	Substance Type	Mixture	Odor Threshold	No data available
	Appearance	Brown/black Liquid		
PROPERTIES	pH	No data available	Vapor pressure	95kPa@37.8°C
	Melting Point/ Freezing Point	No data available	Vapor density	>1 Air=1
	Boiling Point/ Boiling Range	-20 to 722°C -4 to 1331°F	Relative density	No data available
	Flash Point	-40 to 260 °C -40 to 500 °F	Water Solubility	Negligible
	Evaporation Rate	No data available	Partition coefficient: n-octanol/water	No data available
	Flammability (solid, gas)	No data available	Autoignition temperature	No data available
	Upper Flammability Limit	No data available	Decomposition temperature	No data available

Lower Flammability Limit	No data available	Specific Gravity	0.90-0.925
Viscosity	< 145 cSt @ 10°C		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE	Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
	Eye Contact	• Causes serious eye irritation.
	Skin Contact	• Causes skin irritation.
	Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
Natural gas condensates (petroleum)	-	–	>600 mg/m³ (Rat)
Asphalt	>5000 mg/kg (Rat)	–	>94.4 mg/m³ (Rat)
Propane	–	–	>800000 ppm (Rat) 15 min
Pentane	>2000 mg/kg (Rat)	–	364 g/cu (Rat) 4 h
2-Methylbutane	–	–	= 150,000 mg/m³ (Rat) 2 h
Butane	–	–	658 mg/L (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m³ (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h

Octane	–	–	=118g/m³(Rat)4h =25260ppm(Rat)4h
Nonane	–	–	= 3200 ppm (Rat) 4 h
Decane	>5000mg/kg	>2000mg/kg (Rat	–
Benzene	1800mg/kg (Rat)	–	13050-14380ppm(Rat)4h
Xylenes	=3500mg/kg (Rat)	>4350mg/kg(Rabbit) >1700mg/kg(Rabbit)	=29.08mg/L(Rat)4h =5000ppm (Rat)4h
Toluene	2.6to7.5g/kg(Rat)	14.1ml/kg(Rabbit)	–
Ethylbenzene	=3500mg/kg(Rat)	=15400mg/kg(Rabbit)	=17.2mg/L(Rat)4h
MethylCyclohexane	>3200mg/kg(Rat)	–	–
Cyclohexane	>5000mg/kg(Rat)	>2000mg/kg(Rabbit)	=13.9mg/L(Rat)4h
Cyclopentane	11400 mg/kg(Rat)	–	72g/m³(Mouse)
1,2,4-Trimethylbenzene	5g/kg(Rat)	–	18000mg/m³(Rat)4h
Hydrogen sulfide	–	–	=444ppm(Rat)

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene	• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.
Hydrogen Sulfide Gas (H_2S)	• Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/ week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Xylenes	• Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver,

kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.

Toluene	Carcinogenicity: Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. Target Organs: Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by del berate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. Reproductive Toxicity: Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Ethylbenzene	Carcinogenicity: Rats and mice exposed to 0, 75, 250, or 750 ppm ethylbenzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethylbenzene has been listed as a possible human carcinogen by IARC. Target Organs: In rats and mice exposed to 0, 75, 250, or 750 ppm ethylbenzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT-AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Petroleum distillate (naphtha)	A2	–	Group 3		–
Asphalt	A4	–	Group 2B	Reasonably Anticipated	–
Hexane	–	X	–	–	–
Benzene	A1	X	Group 1	Known	X
Xylenes	A4	–	Group 3	Evidence	
Toluene	A4	–	Group 3	Evidence	–
Ethylbenzene	A3	–	Group 2B	Evidence	X

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY	• Suspected of damaging fertility or the unborn child.
STOT—SINGLE EXPOSURE	• May cause drowsiness and dizziness.
STOT—REPEATED EXPOSURE	• Causes damage to organs through prolonged or repeated exposure.
ASPIRATION HAZARD	May be fatal if swallowed and enters airways. Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Petroleum distillate (naphtha)	–	LC50: 258 mg/L Salmo gairdneri 96 h static	EC50 48h: <0.26 mg/L Static (Daphnia magna) EC50 24h: = 36 mg/L (Daphnia magna)	–
Natural gas condensates (petroleum)	–	LC50 96h: = 119 mg/L static (Alburnus alburnus) LC50 96h: = 82 mg/L static (Cyprinodon variegatus)	EC50 24h: = 170 mg/L (Daphnia magna)	–
Butane	–	–	–	–
Pentane	–	LC50 96h: = 11.59 mg/L (Pimephales promelas) LC50 96h: = 9.87 mg/L (Oncorhynchus mykiss) LC50 96h: = 9.99 mg/L (Lepomis macrochirus)	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
Octane	–	–	EC50 48h: = 0.38 mg/L (water flea) EC50 48h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
Heptane	–	LC50 96h: = 375.0 mg/L (Cichlid fish)	EC50 24h: > 10 mg/L (Daphnia magna)	–
2-Methylbutane			EC50 48h: = 2.3 mg/L (Daphnia magna)	
Hexane	–	LC50 96h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24h: > 1000 mg/L (Daphnia magna)	–
Decane	EC50 24h: = 0.043 mg/L (Chlorella vulgaris)	–	EC50 48h: = 0.029 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72h: =29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: =5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: =22.49 mg/L static (Lepomis macrochirus) LC50 96 h: =28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: =10 mg/L (Daphnia magna)	–
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Cyclopentane			EC50 48 h: 150 nmol/cu m (Daphnia magna)	LC50 24h: 280 mmol/cu m Artemia salina (Brine Shrimp)
MethylCyclohexane		LC50 96hr: 72.0 mg/l (Golden Shiner)		
Xylenes	EC50 72h: =11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: =3.82 mg/L (water flea) LC50 48 h: =0.6 mg/L (Gammarus lacustris)	-
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19 05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0 - 15.0 mg/L Lepomis macrochirus 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: =11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
		LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poeciliareticulata96hstatic		

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Ethylbenzene	EC50 72h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96h: >438 mg/L (Pseudokirchneriella subcapitata) EC50 72h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96h: = 32 mg/L static (Lepomis macrochirus) LC50 96h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96 mg/L 24 h (Microorganisms)
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)
Hydrogen sulfide	–	LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	–

ECOTOXICITY

- No information available

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY

PERSISTENCE AND DEGRADABILITY

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
Asphalt	6.006
Butane	2.89
Benzene	1.83
YCyclohexane	3.44
Cyclopentane	3.00
Decane	5.1
Ethane	1.81
Ethylbenzene	3.118
Pentane	3.39
Octane	5.18
Heptane	4.66
2-Methylbutane	2.72
Methylcyclohexane	3.61
Methylcyclopentane	3.37
Nonane	5.65
Propane	2.36
Toluene	2.65
Xylene	2.77-3.15
Isobutane	2.76
Hexane	3.90

1,2,4-Trimethylbenzene	8.73
Hydrogen Sulfide	0.45

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
Petroleum distillate (naphtha)	High
Butane	Low
Cyclohexane	Moderate
Cyclopentane	Moderate
Ethane	Very High
Methylcyclopentane	Low
Propane	Moderate
Pentane	High
Octane	Immobile
Nonane	Immobile
Heptane	Moderate
2-Methylbutane	Low
Isobutane	Very High
Hexane	High
Decane	Immobile
Benzene	High
Xylene	Very High to Moderate
Toluene	High to Moderate
Ethylbenzene	Low
1,2,4-Trimethylbenzene	Low

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

• This product co	uld also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP). • This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s). • It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging	Waste	• Containers contents should be completely used and containers should be emptied prior to discard. • Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. • Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner. • To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

CHART NAME

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1267	Petroleum Crude Oil	3	I	Emergency response guide number: 128
TDG	UN1267	Petroleum Crude Oil	3	I	Marine Pollutant
IMO/IMDG	UN1267	Petroleum Crude Oil	3	I	Marine Pollutant
IATA/ICAO	UN1267	Petroleum Crude Oil	3	I	ERG Code 3L

SPECIAL RECAUTIONS FOR USER

• None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Cyclopentane	287-92-3	Not Listed
Ethane	74-84-0	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Propane	74-98-6	Not Listed

Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed

Isobutane	75-28-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Decane	124-18-5	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb RQ
Cyclopentane	287-92-3	Not Listed
Ethane	74-84-0	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Propane	74-98-6	Not Listed
Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed
Isobutane	75-28-5	Not Listed
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	10 lb RQ

Xylene	1330-20-7	100lbRQ
Toluene	108-88-3	1000lbRQ
Ethylbenzene	100-41-4	1000lbRQ
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	100lbRQ

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
HydrogenSulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Cyclopentane	287-92-3	Not Listed
Ethane	74-84-0	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Pentane	109-66-0	Not Listed
Propane	74-98-6	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed
Isobutane	75-28-5	Not Listed
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	X
Xylene	1330-20-7	X
Toluene	108-88-3	X

Ethylbenzene	100-41-4	X
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS#	LISTED
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Cyclopentane	287-92-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Propane	74-98-6	Not Listed
Ethane	74-84-0	Not Listed
Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed
Isobutane	75-28-5	Not Listed
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	X
Xylene	1330-20-7	Not Listed
Toluene	108-88-3	X
Ethylbenzene	100-41-4	X
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	Not Listed

COMPONENT	CAS #	CLASSIFICATION
1,2,4-Trimethylbenzene	95-63-6	B3
2-Methylbutane (In Liquid form)	78-78-4	B2
Asphalt	8052-42-4	Not Listed
Benzene	71-43-2	B2, D2A, D2B
Butane	106-97-8	A, B1
Cyclohexane	110-82-7	B2, D2B
Cyclopentane	287-92-3	B2
Decane	124-18-5	B3, D2B
Ethane	74-84-0	A, B1
Ethylbenzene	100-41-4	B2, D2A, D2B
Heptane	142-82-5	B2, D2B
Hexane	110-54-3	B2, D2A, D2B
Hydrogen Sulfide	7783-06-4	A, B1, D1A, D2B
Isobutane	75-28-5	A, B1 (listed under Methyl-2 propane)
Methylcyclohexane	108-87-2	B2
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	B2, D2B
Octane	111-65-9	B2, D2B
Pentane	109-66-0	B2
Petroleum	8002-05-9	B2
Propane	74-98-6	A, B1

Toluene	108-88-3	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Cyclopentane	287-92-3	Not Listed
Pentane	109-66-0	X
Ethane	74-84-0	X
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed

Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	X
Isobutane	75-28-5	X
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	X
Xylene	1330-20-7	X
Propane	74-98-6	X
Toluene	108-88-3	X
Ethylbenzene	100-41-4	X
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	Flammability: 4	Instability: 0	Physical and Chemical Hazards: X

HMIS	Health Hazard: 2	Flammability: 4	Instability: 0	Personal Protection: X
ISSUING DATE	09/19/16			
REVISION DATE	09/19/16			

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER

Petroleum Crude Oil - Condensate

OTHER MEANS OF IDENTIFICATION

UN-Number	UN1268
Synonyms	Condensate Blend (CRW), Pembina Condensate (CPM), Southern Lights Diluent (SLD), Fort Saskatchewan Condensate (CFT), Gibson Condensate (CGB), Condensate Gibsons Light Density (CGL), Plains Marketing Condensate (CLN), Pembina Nexus Condensate (CPN), Rangeland Condensate (CRL), Rimbey Condensate (CRM), Petrocanada Condensate (CPC), Suncor N (OSN), Federated Condensate (CFD), Gibson Condensate Hardisty (CGY)
Chemical Category	Crude oils—extremely flammable Petroleum Distillate

RECOMMENDED USE

Refinery feedstock

RESTRICTIONS OF USE

No information available

SUPPLIER INFORMATION

Enbridge Pipelines Inc.
10201 Jasper Avenue
Edmonton, Alberta T5J 3N7
Canada
TEL: 1-780-420-5210

EMERGENCY CONTACT INFORMATION

CHEMTREC	1-800-424-9300 for US 703-527-3887 outside US
CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
1,2,4-Trimethylbenzene	95-63-6	0-5	
2-Methylbutane (In Liquid form)	78-78-4	0-10	
Benzene	71-43-2	0-10	
Benzene, trimethyl-	25551-13-7	0-1	
Butane	106-97-8	0-7	
Cyclohexane	110-82-7	0-5	
Cyclopentane	287-92-3	0-5	
Decane	124-18-5	0-7	
Ethane	74-84-0	0-60	
Ethylbenzene	100-41-4	0-5	
Heptane	142-82-5	0-20	
Hexane	110-54-3	0-30	
Hydrogen Sulfide	7783-06-4	0-1	
Isobutane	75-28-5	0-5	
Methylcyclohexane	108-87-2	0-10	
Methylcyclopentane	96-37-7	0-6	
Naphtha (oil sand), Hydrotreated	128683-33-0	0-100	
Natural gas condensate	68919-39-1	0-100	
Natural gas condensates (petroleum)	64741-47-5	0-100	
Nonane	111-84-2	0-10	
Octane	111-65-9	0-15	
Pentane	109-66-0	0-70	
Propane	74-98-6	0-60	
Toluene	108-88-3	0-10	
Xylene	1330-20-7	0-10	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment	• Stop leak if you can do it without risk. • Contain and recover liquid when possible. • A vapor suppressing foam may be used to reduce vapors. • Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming. • Use water spray to reduce vapors or divert vapor cloud drift. • A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.
Methods for Cleaning Up	• Clean up spill immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges.

	Handling	• Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. • Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	**Storage**	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
1,2,4-Trimethylbenzene	–	–	TWA 25 ppm TWA 125 mg/m^3
2-Methylbutane (In Liquid form)	TLV 1000 ppm	–	–
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Benzene, trimethyl-	TLV 25 ppm	–	–

Butane	STEL 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3
Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm
Cyclopentane	TLV 600 ppm	–	TWA 600 ppm TWA 1720 mg/m^3
Ethane	TLV 1000 ppm	–	–
Ethylbenzene	TLV 20 ppm TLV 87 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 125 ppm STEL 545 mg/m^3 IDLH 800 ppm
Heptane	TLV 400 ppm TLV 1640 mg/m^3 STEL 500 ppm STEL 2000 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 85 ppm TWA 350 mg/m^3 Ceiling 440 ppm Ceiling 1800 mg/m^3 IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m^3 STEL 5 ppm STEL 7 mg/m^3	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m^3 IDLH 100 ppm
Isobutane	TWA 1000 ppm		
Methylcyclohexane	TLV 400 ppm TLV 1610 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 400 ppm TWA 1600 mg/m^3 IDLH 1200 ppm
Nonane	TLV 200 ppm TLV 1050 mg/m^3	–	TWA 200 ppm TWA 1050 mg/m^3
Octane	TLV 300 ppm TLV 1401 mg/m^3	PEL 500 ppm PEL 2350 mg/m^3	TWA 75 ppm TWA 350 mg/m^3 Ceiling 385 ppm Ceiling 1800 mg/m^3 IDLH 1000 ppm
Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m^3 IDLH 1500 ppm

Propane	TLV 1000 ppm listed under Aliphatic hydrocarbon gases: Alkane C1-4)	TWA 1800 ppm TWA 1800 mg/m^3	TWA 1000 ppm TWA 1800 mg/m^3
Toluene	TLV 20 ppm TLV 75 mg/m^3	PEL 200 ppm STEL 300 mg/m^3	TWA 100 ppm TWA 375 mg/m^3 STEL 150 ppm STEL 560 mg/m^3 IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m^3 STEL 150 ppm STEL 651 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 150 ppm STEL 655 mg/m^3 IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid	**Odor**	Petroleum like odor
Substance Type	Mixture	**Odor Threshold**	No data available
Appearance	Yellow/green to Brown/black liquid		

PROPERTIES

pH	No data available	**Vapor Pressure**	No data available
Melting Point/ Freezing Point	No data available	**Vapor Density**	>1 Air=1
Boiling Point/ Boiling Range	-30 to 538°C -22 to 1000.4°F	**Relative Density**	No data available

Flash Point	>-40 °C >-40 °F	**Water Solubility**	Negligible
Evaporation Rate	No data available	**PartitionCoefficient: n-octanol/water**	No data available
Flammability (solid, gas)	No data available	**Autoignition Temperature**	No data available
Upper Flammability Limit	No data available	**Decomposition Temperature**	No data available
Lower Flammability Limit	No data available	**Specific Gravity**	No data available
Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
1,2,4-Trimethylbenzene	5 g/kg (Rat)	–	18000 mg/m^3 (Rat) 4h
2-Methylbutane (In Liquid form)	–	–	= 150,000 mg/m^3 (Rat) 2 h
Benzene	1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Benzene, trimethyl-	8970 mg/kg (Rat)	–	–
Butane	–	–	658 mg/L (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
Cyclopentane	11400 mg/kg (Rat)	–	72 g/m^3 (Mouse)
Decane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rat)	–
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Hydrogen sulfide	–	–	= 444 ppm (Rat)
Isobutane	–	–	= 658,000 mg/m^3 (Rat) 4 h
Methylcyclohexane	> 3200 mg/kg (Rat)	–	–
Natural gas condensates (petroleum)	–	–	= 600 mg/m^3 (Rat)
Nonane	–	–	= 3200 ppm (Rat) 4 h
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
Pentane	>2000 mg/kg (Rat)	–	364 g/cu (Rat) 4 h
Propane	–	–	>800000 ppm (Rat) 15 min
Hydrogen sulfide	–	–	= 444 ppm (Rat)
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–
Xylenes	= 3500 mg/kg (Rat)	> 4350 mg/kg (Rabbit) > 1700 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene

- Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.

Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Hydrogen Sulfide Gas (H_2S)	• Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.
Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Xylenes	• Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE	**Sensitization**	• No information available
	Mutagenic Effects	• May cause genetic defects
	Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Ethylbenzene	A3	–	Group 2B	Evidence	X
Hexane	–	X	–	–	–
Toluene	A4	–	Group 3	Evidence	–
Xylenes	A4	–	Group 3	Evidence	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY

• Suspected of damaging fertility or the unborn child.

STOT—SINGLE EXPOSURE

• May cause drowsiness and dizziness.

STOT—REPEATED EXPOSURE

• Causes damage to organs through prolonged or repeated exposure.

ASPIRATION HAZARD

May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)
2-Methylbutane (In Liquid form)			EC50 48 h: = 2.3 mg/L (Daphnia magna)	

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Benzene, trimethyl-	–	–	–	LC50 24h: 7000 ug/L Palaemonetes pugio (Daggerblade grass shrimp)
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Cyclopentane			EC50 48 h: 150 nmol/cu m (Daphnia magna)	LC50 24h: 280 mmol/cu m Artemia salina (Brine Shrimp)
Decane	EC50 24 h: = 0.043 mg/L (Chlorella vulgaris)	–	EC50 48 h: = 0.029 mg/L (Daphnia magna)	–
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Hydrogen sulfide	–	LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	–
MethylCyclohexane	–	LC50 96hr: 72.0 mg/l (Golden Shiner)	–	–
Natural gas condensates (petroleum)	–	LC50 96 h: = 119 mg/L static (Alburnus alburnus) LC50 96 h: = 82 mg/L static (Cyprinodon variegatus)	EC50 24 h: = 170 mg/L (Daphnia magna)	–
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
Pentane	–	–	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	-

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
1,2,4-Trimethylbenzene	3.78
2-Methylbutane (In Liquid form)	2.72
Benzene	1.83
Butane	2.89
YCyclohexane	3.44
Cyclopentane	3.00
Decane	5.1
Ethane	1.81
Ethylbenzene	3.118
Heptane	4.66
Hexane	3.90
Hydrogen Sulfide	0.45
Isobutane	2.76
Methylcyclohexane	3.61
Methylcyclopentane	3.37
Nonane	5.65
Octane	5.18
Pentane	3.39
Propane	2.36
Toluene	2.65
Xylene	2.77-3.15

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
1,2,4-Trimethylbenzene	Low
2-Methylbutane (In Liquid form)	Low
Benzene	High
Benzene, trimethyl-	Moderate to High
Butane	Low
Cyclohexane	Moderate
Cyclopentane	Moderate
Decane	Immobile
Ethane	Very High
Ethylbenzene	Low
Heptane	Moderate
Hexane	High
Isobutane	Very High
Methylcyclopentane	Low
Nonane	Immobile
Octane	Immobile
Pentane	High
Propane	Moderate
Toluene	High to Moderate
Xylene	Very High to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.
- This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP).
- This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s).
- It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging Waste

- Container contents should be completely used and containers should be emptied prior to discard.
- Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations.
- Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner.
- To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1268	Petroleum Distillate, N.O.S.	3	I	Emergency response guide number: 128
TDG	UN1268	Petroleum Distillate, N.O.S.	3	I	–
IMO/IMDG	UN1268	Petroleum Distillate, N.O.S.	3	I	–
IATA/ICAO	UN1268	Petroleum Distillate, N.O.S.	3	I	–

SPECIAL RECAUTIONS FOR USER

- None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Benzene, trimethyl-	25551-13-7	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Heptane	142-82-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural gas condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Propane	74-98-6	Not Listed
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS#	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	10 lb RQ
Benzene, trimethyl-	25551-13-7	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb RQ
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	1000 lb RQ
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	100 lb RQ
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural gas condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Propane	74-98-6	Not Listed
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
HydrogenSulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	X
Benzene, trimethyl-	25551-13-7	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural gas condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed

Propane	74-98-6	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	X
Benzene, trimethyl-	25551-13-7	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	Not Listed
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural gas condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Propane	74-98-6	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS#	CLASSIFICATION
1,2,4-Trimethylbenzene	95-63-6	B3
2-Methylbutane (In Liquid form)	78-78-4	B2
Benzene	71-43-2	B2, D2A, D2B
Benzene, trimethyl-	25551-13-7	B3
Butane	106-97-8	A, B1
Cyclohexane	110-82-7	B2, D2B
Cyclopentane	287-92-3	B2
Decane	124-18-5	B3, D2B
Ethane	74-84-0	A, B1
Ethylbenzene	100-41-4	B2, D2A, D2B
Heptane	142-82-5	B2, D2B
Hexane	110-54-3	B2, D2A, D2B
Hydrogen Sulfide	7783-06-4	A, B1, D1A, D2B
Isobutane	75-28-5	A, B1 (listed under Methyl-2 propane)
Methylcyclohexane	108-87-2	B2
Methylcyclopentane	96-37-7	Not Listed
Natural gas condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	B2, D2B
Octane	111-65-9	B2, D2B
Pentane	109-66-0	B2
Propane	74-98-6	A, B1
Toluene	108-88-3	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	X
Benzene	71-43-2	X
Benzene, trimethyl-	25551-13-7	Not Listed
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	X
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Isobutane	75-28-5	X
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural gas condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed

Pentane	109-66-0	X
Propane	74-98-6	X
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 3	**Flammability:** 4	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 3	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 5/8/15

REVISION DATE 5/8/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

SAFETY DATA SHEET

Section 1. Identification

Product name	Diluent
Chemical name	Naphtha
Other means of identification	Light Debutanized Naphtha
SDS #	0000003141
Code	0000003141

Relevant identified uses of the substance or mixture and uses advised against

Product use	Industrial applications
Supplier	BP Products North America Inc. 150 West Warrenville Road Naperville, Illinois 60563-8460 USA
EMERGENCY HEALTH INFORMATION:	1 (800) 447-8735 Outside the US: +1 703-527-3887 (CHEMTREC)
EMERGENCY SPILL INFORMATION:	1 (800) 424-9300 CHEMTREC (USA)
OTHER PRODUCT INFORMATION	1 (866) 4 BP - MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com

Section 2. Hazards identification

OSHA/HCS status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	FLAMMABLE LIQUIDS - Category 1 SKIN IRRITATION - Category 2 GERM CELL MUTAGENICITY - Category 1B CARCINOGENICITY - Category 1A TOXIC TO REPRODUCTION (Fertility) - Category 2 TOXIC TO REPRODUCTION (Unborn child) - Category 2 SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3 ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms

Signal word Danger

Section 2. Hazards identification

Hazard statements

Extremely flammable liquid and vapor.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
Suspected of damaging fertility or the unborn child.
May be fatal if swallowed and enters airways.
May cause drowsiness and dizziness.

Precautionary statements

Prevention

Obtain special instructions before use.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Take precautionary measures against static discharge.
Avoid breathing vapor.
Wash thoroughly after handling.

Response

IF exposed or concerned: Get medical attention. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention.

Storage

Store in well-ventilated place. Keep container tightly closed.

Disposal

Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified

Contains Benzene. Prolonged or repeated exposure to benzene can cause anaemia and other blood diseases, including leukemia.
Contains n-hexane which may cause peripheral nerve damage.
See toxicological information (Section 11).

Section 3. Composition/information on ingredients

Substance/mixture Mixture

Ingredient name	CAS number	%
Isopentane	78-78-4	30
Pentane	109-66-0	25
Hexane, other isomers	None assigned.	15
n-hexane	110-54-3	10
Heptane (and isomers)	142-82-5	5
cyclohexane	110-82-7	5
Methylcylohexane	108-87-2	2
Butane	106-97-8	2
Benzene	71-43-2	2
Toluene	108-88-3	2
Octane	111-65-9	2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Check for and remove any contact lenses. Get medical attention.

Skin contact

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention.

Section 4. First aid measures

Inhalation

If inhaled, remove to fresh air. Get medical attention.

If exposure to vapor, mists or fumes causes drowsiness, headache, blurred vision or irritation of the eyes, nose or throat, remove immediately to fresh air. Keep patient warm and at rest. If any symptoms persist obtain medical advice.

Ingestion

Do not induce vomiting. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Aspiration hazard if swallowed. Can enter lungs and cause damage. Get medical attention immediately.

Protection of first-aiders

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

Most important symptoms/effects, acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician

Treatment should in general be symptomatic and directed to relieving any effects. Product can be aspirated on swallowing or following regurgitation of stomach contents, and can cause severe and potentially fatal chemical pneumonitis, which will require urgent treatment. Because of the risk of aspiration, induction of vomiting and gastric lavage should be avoided. Gastric lavage should be undertaken only after endotracheal intubation. Monitor for cardiac dysrhythmias.

Specific treatments

No specific treatment.

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray. This substance will float and can be reignited on surface water.

Unsuitable extinguishing media

Do not use water jet.

Specific hazards arising from the chemical

Flammable liquid and vapor. Vapor may cause flash fire. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Hazardous combustion products

Combustion products may include the following:
carbon dioxide
carbon monoxide
other hazardous substances.

Special protective actions for fire-fighters

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters

Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

Special remarks on fire hazards

May form explosive mixtures with air.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Immediately contact emergency personnel. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Put on appropriate personal protective equipment. Floors may be slippery; use care to avoid falling. Eliminate all ignition sources. Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained positive pressure breathing apparatus (SCBA).

For emergency responders

Entry into a confined space or poorly ventilated area contaminated with vapor, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained breathing apparatus. Wear a suitable chemical protective suit. Chemical resistant boots. See also the information in "For non-emergency personnel".

Environmental precautions

Liquid leaks generate large volumes of flammable vapor, heavier than air, which may travel to remote sources of ignition (eg. along drainage systems). Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill

Eliminate all ignition sources. Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres.

Large spill

Eliminate all ignition sources. Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Dike spill area and do not allow product to reach sewage system and surface or ground water. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Use spark-proof tools and explosion-proof equipment. Contaminated absorbent material may pose the same hazard as the spilled product. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres. Dispose of via a licensed waste disposal contractor.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Take precautionary measures against electrostatic discharges. Avoid contact of spilled material and runoff with soil and surface waterways. Empty containers retain product residue and can be hazardous. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Do not reuse container. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid exposure during pregnancy. Do not swallow. Aspiration hazard if swallowed. Can enter lungs and cause damage. Never siphon by mouth.

To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material.

Section 7. Handling and storage

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash thoroughly after handling. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Store and use only in equipment/ containers designed for use with this product. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Do not enter storage tanks without breathing apparatus unless the tank has been well ventilated and the tank atmosphere has been shown to contain hydrocarbon vapor concentrations of less than 1% of the lower flammability limit and an oxygen concentration of at least 20% volume.

Light hydrocarbon vapors can build up in the headspace of tanks. These can cause flammability/explosion hazards even at temperatures below the normal flash point (note: flash point must not be regarded as a reliable indicator of the potential flammability of vapor in tank headspaces). Tank headspaces should always be regarded as potentially flammable and care should be taken to avoid static electrical discharge and all ignition sources during filling, ullaging and sampling from storage tanks. When the product is pumped (e.g. during filling, discharge or ullaging) and when sampling, there is a risk of static discharge. Ensure equipment used is properly earthed or bonded to the tank structure. Electrical equipment should not be used unless it is intrinsically safe (i.e. will not produce sparks). .

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Isopentane	**ACGIH TLV (United States).** TWA: 1000 ppm 8 hours. Issued/Revised: 4/2014
pentane	**ACGIH TLV (United States).** TWA: 1000 ppm 8 hours. Issued/Revised: 4/2014 **OSHA PEL (United States).** TWA: 2950 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 1000 ppm 8 hours. Issued/Revised: 6/1993
Hexane, other isomers	**ACGIH TLV (United States).** TWA: 500 ppm 8 hours. STEL: 1000 ppm 15 minutes.
n-hexane	**OSHA PEL (United States). Absorbed through skin.** TWA (States of California & Washington): 50 ppm 8 hours. Form: Vapor TWA: 1800 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 500 ppm 8 hours. Issued/Revised: 6/1993 STEL (State of Washington): 75 ppm 15 minutes. **ACGIH TLV (United States). Absorbed**

Section 8. Exposure controls/personal protection

	through skin. TWA: 50 ppm 8 hours. Issued/Revised: 9/1998
cyclohexane	**ACGIH TLV (United States).** TWA: 100 ppm 8 hours. Issued/Revised: 1/2002 **OSHA PEL (United States).** TWA: 1050 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 300 ppm 8 hours. Issued/Revised: 6/1993
n-Heptane	**ACGIH TLV (United States).** STEL: 2050 mg/m³ 15 minutes. Issued/Revised: 9/1994 STEL: 500 ppm 15 minutes. Issued/Revised: 9/1994 TWA: 1640 mg/m³ 8 hours. Issued/Revised: 9/1994 TWA: 400 ppm 8 hours. Issued/Revised: 9/1994 **OSHA PEL (United States).** TWA: 2000 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 500 ppm 8 hours. Issued/Revised: 6/1993
octane	**ACGIH TLV (United States).** TWA: 300 ppm 8 hours. Issued/Revised: 3/1999 **OSHA PEL (United States).** TWA: 2350 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 500 ppm 8 hours. Issued/Revised: 6/1993
toluene	**OSHA PEL Z2 (United States).** AMP: 500 ppm 10 minutes. Issued/Revised: 6/1993 CEIL: 300 ppm Issued/Revised: 6/1993 TWA: 200 ppm 8 hours. Issued/Revised: 6/1993 **ACGIH TLV (United States).** TWA: 20 ppm 8 hours. Issued/Revised: 11/2006
Benzene	**ACGIH TLV (United States). Absorbed through skin.** STEL: 8 mg/m³ 15 minutes. Issued/Revised: 5/1997 STEL: 2.5 ppm 15 minutes. Issued/Revised: 5/1997 TWA: 1.6 mg/m³ 8 hours. Issued/Revised: 5/1997 TWA: 0.5 ppm 8 hours. Issued/Revised: 5/1997 **OSHA PEL (United States).** STEL: 5 ppm 15 minutes. Issued/Revised: 6/1993 TWA: 1 ppm 8 hours. Issued/Revised: 6/1993 **OSHA PEL Z2 (United States).** AMP: 50 ppm 10 minutes. Issued/Revised: 6/1993 CEIL: 25 ppm Issued/Revised: 6/1993

Section 8. Exposure controls/personal protection

	TWA: 10 ppm 8 hours. Issued/Revised: 6/1993
butane	**OSHA PEL (United States).** TWA: State of Washington / Cal/OSHA : 800 ppm 8 hours. STEL: 1000 ppm, (State of Washington) 15 minutes. **ACGIH TLV (United States).** STEL: 1000 ppm 15 minutes. Issued/Revised: 6/2013
methylcyclohexane	**ACGIH TLV (United States).** TWA: 1610 mg/m³ 8 hours. Issued/Revised: 9/1994 TWA: 400 ppm 8 hours. Issued/Revised: 9/1994 **OSHA PEL (United States).** TWA: 2000 mg/m³ 8 hours. Issued/Revised: 6/1993 TWA: 500 ppm 8 hours. Issued/Revised: 6/1993

While specific OELs for certain components may be shown in this section, other components may be present in any mist, vapor or dust produced. Therefore, the specific OELs may not be applicable to the product as a whole and are provided for guidance only.

Appropriate engineering controls

All activities involving chemicals should be assessed for their risks to health, to ensure exposures are adequately controlled. Personal protective equipment should only be considered after other forms of control measures (e.g. engineering controls) have been suitably evaluated. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained. Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards.
Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.
The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.

Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Chemical splash goggles.

Skin protection

Hand protection

Wear chemical resistant gloves. Recommended: Gloves made from Viton or comparable material resistant to hydrocarbons.

Protective gloves must give suitable protection against mechanical risks (i.e. abrasion, blade cut and puncture). Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.

Consult your supervisor or Standard Operating Procedure (S.O.P) for special handling instructions.

Section 8. Exposure controls/personal protection

Body protection

Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required. Wear suitable protective clothing. Footwear highly resistant to chemicals. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For greatest effectiveness against static electricity, overalls, boots and gloves should all be anti-static. When there is a risk of ignition wear inherently fire resistant protective clothes and gloves. Work clothing / overalls should be laundered on a regular basis. Laundering of contaminated work clothing should only be done by professional cleaners who have been told about the hazards of the contamination. Always keep contaminated work clothing away from uncontaminated work clothing and uncontaminated personal clothes. When the risk of skin exposure is high (from experience this could apply to the following tasks: cleaning work, maintenance and service, filling and transfer, taking samples and cleaning up spillages) then a chemical protective suit and boots will be required. Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection

Use only with adequate ventilation. Do not breathe vapor or mist. If ventilation is inadequate, use a NIOSH certified respirator with an organic vapor cartridge and P95 particulate filter.

If operating conditions cause high vapor concentrations or the TLV is exceeded, use NIOSH-certified, supplied-air respirator.

Use with adequate ventilation.
In case of insufficient ventilation, wear suitable respiratory equipment.
If there is a requirement for the use of a respiratory protective device, but the use of breathing apparatus (independent of ambient atmosphere) is not required, then a suitable filtering device must be worn.
The filter class must be suitable for the maximum contaminant concentration (gas/vapor/aerosol/particulates) that may arise when handling the product.
The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Section 9. Physical and chemical properties

Appearance

Physical state	Liquid.
Color	Clear to Hazy.
Odor	Hydrocarbon.
Odor threshold	Not available.
pH	6 to 8
Melting point	Not available.
Boiling point	23 to 149°C (73.4 to 300.2°F)
Flash point	Closed cup: -42.8°C (-45°F)
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable. Based on - Physical state
Lower and upper explosive (flammable) limits	Lower: 1.3% Upper: 7.2% Based on Gasoline and n-Pentane
Vapor pressure	59.84 kPa (450 mm Hg) at 20°C
Vapor density	Not available.

Section 9. Physical and chemical properties

Density	650 kg/m³ (0.65 g/cm³)
Relative density	<1
Solubility	negligible
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	540°C (1004°F)
Decomposition temperature	Not available.
Viscosity	Dynamic: 0 Pa·s (0.3 cP) at 20°C

Section 10. Stability and reactivity

Reactivity	No specific test data available for this product. Refer to Conditions to avoid and Incompatible materials for additional information.
Chemical stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur. Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	Avoid all possible sources of ignition (spark or flame). Avoid excessive heat.
Incompatible materials	Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Test	Species	Result	Exposure	Remarks
Naphtha	LC50 Inhalation Vapor	Rat - Male, Female	>7630 mg/m³ Nominal	4 hours	Nominal
	LC50 Inhalation Vapor	Rat - Male, Female	>5610 mg/m³ Measured	4 hours	analytical
	LD50 Dermal	Rabbit - Male, Female	>2000 mg/kg	-	
	LD50 Oral	Rat - Male, Female	>5000 mg/kg	-	
	LOAEL Inhalation Vapor	Human - Male	4320 mg/m³	1 hours	central nervous system depression
	LOAEL Inhalation Vapor	Human - Male	2400 mg/m³	1 hours	respiratory tract irritation
	Unspecified Inhalation Vapor	Human - Male	960 to 4800 mg/m³	30 minutes	Not classified.

Conclusion/Summary Not available.

Irritation/Corrosion

Product/ingredient name	Species	Result	Score	Exposure	Observation	Conc.	Remarks

Naphtha	Rabbit	Skin - Irritant	-	-	-	-	Based on gasoline
	Rabbit	Skin - Irritant	-	-	-	-	Based on gasoline

Sensitizer

Product/ingredient name	Route of exposure	Species	Result	Remarks
Naphtha	skin	Guinea pig	Not sensitizing	Based on gasoline

Mutagenicity

Product/ingredient name	Test	Experiment	Result	Remarks
Naphtha	Equivalent to OECD 476	Experiment: In vitro Subject: Mammal - species unspecified	Negative	Based on gasoline
	Equivalent to OECD 471	Experiment: In vitro Subject: Non-mammalian species	Negative	Based on gasoline
	EPA OPPTS 870.5395	Experiment: In vivo Subject: Unspecified	Negative	Based on Gasoline vapor condensate
	Equivalent to OECD 475	Experiment: In vivo Subject: Unspecified	Negative	Based on gasoline

Conclusion/Summary May cause genetic defects.

Carcinogenicity

Product/ingredient name							
Naphtha	Equivalent to OECD	451	Rat	Inhalation	113 weeks	Negative - Inhalation - Unspecified	Based on gasoline
	Equivalent to OECD	451	Mouse	Dermal	102 weeks	Negative - Dermal - Unspecified	Based on gasoline

Conclusion/Summary May cause cancer

Classification

Product/ingredient name	OSHA	IARC	NTP
Benzene	+	1	Known to be a human carcinogen.
toluene	-	3	-

Descriptors:

OSHA:
+ - Potential occupational carcinogen

IARC:
1 - Carcinogenic to human.
2A - Probable human carcinogen.
2B - Possible carcinogen to human.
3 - Not classifiable as a human carcinogen.
4 - Probably not a human carcinogen.

NTP:
Proven - Known to be human carcinogens.
Possible - Reasonably anticipated to be human carcinogens.

Reproductive toxicity

Product/ingredient name	Maternal toxicity	Fertility	Development toxin	Species	Result	Exposure
Naphtha	-	Negative	-	Rat	Inhalation	2 generation
	-	-	Negative	Rat	Inhalation	14 days

Section 11. Toxicological information

Conclusion/Summary

Development: Suspected of damaging fertility or the unborn child.
Fertility: Suspected of damaging fertility or the unborn child.
Effects on or via lactation: Based on available data, the classification criteria are not met.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Isopentane	Category 3	Not applicable.	Narcotic effects
pentane	Category 3	Not applicable.	Narcotic effects
n-hexane	Category 3	Not applicable.	Narcotic effects
cyclohexane	Category 3	Not applicable.	Narcotic effects
n-Heptane	Category 3	Not applicable.	Narcotic effects
octane [and isomers]	Category 3	Not applicable.	Narcotic effects
octane	Category 3	Not applicable.	Narcotic effects
toluene	Category 3	Not applicable.	Narcotic effects
butane	Category 3	Not applicable.	Narcotic effects
methylcyclohexane	Category 3	Not applicable.	Narcotic effects

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
n-hexane	Category 2	Inhalation	peripheral nervous system
toluene	Category 2	Not determined	ears
Benzene	Category 1	Not determined	blood system

Aspiration hazard

Name	Result
Isopentane	ASPIRATION HAZARD - Category 1
n-hexane	ASPIRATION HAZARD - Category 1
cyclohexane	ASPIRATION HAZARD - Category 1
n-Heptane	ASPIRATION HAZARD - Category 1
octane [and isomers]	ASPIRATION HAZARD - Category 1
octane	ASPIRATION HAZARD - Category 1
toluene	ASPIRATION HAZARD - Category 1
Benzene	ASPIRATION HAZARD - Category 1
methylcyclohexane	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure

Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Eye contact

No known significant effects or critical hazards.

Skin contact

Causes skin irritation.

Inhalation

Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Ingestion

Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach. Aspiration hazard if swallowed -- harmful or fatal if liquid is aspirated into lungs.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact

Adverse symptoms may include the following:
pain or irritation
watering
redness

Skin contact

Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Section 11. Toxicological information

Inhalation

Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Ingestion

Adverse symptoms may include the following:
nausea or vomiting
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects: Not available.

Potential delayed effects: Not available.

Long term exposure

Potential immediate effects: Not available.

Potential delayed effects: Not available.

Potential chronic health effects

General

This product contains n-hexane. Overexposure to n-hexane may cause progressive and potentially irreversible damage to the peripheral nervous system, particularly in the arms and legs. Animal studies have also shown that n-hexane overexposure may cause testicular injury. However, animal studies conducted with commercial hexane, containing 53% n-hexane, showed neither peripheral nervous system damage nor testicular injury at inhalation exposures up to 9000 ppm. Solvent "sniffing" (abuse) or intentional overexposure to vapors can produce serious central nervous system effects, including unconsciousness, and possibly death.

Carcinogenicity: May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity: May cause genetic defects.

Teratogenicity: Suspected of damaging the unborn child.

Developmental effects: No known significant effects or critical hazards.

Fertility effects: Suspected of damaging fertility.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Other information

Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Do not siphon by mouth.

High vapor concentrations can cause headaches, dizziness, drowsiness and nausea and may lead to unconsciousness. Exposure to vapor at high concentrations may have the following effects: heart beat irregularity (arrhythmia).

Additional information

Benzene: Acute toxicity of benzene results primarily from depression of the central nervous system (CNS). Inhalation of concentrations over 50 ppm can produce headache, lassitude, weariness, dizziness, drowsiness, or excitation. Exposure to very high levels can result in unconsciousness and death.

Benzene: Long-term overexposure to benzene has been associated with certain types of leukemia in humans. In addition, the International Agency for Research on Cancer (IARC), the National Toxicology Program, and OSHA consider benzene to be a human carcinogen. Chronic exposures to high levels of benzene have been reported to cause

Section 11. Toxicological information

adverse blood effects including anemia. Benzene exposure can occur by inhalation and absorption through the skin.
Inhalation and forced feeding studies of benzene in laboratory animals have produced a carcinogenic response in a variety of organs, including possibly leukemia, other adverse effects on the blood, chromosomal changes and some effects on the immune system. Exposure to benzene at levels up to 300 ppm did not produce birth defects in animal studies; however, exposure to higher dosage levels resulted in a reduction of body weight of the rat pups (fetotoxicity). Changes in the testes have been observed in mice exposed to benzene at 300 ppm, but reproductive performance was not altered in rats exposed to benzene at the same level. Aspiration of this material into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this material.

Toluene: Aspiration of this material into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this material. Deliberate inhalation of high concentrations of toluene has been linked to damage of the brain, liver and kidney. Inhalation of very high concentrations of toluene, such as in cases of solvent abuse, has resulted in sudden death which may be a result of cardiac arrhythmia or central nervous system depression. Mental and/or growth retardation has been reported in children of women who deliberately inhale toluene during pregnancy (usually at thousands of ppm). Fetal developmental toxicity was observed when pregnant rats were exposed to toluene at levels of 1500 ppm. Maternal toxicity was also observed at this concentration. Prolonged, high level exposure to toluene in laboratory animals has resulted in hearing loss. Exposure studies in rats have resulted in adverse effects on the kidney, liver and central nervous system. Studies in occupationally exposed individuals indicate that toluene exposure has been associated with impaired color vision and decreased performance in some neurobehavioral tests. There are occupational studies which report an association between inhalation exposure to toluene and adverse effects on reproduction including spontaneous abortion. The methodology of these studies and the reliability of the results have been questioned. In a two-generation study in rats, inhalation of toluene at levels up to 2000 ppm did not produce adverse effects on fertility or reproductive performance.

Section 12. Ecological information

Toxicity

Persistence and degradability

Not available.

Bioaccumulative potential

The product is not expected to bioaccumulate.

Mobility in soil

Soil/water partition coefficient (K_{OC})	Not available.
Mobility	Spillages may penetrate the soil causing ground water contamination.

Other ecological information Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

Section 13. Disposal considerations

Disposal methods The generation of waste should be avoided or minimized wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a

Section 13. Disposal considerations

safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Cyclohexane (I); Benzene, hexahydro- (I)	110-82-7	Listed	U056
Benzene (I,T)	71-43-2	Listed	U019
Toluene; Benzene, methyl-	108-88-3	Listed	U220

Section 14. Transport information

	DOT Classification	TDG Classification	IMDG	IATA
UN number	UN1268	UN1268	UN1268	UN1268
UN proper shipping name	PETROLEUM DISTILLATES, N.O.S. (Naphtha, Benzene) RQ	PETROLEUM DISTILLATES, N.O.S. (Naphtha, Benzene)	PETROLEUM DISTILLATES, N.O.S. (Naphtha, Benzene)	PETROLEUM DISTILLATES, N.O.S. (Naphtha, Benzene)
Transport hazard class(es)	3 	3 	3  	3 
Packing group	I	I	I	I
Environmental hazards	No.	No.	Yes.	No.
Additional information	**Reportable quantity** 10 lbs / 4.54 kg [1.8451 gal / 6.9846 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	-	The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg.	The environmentally hazardous substance mark may appear if required by other transportation regulations.

Special precautions for user Not available.

Section 14. Transport information

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not available.

Section 15. Regulatory information

U.S. Federal regulations

United States inventory (TSCA 8b) All components are listed or exempted.

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 311/312

Classification

Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

SARA 313

	Product name	CAS number	Concentration
Form R - Reporting requirements	n-hexane	110-54-3	10
	cyclohexane	110-82-7	5
	Benzene	71-43-2	2
	toluene	108-88-3	2
Supplier notification	n-hexane	110-54-3	10
	cyclohexane	110-82-7	5
	Benzene	71-43-2	2
	toluene	108-88-3	2

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts The following components are listed: ISOPENTANE; PENTANE; HEXANE; HEPTANE (N-HEPTANE); CYCLOHEXANE; METHYLCYCLOHEXANE; BUTANE; BENZENE; TOLUENE; OCTANE

New Jersey The following components are listed: ISOPENTANE; BUTANE, 2-METHYL-; PENTANE; n-HEXANE; HEXANE; n-HEPTANE; HEPTANE; CYCLOHEXANE; METHYLCYCLOHEXANE; CYCLOHEXANE, METHYL-; BUTANE; BENZENE; TOLUENE; BENZENE, METHYL-; OCTANE

Pennsylvania The following components are listed: BUTANE, 2-METHYL-; PENTANE; HEXANE; HEPTANE; CYCLOHEXANE; CYCLOHEXANE, METHYL-; BUTANE; BENZENE; BENZENE, METHYL-; OCTANE

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.
toluene

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.
Benzene

Other regulations

Australia inventory (AICS) Not determined.

Canada inventory All components are listed or exempted.

China inventory (IECSC) Not determined.

Japan inventory (ENCS) All components are listed or exempted.

Korea inventory (KECI) Not determined.

Philippines inventory (PICCS) Not determined.

Taiwan inventory (CSNN) Not determined.

Section 15. Regulatory information

REACH Status

For the REACH status of this product please consult your company contact, as identified in Section 1.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		3
Physical hazards		0
Personal protection		X

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

National Fire Protection Association (U.S.A.)

History

Date of issue/Date of revision 05/20/2015.

Date of previous issue No previous validation.

Key to abbreviations

ACGIH = American Conference of Industrial Hygienists
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
CAS Number = Chemical Abstracts Service Registry Number
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
OEL = Occupational Exposure Limit
SDS = Safety Data Sheet
STEL = Short term exposure limit
TWA = Time weighted average
UN = United Nations
UN Number = United Nations Number, a four digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods.

Indicates information that has changed from previously issued version.

Notice to reader

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from BP Group.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be

Section 16. Other information

taken. You can contact the BP Group to ensure that this document is the most current available. Alteration of this document is strictly prohibited.

Safety Data Sheet

According to OSHA HCS 2012 (29 CFR 1910.1200)

Section 1: Identification

Product Identifier: **LP™ 100 Flow Improver**
Other means of identification: LP™ 100
SDS Number: **472980**
Intended Use: Flow Improver
Uses Advised Against: All others
Emergency Health and Safety Number: +1 800-424-9300 (USA, 24 hours)
+1 703-527-3887 (USA, 24 hours)
CANUTEC 613-996-6666
CHEMTREC Mexico 01-800-681-9531

Manufacturer:
Lubrizol Specialty Products, Inc.
P.O. Box 4428
Houston, TX 77210
United States of America

SDS Information:
Phone: 800-762-0942
Email: SDS@P66.com
URL: www.Phillips66.com

Customer Service:
+1 832-765-6003 or +1 800-897-2774

Section 2: Hazards Identification

Classified Hazards
This material is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Other Hazards
None Known

Label Elements

No classified hazards

Section 3: Composition / Information on Ingredients

Chemical Name	CASRN	Concentration[1]
Water	7732-18-5	55 - 65
Non-Hazardous Materials	VARIOUS	35 - 45

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Section 4: First Aid Measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: First aid is not normally required. However, it is good practice to wash any chemical from the skin.

Inhalation (Breathing): First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects, both acute and delayed: No known effects of overexposure.

Other Comments: none

Section 5: Fire-Fighting Measures

NFPA 704 Hazard Class

Health: 0 **Flammability:** 0 **Instability:** 0

0 (Minimal)
1 (Slight)
2 (Moderate)
3 (Serious)
4 (Severe)

Extinguishing Media: Use extinguishing agent suitable for type of surrounding fire

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: No unusual fire or explosion hazards are expected. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous Combustion Products: Combustion may yield carbon monoxide and oxides of nitrogen.

Special protective actions for firefighters: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard.

Methods and material for containment and cleaning up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

Section 7: Handling and Storage

Precautions for safe handling: Wear eye/face protection. Wash thoroughly afler handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8). Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated areas. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

Section 8: Exposure Controls / Personal Protection

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: General ventilation should be adequate for normal conditions of intended use. Additional engineering controls may be necessary if working with the product in enclosed areas and/or at elevated temperatures.

Eye/Face Protection: The use of eye/face protection is not normally required; however, good industrial hygiene practice suggests the use of eye protection that meets or exceeds ANSI Z.87.1 whenever working with chemicals.

Skin/Hand Protection: The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals.

Respiratory Protection: Respiratory protection is not normally required under intended conditions of use. Emergencies or conditions that could result in significant airborne exposures may require the use of NIOSH approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance: White
Physical Form: Liquid
Odor: Mild
Odor Threshold: No data
pH: 10.0-12.3
Vapor Density (air=1): <1
Upper Explosive Limits (vol % in air): No data
Lower Explosive Limits (vol % in air): No data
Evaporation Rate (nBuAc=1): Same as water
Particle Size: Not applicable
Percent Volatile: No data
Flammability (solid, gas): Not applicable

Flash Point: Not applicable
Test Method: Not applicable
Initial Boiling Point/Range: 212 °F / 100 °C
Vapor Pressure: 23.8 mm Hg @ 77F / 25°C
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: 32 °F / 0 °C
Auto-ignition Temperature: No data
Decomposition Temperature: No data
Specific Gravity (water=1): 0.87 - 0.97 @ 60ºF (15.6ºC)
Bulk Density: No data
Viscosity: 350 cP @ 511s-1 @ 77°F / 25°C (Non-Newtonian)
Solubility in Water: Disperses completely

Section 10: Stability and Reactivity

Reactivity: Stable under normal ambient and anticipated conditions of use.

Chemical stability: Stable under normal ambient and anticipated conditions of use.

Possibility of hazardous reactions: Hazardous reactions not anticipated.

Conditions to avoid: Avoid high temperatures and all sources of ignition.

Incompatible materials: Avoid contact with strong oxidizing agents

Hazardous decomposition products: Not anticipated under normal conditions of use.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)

Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Aspiration Hazard: Not an aspiration hazard.

Skin Corrosion/Irritation: Not expected to be irritating.

Serious Eye Damage/Irritation: Not expected to be irritating.

Skin Sensitization: No information available on the mixture, however none of the components have been classified for skin sensitization (or are below the concentration threshold for classification).

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: No information available on the mixture, however none of the components have been classified for carcinogenicity (or are below the concentration threshold for classification).

Germ Cell Mutagenicity: No information available on the mixture, however none of the components have been classified for germ cell mutagenicity (or are below the concentration threshold for classification).

Reproductive Toxicity: No information available on the mixture, however none of the components have been classified for reproductive toxicity (or are below the concentration threshold for classification).

Section 12: Ecological Information

GHS Classification:
No classified hazards

Toxicity: Not expected to be harmful to aquatic organisms based on test data from the individual components or similar materials.

Persistence and Degradability: Not expected to persist in the environment if spilled or released.

Bioaccumulative Potential: Not expected to bioaccumulate in the environment based on its physical properties.

Mobility in Soil: Expected to have low mobility in soil and sediments with adsorption being the predominant physical process.

Other adverse effects: None anticipated.

Section 13: Disposal Considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations. This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the SDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste. Container contents should be completely used and containers should be emptied prior to discard.

Section 14: Transport Information

U.S. Department of Transportation (DOT)
Shipping Description: ***Not regulated***

International Maritime Dangerous Goods (IMDG)
Shipping Description: ***Not regulated***

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:
Not applicable

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)
UN/ID #: ***Not regulated***

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	---	---	---
Max. Net Qty. Per Package:	---	---	---

Section 15: Regulatory Information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

CERCLA/SARA - Section 313 and 40 CFR 372:
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds):
This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65:
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

Canada:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the Regulations.

WHMIS Hazard Class:
none

National Chemical Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are either on the DSL, or are exempt from DSL listing requirements.

U.S. Export Control Classification Number: EAR99

Section 16: Other Information

Date of Issue:	Previous Issue Date:	SDS Number:	Status:
07-Apr-2014	03-Feb-2012	472980	FINAL

Revised Sections or Basis for Revision:
Format change; Manufacturer (Section 1)

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:
The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

LSPI
Lubrizol Specialty Products, Inc.

Dear Customer:

Enclosed is the Safety Data Sheet (SDS) related to your recent product purchase.

For the SDS to serve its intended purpose it must be forwarded to all locations where the product is used, handled, resold, or stored. In addition, the SDS should be forwarded to all individuals involved with the design, implementation and/or control of operations involving the product. If you resell, repackage or otherwise distribute the purchased product(s) and the product is hazardous, it is your responsibility to provide the SDS to your customers.

SDSs are provided to current customers with the initial purchase of a product and whenever it is revised to reflect new health or safety information. If you currently have copies of this product SDS, please check the issue date of your present copies against the date of the attached SDS and replace any outdated copies.

For products containing SARA Section 313 substances, an SDS is sent to all customers with their first order of the calendar year to comply with the supplier notification provisions of the Superfund Amendment and Reauthorization Act.

In accordance with US EPA rules, should any of your employees allege or exhibit any new adverse health or environmental effects related specifically to the product, please advise us in writing of the circumstances of the allegation according to TSCA, Section 8c.

If you are not the correct recipient of this SDS, if you need to change your company contact information for receiving SDSs or you need additional information about our products, please contact us at 713-339-8703 / 800-897-2774 or by email at LSPI.SDS@Lubrizol.com

Thank you for your continued business.

Lubrizol Specialty Products, Inc.
2000 W Sam Houston Pkwy S
Third Floor, Suite 320
Houston, TX 77042
www.liquidpower.com

Safety Data Sheet

According to OSHA HCS 2012 (29 CFR 1910.1200)

SECTION 1: Identification

Product Identifier: **EP™ 2000 Flow Improver**
SDS Number: **828649**
Relevant identified uses: Flow Improver
Uses Advised Against: All others
24 Hour Emergency Phone Number: +1 800-424-9300 (USA, 24 hours)
+1 703-527-3887 (USA, 24 hours)

Manufacturer/Supplier:
Lubrizol Specialty Products, Inc.
One Briar Lake Plaza
2000 W Sam Houston Pkwy S
Third Floor, Suite 320
Houston, TX 77042

SDS Information:
URL:
www.LubrizolSpecialtyProducts.com
Email: LSPI.SDS@Lubrizol.com

Customer Service:
+1 713-339-8703 or +1 800-897-2774 (USA Toll Free)

SECTION 2: Hazard identification

Classified Hazards
H315 -- Skin corrosion/irritation -- Category 2
H336 -- Specific target organ toxicity (single exposure) -- Category 3
H373 -- Specific target organ toxicity (repeated exposure) -- Category 2
H412 -- Hazardous to the aquatic environment, chronic toxicity -- Category 3

Other Hazards
None Known

Label Elements

WARNING

Causes skin irritation
May cause drowsiness or dizziness
May cause damage to organs through prolonged or repeated exposure
Harmful to aquatic life with long lasting effects

Wash skin thoroughly after handling; Use only outdoors or in a well-ventilated area; Avoid release to the environment; Wear protective gloves/protective clothing and eye/face protection; IF ON SKIN: Wash with plenty of soap and water; If skin irritation or rash occurs: Get medical advice/attention; IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing; Call a POISON CENTER or doctor/physician if you feel unwell; Take off contaminated clothing and wash before reuse; Store in a well-ventilated place. Keep container tightly closed; Dispose of contents/container to an approved waste disposal plant

SECTION 3: Composition/information on ingredients

Chemical Name	CASRN	Concentration[1]
Non-Hazardous Materials	VARIOUS	60 - 80
Ethylene glycol	107-21-1	10 - 40
C11-C15 hydrocarbon solvent	PROPRIETARY	2 - 10

One of the following substances may also be present:

Chemical Name	CASRN	Concentration[1]
Alcohols, C12-14-secondary, ethoxylated	84133-50-6	0 - 6
Alcohol Ethoxylate 1	PROPRIETARY	0 - 6
Alcohol Ethoxylate 2	PROPRIETARY	0 - 6

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing, and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops, seek medical attention. Wash contaminated clothing before reuse.

Inhalation (Breathing): First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects, both acute and delayed: While significant vapor concentrations are not likely, high concentrations can cause minor respiratory irritation, headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Ingestion can cause irritation of the digestive tract, nausea, diarrhea, and vomiting. Effects of overexposure may include coughing, abdominal pain, pulmonary edema (accumulation of fluids in the lungs), irregular heartbeats (arrhythmias), visual disturbances, convulsions and coma. Dry skin and possible irritation with repeated or prolonged exposure.

SECTION 5: Firefighting measures

NFPA 704 Hazard Class

Health: 1 **Flammability:** 1 **Instability:** 0

0 (Minimal)
1 (Slight)
2 (Moderate)
3 (Serious)
4 (Severe)

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous Combustion Products: Combustion may yield carbon monoxide and aldehydes.

Special protective actions for firefighters: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: If spill/release in excess of EPA reportable quantity (see Section 15) is made into the environment, immediately notify the National Response Center (phone number 800-424-8802). Stop and contain spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard.

Methods and material for containment and cleaning up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

SECTION 7: Handling and storage

Precautions for safe handling: Keep away from flames and hot surfaces. Wear eye/face protection. Wash thoroughly after handling. Do not breathe vapors or mists. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8). Spills will produce very slippery surfaces. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: Exposure controls/personal protection

Chemical Name	ACGIH	OSHA	Other
Ethylene glycol	Ceiling: 100 mg/m³	---	---
C11-C15 hydrocarbon solvent	TWA: 200 mg/m³ Skin	---	

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Suggested protective materials: Nitrile. Depending on exposure and use conditions, additional protection may be necessary to prevent skin contact including use of items such as chemical resistant boots, aprons, arm covers, hoods, coveralls, or encapsulated suits.

Respiratory Protection: Respiratory protection is not normally required under intended conditions of use. Emergencies or conditions that could result in significant airborne exposures may require the use of NIOSH approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

SECTION 9: Physical and chemical properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance: White
Physical Form: Liquid
Odor: Mild
Odor Threshold: No data
pH: 6-8
Vapor Density (air=1): <1
Upper Explosive Limits (vol % in air): No data
Lower Explosive Limits (vol % in air): No data
Evaporation Rate (nBuAc=1): Same as water
Particle Size: Not applicable
Percent Volatile: No data
Flammability (solid, gas): Not applicable

Flash Point: > 200 °F / > 93 °C
Test Method: Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
Initial Boiling Point/Range: 222 °F / 106 °C
Vapor Pressure: 24 mm Hg @ 100°F / 37.8°C (estimate)
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: -9 °F / -23 °C
Auto-ignition Temperature: No data
Decomposition Temperature: No data
Specific Gravity (water=1): 1.00 - 1.02 @ 68ºF (20ºC)
Bulk Density: N/D
Viscosity: 85 cP @ 511s-1 @ 77°F (Non-Newtonian)
Solubility in Water: Disperses completely

SECTION 10: Stability and reactivity

Reactivity: Not chemically reactive.

Chemical stability: Stable under normal ambient and anticipated conditions of use.

Possibility of hazardous reactions: Hazardous reactions not anticipated.

Conditions to avoid: Avoid all possible sources of ignition.

Incompatible materials: Avoid contact with strong oxidizing agents

Hazardous decomposition products: Not anticipated under normal conditions of use.

SECTION 11: Toxicological information

Information on Toxicological Effects of Substance/Mixture

Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)
Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Aspiration Hazard: Not expected to be an aspiration hazard.

Skin Corrosion/Irritation: Causes skin irritation. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Causes mild eye irritation.

Skin Sensitization: No information available on the mixture, however none of the components have been classified for skin sensitization (or are below the concentration threshold for classification).

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): May cause drowsiness and dizziness. Based on component information

Specific Target Organ Toxicity (Repeated Exposure): May cause damage to organs through prolonged or repeated exposure. Based on component information.

Carcinogenicity: No information available on the mixture, however none of the components have been classified for carcinogenicity (or are below the concentration threshold for classification).

Germ Cell Mutagenicity: No information available on the mixture, however none of the components have been classified for germ cell mutagenicity (or are below the concentration threshold for classification).

Reproductive Toxicity: No information available on the mixture, however none of the components have been classified for reproductive toxicity (or are below the concentration threshold for classification).

Information on Toxicological Effects of Components

Ethylene glycol

Reproductive Toxicity: Ethylene glycol can cause adverse developmental effects such as skeletal and soft tissue malformations in rodents when administered during gestation at high doses. However, given the absence of reported developmental effects in humans, the relevance of defects in rodents remains largely unknown. It was concluded by the National Toxicology Program Center for the Evaluation of Risks to Human Reproduction that there is negligible concern for reproductive or developmental toxicity in humans at typical exposure levels.

Target Organ(s): Ingestion of ethylene glycol by humans results in kidney damage (renal epithelial damage and oxalate crystals in the tubules). Administration of ethylene glycol resulted in hepatocellular hyaline degeneration in male mice fed diets containing 12,500 or 25,000 ppm ethylene glycol and female mice fed diets containing 50,000 ppm ethylene glycol.

C11-C15 hydrocarbon solvent

Reproductive Toxicity: C11-C15 hydrocarbon solvent applied to the skin of female rats at 494, 330, or 165 mg/kg daily for 7 consecutive weeks (premating, mating, and gestation), or for 8 consecutive weeks in males did not result in systemic, reproductive, or developmental toxicity.

SECTION 12: Ecological information

GHS Classification:
H412 -- Hazardous to the aquatic environment, chronic toxicity -- Category 3
Harmful to aquatic life with long lasting effects.

Toxicity: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Persistence and Degradability: Not expected to persist in the environment if spilled or released.

Bioaccumulative Potential: Not expected to bioaccumulate in the environment based on its physical properties.

Mobility in Soil: Expected to have low mobility in soil and sediments with adsorption being the predominant physical process.

Other adverse effects: None anticipated.

SECTION 13: Disposal considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations. This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the SDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste. Container contents should be completely used and containers should be emptied prior to discard.

SECTION 14: Transport information

U.S. Department of Transportation (DOT)

Shipping Description:	***Shipping description is only for shipments that contain a CERCLA Reportable Quantity in a single container, other shipments are NOT REGULATED. See Section 15 for RQ amount.*** NA3082, Other Regulated Substances, Liquid, n.o.s (Ethylene glycol), 9, III, RQ
Non-Bulk Package Marking:	none
Non-Bulk Package Labeling:	none
Bulk Package/Placard Marking:	None / 3082 ***or*** Class 9 / 3082
Packaging - References:	None; None; 49 CFR 173.241 ***(Exceptions; Non-bulk; Bulk)***

Hazardous Substances: See Section 15 for RQ`s Yes. See Section 15 for RQ's.
Emergency Response Guide: 171

International Maritime Dangerous Goods (IMDG)
Shipping Description: ***Not regulated***
Note: ***U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 25.***

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:
Not applicable

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)
UN/ID #: ***Not regulated***
Note: ***U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 24.***

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	---	---	---
Max. Net Qty. Per Package:	---	---	---

SECTION 15: Regulatory information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health Hazard:	Yes
Chronic Health Hazard:	Yes
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

CERCLA/SARA - Section 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

Chemical Name	Concentration[1]	de minimis
Ethylene glycol	10 - 40	1.0%

EPA (CERCLA) Reportable Quantity (in pounds):
This material contains the following chemicals subject to the reporting requirements of 40 CFR 302.4:

Chemical Name	RQ
Ethylene glycol	5000 lb

California Proposition 65:
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Hazard Classification

Canada:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the Regulations.

WHMIS Hazard Class:
D1B - Toxic materials
D2A - Very toxic materials

National Chemical Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.

All components are either on the DSL, or are exempt from DSL listing requirements.

U.S. Export Control Classification Number: EAR99

SECTION 16: Other information

Date of Issue:	Previous Issue Date:	SDS Number:	Status:
22-May-2014	18-Dec-2014	828649	FINAL

Revised Sections or Basis for Revision:
General edits

Precautionary Statement(s):

P264 - Wash skin thoroughly after handling
P271 - Use only outdoors or in a well-ventilated area
P273 - Avoid release to the environment
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P332 + P313 - If skin irritation occurs: Get medical advice/attention
P304 + P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
P312 - Call a POISON CENTER or doctor if you feel unwell
P362 - Take off contaminated clothing and wash before reuse
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed
P501 - Dispose of contents/ container to an approved waste disposal plant

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:
The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Material Safety Data Sheet

1 . Product and company identification

Product name : FLO FUSION3000 PIPELINE BOOSTER

Supplier : Baker Hughes Canada Company
5050 47th Street S.E.
Calgary, Alberta, T2B 3S1, Canada
For Product Information: 403-537-3850 or 281-276-5400
(8:00 a.m. - 5:00 p.m. cst, Monday - Friday)

Material Uses : Special: Pipeline Booster.

Code : FLOFUS3000

Validation date : 1/18/2016.

Print date : 1/18/2016.

Version : 1

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CANUTEC 613-996-6666 (Canada 24 hours)
Baker Petrolite 800-231-3606 (North America 24 hour)
(001)281-276-5400
CHEMTREC 800-424-9300 (U.S. 24 hour)
CHEMTREC Int'l 01-703-527-3887 (International 24 hours)

Canada

WHMIS (Canada) : Class B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

WHMIS (Pictograms) :

2 . Hazards identification

Physical state : Liquid. [Opaque. Dispersion.]

Odor : Mild. Sweet.

Color : White.

Emergency overview : WARNING!

COMBUSTIBLE LIQUID AND VAPOR. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

At elevated temperatures, vapors can form an ignitable or explosive mixture with air. Can form explosive mixtures at temperatures at or above the flash point. Static discharges can cause ignition or explosion when container is not bonded. Keep away from heat, sparks and flame. Do not get in eyes. Avoid breathing vapor or mist. Avoid contact with skin and clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling. Vapors can travel to a source of ignition and flashback. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material.

Routes of entry : Eye contact.

Potential acute health effects

2 . Hazards identification

Inhalation : Irritating to respiratory system.

Ingestion : Ingestion may cause gastrointestinal irritation and diarrhea.

Skin : Harmful in contact with skin. Irritating to skin.

Eyes : Severely irritating to eyes. Risk of serious damage to eyes.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data. Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/or dermatitis.

Target organs : Contains material which may cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : None known.

Skin : irritation, redness, dryness, cracking

Eyes : pain or irritation, watering, redness

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	Wt. %
Olefin copolymer	86797-81-1	10 - 30
Alkyl alcohol	111-87-5	10 - 30
Hexylene glycol	107-41-5	10 - 30
Alpha olefin	112-41-4	5 - 10
Alkyl alcohol	111-27-3	5 - 10
Ethene homopolymer	9002-88-4	1 - 5
Alpha olefin	592-41-6	1 - 5
2-Butoxyethanol	111-76-2	1 - 5
Medium aliphatic naphtha	64742-88-7	1 - 5

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

4 . First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wear suitable protective clothing and gloves. Remove contaminated clothing and shoes.

5 . Fire-fighting measures

Flammability of the product : Combustible liquid. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back.

Extinguishing media

Suitable : Use dry chemical, CO_2, water spray (fog) or foam.

Not suitable : Do not use water jet.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Hexylene glycol	US ACGIH	-	-	-	-	-	-	25	121	-	
	OSHA PEL 1989	-	-	-	-	-	-	25	125	-	
Alpha olefin	US ACGIH	50	-	-	-	-	-	-	-	-	
2-Butoxyethanol	US ACGIH	20	-	-	-	-	-	-	-	-	
	OSHA PEL	50	240	-	-	-	-	-	-	-	[1]
	OSHA PEL 1989	25	120	-	-	-	-	-	-	-	[1]
Medium aliphatic naphtha	OSHA PEL	100	400	-	-	-	-	-	-	-	
	OSHA PEL 1989	100	400	-	-	-	-	-	-	-	
Ethene homopolymer	US ACGIH	-	10	-	-	-	-	-	-	-	[a]
	US ACGIH	-	3	-	-	-	-	-	-	-	[b]
	OSHA PEL	-	5	-	-	-	-	-	-	-	[c]
	OSHA PEL	-	15	-	-	-	-	-	-	-	[d]

[1]Absorbed through skin.
Form: [a]Inhalable fraction. [b]Respirable fraction [c]Respirable dust [d]Total dust

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

Engineering measures : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Use explosion-proof ventilation equipment.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

8 . Exposure controls/personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Liquid. [Opaque. Dispersion.]

Flash point : Closed cup: 62.778°C (145°F) [SFCC]

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : White.

Odor : Mild. Sweet.

pH : Not available.

Boiling/condensation point : Not available.

Initial Boiling Point : Not available.

Melting/freezing point : Not available.

Relative density : 0.853 (20°C)

Density : 7.1287 (lbs/gal)

Vapor density : >1 [Air = 1]

Odor threshold : Not available.

Evaporation rate : Not available.

VOC : Not available.

Viscosity : Not available.

Solubility (Water) : Insoluble

Vapor pressure : Not available.

Pour Point : Not available.

Partition coefficient (LogKow) : Not available.

10 . Stability and Reactivity

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Materials to avoid : Reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Conditions of reactivity : Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Hexylene glycol	LD50 Dermal	Rabbit	7890 mg/kg	-
	LD50 Oral	Rat	3700 mg/kg	-
Alkyl alcohol	LC50 Inhalation Vapor	Rat	>21 mg/l	1 hours
	LD50 Dermal	Rabbit	2330 mg/kg	-
	LD50 Dermal	Rabbit	2542 mg/kg	-
	LD50 Dermal	Rabbit	1500 to 2000 mg/kg	-
	LD50 Dermal	Rat	3210 mg/kg	-
	LD50 Oral	Rat	710 mg/kg	-
Alkyl alcohol	LD50 Dermal	Rabbit	2000 mg/kg	-
	LD50 Oral	Rat	5000 mg/kg	-
Alpha olefin	LC50 Inhalation Gas.	Rat	32000 ppm	4 hours
	LD50 Dermal	Rabbit	>2000 mg/kg	-
	LD50 Oral	Rat	>5600 mg/kg	-
Alpha olefin	LD50 Dermal	Rabbit	10000 mg/kg	-
	LD50 Oral	Rat	10000 mg/kg	-
2-Butoxyethanol	LC50 Inhalation Gas.	Rat	450 ppm	4 hours
	LD50 Dermal	Guinea pig	>2000 mg/kg	-
	LD50 Dermal	Rabbit	200 mg/kg	-
	LD50 Dermal	Rabbit	99 mg/kg	-
	LD50 Oral	Guinea pig	500 to 2000 mg/kg	-
	LD50 Oral	Rabbit	320 mg/kg	-
Medium aliphatic naphtha	LD50 Dermal	Rabbit	3900 mg/kg	-
	LD50 Oral	Rat	>19500 mg/kg	-
Ethene homopolymer	LD50 Oral	Rat	>3000 mg/kg	-

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Ethene homopolymer	-	3	-	-	-	-
2-Butoxyethanol	A3	3	-	-	-	-

Chronic toxicity Remarks

1) Olefin copolymer

Not available.

2) Alkyl alcohol

Not available.

3) Hexylene glycol

Hexylene glycol is a component of this product. Hexylene glycol did affect male fertility in rats when given orally at a dose of 148 to 190 mg/kg/day for 130 days (Clayton & Clayton, 1982).

4) Alpha olefin

Not available.

5) Alkyl alcohol

The alkyl alcohol produced questionable signs of neurotoxicity in rats exposed for 30 weeks (Perbellini et al, 1978). In

11 . Toxicological information

rabbits, inhalation of the alkyl alcohol for 6 months caused ultrastructural changes in the eyes, with the possibility of decreased color vision (Gendilo et al, 1971). At the time of this review, no chronic effects were found for the alkyl alcohol in humans.

6) Ethene homopolymer

An ethene homopolymer (polyethylene) is a component of this product. Polyethylene in its solid form is not expected to have any significant toxicological effect, except intestinal blockage if swallowed. The only chronic effects seen in humans has been with exposure to polyethylene pyrolysis products. Workers exposed to these pyrolysis products had symptoms of eye, mucous membrane, and skin inrritation, headaches, nausea, coughing, shortness of breath, and flu-like complaints (Robinson et al, 1982), indicative of poymer fume fever. Rats after inhaling polyethylene dust developed mild inflammatory changes in the lungs (Kochetkova et al, 1971). Prolonged inhalation of thermal degradation products from polyethylene caused neurological effects in rats (Zitting & Savolainen, 1979).

7) Alpha olefin

Not available.

8) 2-Butoxyethanol

2-Butoxyethanol [synonym: ethylene glycol monobutyl ether (EGBE)] is a component of this product. EGBE has no tendency to accumulate in humans or animals (Clayton & Clayton, 1994). Little is known about the potential long-term or delayed effects of low-level chronic EGBE exposure.

In mice, treatment with doses of 500 or 1,000 mg/kg/day for 4 days induced atrophy of the thymus and lymphocytopenia, indicative of potential depression of the immune system. Hemolytic anemia was also produced (Grant et al, 1985). Anemia was also produced in rats.

Reproductive studies in laboratory animals have produced mixed results.

Chronic inhalation has produced tumors in laboratory animals [National Toxicology Program (2000) Report NTP TR 484 and NIH Publication No. 00-3974].

In vitro mutagenicity has been demonstrated in human lymphocytes [Vallalobos-Pietnini, R. et al (1989) Revista Internacionial de Contaminaci on Ambiental 5: 41-48]. 2-Butoxyethanol expressed positive in vitro mutagenic results in Salmonella typhimurium TA 97a, with and without metabolic activation [Hoflack, J.C. et al (1995) Mutation Research 341: 281-287].

Chronic ingestion and inhalation has produced fetotoxicity and postnatal developmental toxicity in laboratory animals [Heindel, J.J. et al (1990) Fundmental Applied Toxicology 15: No. 4 683-696 and Tyl, R. et al (1984) Environmental Health Persp. 57: 47-68].

ACGIH has classified 2-butoxyethanol as an animal carcinogen with unknown relevance to humans.

9) Medium aliphatic naphtha

Chronic exposure to some naphthas has been associated with liver, kidney, and brain damage. Naphtha, in general, has been linked with birth defects and menstrual disorders in humans.

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Hexylene glycol	Acute EC50 2800000 to 3200000 µg/l Fresh water	Crustaceans - Water flea - Ceriodaphnia reticulata - Larvae	48 hours
	Acute EC50 3200000 to 3700000 µg/l Fresh water	Daphnia - Water flea - Daphnia magna - Larvae	48 hours
	Acute LC50 10000000 µg/l Marine water	Fish - Inland silverside - Menidia beryllina	96 hours
Alkyl alcohol	Acute LC50 120000 µg/l Marine water	Fish - Bleak - Alburnus alburnus	96 hours
Alkyl alcohol	Acute LC50 13100 µg/l Fresh water	Fish - Fathead minnow - Pimephales promelas	96 hours
	Chronic NOEC 1000 µg/l Fresh water	Daphnia - Water flea - Daphnia magna	21 days
Alpha olefin	Acute EC50 30 mg/l Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
	Acute LC50 25 mg/l Fresh water	Fish - Zebra danio - Danio rerio - Young	96 hours
2-Butoxyethanol	Acute EC50 >1000 mg/l Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
	Acute LC50 1000 mg/l Marine water	Crustaceans - Amphipod - Chaetogammarus marinus - Young	48 hours
	Acute LC50 1250000 µg/l Marine water	Fish - Inland silverside - Menidia beryllina	96 hours

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	NA1993	COMBUSTIBLE LIQUID, N.O.S. (Contains: Alkyl alcohol)	Combustible liquid.	III		**Remarks** This material is not regulated by DOT if transported in a packaging </= 119 gallons.
TDG Classification	Not regulated.	-	-	-		-

14 . Transport information

IMDG Class	Not regulated.	-	-	-		-
IATA-DGR Class	Not regulated.	-	-	-		-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : 128

15 . Regulatory information

Canada

WHMIS (Canada) : Class B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Canada (CEPA DSL): : All components are listed or exempted.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Canadian NPRI : The following components are listed: Hexene (all isomers); 2-Butoxyethanol; Solvent naphtha (petroleum), medium aliph.

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304 : No products were found.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

SARA 313

Supplier notification :

Product name	CAS number	Concentration
2-Butoxyethanol	111-76-2	1 - 5

16 . Other information

Label requirements : COMBUSTIBLE LIQUID AND VAPOR. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

National Fire Protection Association (U.S.A.) :

Date of printing : 1/18/2016.

16 . Other information

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this SDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This SDS was prepared and is to be used for this product. If the product is used as a component in another product, this SDS information may not be applicable.

Conforms to HazCom 2012/United States

SAFETY DATA SHEET

MURPHY OIL USA, INC
200 Peach Street (71730)
P O Box 7000
El Dorado AR 71731-7000
(870) 862-6411

Gasoline (All Grades)

Section 1. Identification

GHS product identifier : Gasoline (All Grades)

Chemical name : Mixture (C4 to C12 Hydrocarbon)

Other means of identification : Motor Gasoline, Petrol, Gas

Product type : Liquid.

Identified uses

Motor Fuel.

Supplier's details : Murphy Oil USA, Inc.
200 Peach Street
El Dorado, AR 71730
Tel: +1-870-875-7600
Fax: 866-933-1563
Website: http://www.murphyusa.com

Emergency telephone number (with hours of operation) : CHEMTREC, U.S. : 1-800-424-9300 International: +1-703-527-3887 # CCN15145
24 hours/day, 7 days/week

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 1
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
GERM CELL MUTAGENICITY - Category 1B
CARCINOGENICITY - Category 1A
TOXIC TO REPRODUCTION (Fertility) - Category 2
TOXIC TO REPRODUCTION (Unborn child) - Category 2
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1
ASPIRATION HAZARD - Category 1
AQUATIC HAZARD (ACUTE) - Category 2
AQUATIC HAZARD (LONG-TERM) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Section 2. Hazards identification

Hazard statements : Extremely flammable liquid and vapor.
Causes serious eye irritation.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
Suspected of damaging fertility or the unborn child.
May be fatal if swallowed and enters airways.
Causes damage to organs through prolonged or repeated exposure.
Toxic to aquatic life with long lasting effects.

Precautionary statements

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Avoid release to the environment. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. High-pressure injection under skin may cause serious damage. Prolonged and repeated exposure to benzene may cause serious injury to blood forming organs and is associated with anemia and to the later development of acute myelogenous leukemia (AML).

Response : Collect spillage. Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Chemical name : Mixture (C4 to C12 Hydrocarbon)

Other means of identification : Motor Gasoline, Petrol, Gas

CAS number/other identifiers

CAS number : Not applicable.

Product code : 501, 502, 503, 504, 505, 506, 507, 508, 509, 556, 557, 558, 561, 562, 563, 565, 566, 567, 568, 571, 572, 573, 575, 576, 577, 578, 579, 581, 582, 583, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 665, 666, 667, 668, 687, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 728, 729, 730, 732, 733, 734, 735, 757, 758, 777, 778, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 806, 809, 810,

Section 3. Composition/information on ingredients

Ingredient name	%	CAS number
Gasoline, natural	89 - 100	8006-61-9
Contains:		
Ethyl Alcohol	<11	64-17-5
Xylene	<5	1330-20-7
Toluene	<5	108-88-3
Benzene	<5	71-43-2
Ethylbenzene	<5	100-41-4
n-Hexane	<5	110-54-3
Naphthalene	<5	91-20-3
1,2,4-Trimethylbenzene	<5	95-63-6
Trimethylbenzene	<5	25551-13-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 20 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 20 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : May cause mild, short-lasting discomfort to eyes.

Inhalation : Minimally toxic. Elevated temperatures or mechanical action may form vapors, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.

Skin contact : Causes skin irritation.

Ingestion : May be fatal if swallowed and enters airways. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Section 4. First aid measures

Inhalation : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
nausea or vomiting
reduced fetal weight
increase in fetal deaths
skeletal malformations

Medical conditions aggravated by overexposure : For the product itself: Laboratory animal studies have shown that prolonged and repeated inhalation exposure to light hydrocarbon vapors in the same boiling range as this product can produce adverse kidney effects in male rats. However, these effects were not observed in similar studies with female rats, male and female mice, or in limited studies with other animal species. Additionally, in a number of human studies, there was no clinical evidence of such effects at normal occupational levels. In 1991, The U.S. EPA determined that the male rat kidney is not useful for assessing human risk. Vapor concentrations above recommended exposure levels are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic and may have other central nervous system effects. Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema. Gasoline unleaded: Caused cancer in animal tests. Chronic inhalation studies resulted in liver tumors in female mice and kidney tumors in male rats. Neither result considered significant for human health risk assessment by the United States EPA and others. Did not cause mutations In Vitro or In Vivo. Negative in inhalation developmental studies and reproductive tox studies. Inhalation of high concentrations in animals resulted in reversible central nervous system depression, but no persistent toxic effect on the nervous system. Non-sensitizing in test animals. Caused nerve damage in humans from abusive use (sniffing).

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet or water-based fire extinguishers.

Specific hazards arising from the chemical : Extremely flammable liquid and vapor. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. This material is toxic to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

Methods and materials for containment and cleaning up

Spill : Use spark-proof tools and explosion-proof equipment. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Avoid breathing vapor or mist. Avoid contact with skin. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Potentially toxic/irritating fumes/vapors may be evolved from heated or agitated material. Do not siphon by mouth. Use only with adequate ventilation. Use proper bonding and/or grounding procedures. Do not use as a cleaning solvent or other non-motor fuel uses. For use as a motor fuel only. It is dangerous and/or unlawful to put fuel into unapproved containers. Do not fill container while it is in or on a vehicle. Static electricity may ignite vapors and cause fire. Place container on ground when filling and keep nozzle in contact with container. Do not use electronic devices (including but not limited to cellular phones, computers, calculators, pagers or other electronic devices, etc.) in or around any fueling operation or storage area unless the devices are certified intrinsically safe by an approved national testing agency and to the safety standards required by national and/or local laws and regulations. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. See also Section 8 for additional information on hygiene measures. Remove contaminated clothing and protective equipment before entering eating areas.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. Ample fire water supply should be available. A fixed sprinkler/deluge system is recommended. Handle containers with care. Open slowly in order to control possible pressure release. Outside or detached storage preferred. Storage containers should be grounded and bonded. Drums must be grounded and bonded and equipped with self-closing valves, pressure vacuum bungs and flame arresters.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Gasoline, natural	**OSHA PEL 1989 (United States, 3/1989).** STEL: 1500 mg/m³ 15 minutes. STEL: 500 ppm 15 minutes. TWA: 900 mg/m³ 8 hours. TWA: 300 ppm 8 hours.
Ethyl Alcohol	**ACGIH TLV (United States, 6/2013).** STEL: 1000 ppm 15 minutes. **NIOSH REL (United States, 4/2013).** TWA: 1900 mg/m³ 10 hours. TWA: 1000 ppm 10 hours. **OSHA PEL (United States, 2/2013).** TWA: 1900 mg/m³ 8 hours. TWA: 1000 ppm 8 hours.
Xylene	**ACGIH TLV (United States, 6/2013).** STEL: 651 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 434 mg/m³ 8 hours. TWA: 100 ppm 8 hours. **OSHA PEL (United States, 2/2013).**

Section 8. Exposure controls/personal protection

	TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours.
Toluene	**NIOSH REL (United States, 4/2013).** STEL: 560 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 375 mg/m³ 10 hours. TWA: 100 ppm 10 hours. **OSHA PEL Z2 (United States, 2/2013).** AMP: 500 ppm 10 minutes. CEIL: 300 ppm TWA: 200 ppm 8 hours. **ACGIH TLV (United States, 6/2013).** TWA: 20 ppm 8 hours.
Benzene	**ACGIH TLV (United States, 6/2013). Absorbed through skin.** STEL: 8 mg/m³ 15 minutes. STEL: 2.5 ppm 15 minutes. TWA: 1.6 mg/m³ 8 hours. TWA: 0.5 ppm 8 hours. **NIOSH REL (United States, 4/2013).** STEL: 1 ppm 15 minutes. TWA: 0.1 ppm 10 hours. **OSHA PEL (United States, 2/2013).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL Z2 (United States, 2/2013).** AMP: 50 ppm 10 minutes. CEIL: 25 ppm TWA: 10 ppm 8 hours.
Ethy benzene	**ACGIH TLV (United States, 6/2013).** TWA: 20 ppm 8 hours. **NIOSH REL (United States, 4/2013).** STEL: 545 mg/m³ 15 minutes. STEL: 125 ppm 15 minutes. TWA: 435 mg/m³ 10 hours. TWA: 100 ppm 10 hours. **OSHA PEL (United States, 2/2013).** TWA: 435 mg/m³ 8 hours. TWA: 100 ppm 8 hours.
n-Hexane	**ACGIH TLV (United States, 6/2013). Absorbed through skin.** TWA: 50 ppm 8 hours. **NIOSH REL (United States, 4/2013).** TWA: 180 mg/m³ 10 hours. TWA: 50 ppm 10 hours. **OSHA PEL (United States, 2/2013).** TWA: 1800 mg/m³ 8 hours. TWA: 500 ppm 8 hours.
Naphthalene	**ACGIH TLV (United States, 6/2013). Absorbed through skin.** STEL: 79 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 52 mg/m³ 8 hours. TWA: 10 ppm 8 hours. **NIOSH REL (United States, 4/2013).** STEL: 75 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 50 mg/m³ 10 hours. TWA: 10 ppm 10 hours. **OSHA PEL (United States, 2/2013).** TWA: 50 mg/m³ 8 hours. TWA: 10 ppm 8 hours.
1,2,4-Trimethylbenzene	**ACGIH TLV (United States, 6/2013).** TWA: 123 mg/m³ 8 hours. TWA: 25 ppm 8 hours. **NIOSH REL (United States, 4/2013).** TWA: 125 mg/m³ 10 hours. TWA: 25 ppm 10 hours. **OSHA PEL 1989 (United States, 3/1989).** TWA: 25 ppm 8 hours. TWA: 125 mg/m³ 8 hours.

Section 8. Exposure controls/personal protection

Trimethy benzene	**ACGIH TLV (United States, 6/2013).** TWA: 123 mg/m³ 8 hours. TWA: 25 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** TWA: 25 ppm 8 hours. TWA: 125 mg/m³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Use gloves appropriate for work or task being performed. Recommended: If prolonged or repeated contact is likely, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves. If contact with forearms is likely, wear gauntlet style gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or supplied air respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid.

Color : Clear (May Be Dyed).

Odor : Petroleum/Solvent.

Odor threshold : Not available.

pH : Not applicable.

Melting point : Not available.

Boiling point : 20°C (68°F)

Section 9. Physical and chemical properties

Flash point : Closed cup: <-40°C (<-40°F) [Pensky-Martens.]

Evaporation rate : >10 (Butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 1.4%
Upper: 7.5%

Vapor pressure : 7 psi to 13.5 psi, Reid Vapor Pressure (RVP) [depending on the time of year]

Vapor density : 3 [Air = 1]

Relative density : 0.72

Solubility : Negligible.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : >254°C (>489.2°F)

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C (104°F)): <0.01 cm^2/s (<1 cSt)

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatible materials : Halogens, Strong Acids, Alkalies, Strong oxidizers.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Ethyl Alcohol	LC50 Inhalation Vapor	Rat	124700 mg/m³	4 hours
	LD50 Oral	Rat	7 g/kg	-
Xylene	LC50 Inhalation Gas.	Rat	5000 ppm	4 hours
	LD50 Oral	Rat	4300 mg/kg	-
Toluene	LC50 Inhalation Vapor	Rat	49 g/m³	4 hours
	LD50 Oral	Rat	636 mg/kg	-
Benzene	LD50 Oral	Rat	930 mg/kg	-
Ethy benzene	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	3500 mg/kg	-
n-Hexane	LC50 Inhalation Gas.	Rat	48000 ppm	4 hours
	LD50 Oral	Rat	15840 mg/kg	-
Naphthalene	LD50 Dermal	Rabbit	>20 g/kg	-
	LD50 Oral	Rat	490 mg/kg	-
1,2,4-Trimethylbenzene	LC50 Inhalation Vapor	Rat	18000 mg/m³	4 hours
	LD50 Oral	Rat	5 g/kg	-

Section 11. Toxicological information

Trimethy benzene	LD50 Oral	Rat	8970 mg/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Gasoline, natural	Eyes - Mild irritant	Human	-	8 hours 140 ppm	-
	Eyes - Moderate irritant	Man	-	1 hours 500 ppm	-
Ethyl Alcohol	Eyes - Moderate irritant	Rabbit	-	100 µL	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 mg	-
	Eyes - Mild irritant	Rabbit	-	24 hours 500 mg	-
	Eyes - Moderate irritant	Rabbit	-	0.06 minutes 100 mg	-
	Eyes - Severe irritant	Rabbit	-	500 mg	-
	Skin - Mild irritant	Rabbit	-	400 mg	-
Xylene	Eyes - Mild irritant	Rabbit	-	87 mg	-
	Eyes - Severe irritant	Rabbit	-	24 hours 5 mg	-
	Skin - Mild irritant	Rat	-	8 hours 60 µL	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-
	Skin - Moderate irritant	Rabbit	-	100%	-
Toluene	Eyes - Mild irritant	Rabbit	-	0.5 minutes 100 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 mg	-
	Eyes - Mild irritant	Rabbit	-	870 µg	-
	Eyes - Severe irritant	Rabbit	-	24 hours 2 mg	-
	Skin - Mild irritant	Pig	-	24 hours 250 µL	-
	Skin - Mild irritant	Rabbit	-	435 mg	-
	Skin - Moderate irritant	Rabbit	-	500 mg	-
Benzene	Eyes - Moderate irritant	Rabbit	-	88 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 mg	-
	Eyes - Severe irritant	Rabbit	-	24 hours 2 mg	-
	Skin - Mild irritant	Rat	-	8 hours 60 µL	-
	Skin - Mild irritant	Rabbit	-	24 hours 15 mg	-
Ethy benzene	Eyes - Severe irritant	Rabbit	-	500 mg	-
	Skin - Mild irritant	Rabbit	-	24 hours 15 mg	-
n-Hexane	Eyes - Mild irritant	Rabbit	-	10 milligrams	-
Naphthalene	Skin - Mild irritant	Rabbit	-	495 mg	-
	Skin - Severe irritant	Rabbit	-	24 hours 0.05 mL	-
Trimethy benzene	Eyes - Mild irritant	Rabbit	-	24 hours 500 mg	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 mg	-

Sensitization

There is no data available.

Carcinogenicity

Classification

Product/ingredient name	OSHA	IARC	NTP	ACGIH	EPA	NIOSH
Gasoline, natural	-	2B	-	-	-	+
Xylene	-	3	-	A4	-	-
Toluene	-	3	-	A4	-	-
Benzene	+	1	Known to be a human carcinogen.	A1	-	+
Ethylbenzene	-	2B	-	A3	-	None.
Naphthalene	-	2B	Reasonably anticipated to be a human carcinogen.	A4	-	None.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Ethyl Alcohol	Category 3	Not applicable.	Narcotic effects
Toluene	Category 3	Not applicable.	Narcotic effects
n-Hexane	Category 3	Not applicable.	Narcotic effects
1,2,4-Trimethylbenzene	Category 3	Not applicable.	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Name	Category	Route of exposure	Target organs
Toluene	Category 2	Not determined	Not determined
Benzene	Category 1	Not determined	Not determined
n-Hexane	Category 2	Not determined	Not determined

Aspiration hazard

Name	Result
Gasoline, natural	ASPIRATION HAZARD - Category 1
Toluene	ASPIRATION HAZARD - Category 1
Benzene	ASPIRATION HAZARD - Category 1
n-Hexane	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Eye contact : May cause mild, short-lasting discomfort to eyes.

Inhalation : Minimally toxic. Elevated temperatures or mechanical action may form vapors, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.

Skin contact : Causes skin irritation.

Ingestion : May be fatal if swallowed and enters airways. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
nausea or vomiting
reduced fetal weight
increase in fetal deaths
skeletal malformations

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : No known significant effects or critical hazards.

Potential delayed effects : No known significant effects or critical hazards.

Long term exposure

Potential immediate effects : No known significant effects or critical hazards.

Section 11. Toxicological information

Potential delayed effects : No known significant effects or critical hazards.

Potential chronic health effects

General : Causes damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : May cause genetic defects.

Teratogenicity : Suspected of damaging the unborn child.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : Suspected of damaging fertility.

Numerical measures of toxicity

Acute toxicity estimates

Route	ATE value
Oral	4244.9 mg/kg
Dermal	11111.1 mg/kg
Inhalation (gases)	101010.1 ppm
Inhalation (vapors)	137.9 mg/L

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Gasoline, natural	Acute EC50 17.5 mg/L Marine water	Crustaceans - Artemia sp. - Nauplii	48 hours
	Acute EC50 1.5 mg/L Marine water	Daphnia - Daphnia magna - Neonate	48 hours
Ethyl Alcohol	Acute EC50 17.921 mg/L Marine water	Algae - Ulva pertusa	96 hours
	Acute EC50 2000 µg/l Fresh water	Daphnia - Daphnia magna	48 hours
	Acute LC50 25500 µg/l Marine water	Crustaceans - Artemia franchiscana - Larvae	48 hours
	Acute LC50 42000 µg/l Fresh water	Fish - Oncorhynchus mykiss	4 days
	Chronic NOEC 4.995 mg/L Marine water	Algae - Ulva pertusa	96 hours
	Chronic NOEC 0.375 ul/L Fresh water	Fish - Gambusia holbrooki - Larvae	12 weeks
Xylene	Acute IC50 10 mg/L	Algae	72 hours
	Acute LC50 8500 µg/l Marine water	Crustaceans - Palaemonetes pugio	48 hours
	Acute LC50 13400 µg/l Fresh water	Fish - Pimephales promelas	96 hours
Toluene	Acute EC50 433 ppm Marine water	Algae - Skeletonema costatum	96 hours
	Acute EC50 12500 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 11600 µg/l Fresh water	Crustaceans - Gammarus pseudolimnaeus - Adult	48 hours
	Acute EC50 6000 µg/l Fresh water	Daphnia - Daphnia magna - Juvenile (Fledgling, Hatchling, Weanling)	48 hours
	Acute LC50 5500 µg/l Fresh water	Fish - Oncorhynchus kisutch - Fry	96 hours
	Chronic NOEC 500000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
	Chronic NOEC 1000 µg/l Fresh water	Daphnia - Daphnia magna	21 days
Benzene	Acute EC50 29000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 1360000 µg/l Fresh water	Algae - Scenedesmus abundans	96 hours
	Acute EC50 9230 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 21000 µg/l Marine water	Crustaceans - Artemia salina - Nauplii	48 hours
	Acute LC50 5.28 ul/L Fresh water	Fish - Oncorhynchus gorbuscha - Fry	96 hours
	Chronic NOEC 1.5 to 5.4 ul/L Marine water	Fish - Morone saxatilis - Juvenile (Fledgling, Hatchling, Weanling)	4 weeks
Ethylbenzene	Acute EC50 4600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 3600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
	Acute EC50 2970 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 5200 µg/l Marine water	Crustaceans - Americamysis bahia	48 hours
	Acute LC50 4200 µg/l Fresh water	Fish - Oncorhynchus mykiss	96 hours
	Chronic NOEC 1000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
n-Hexane	Acute LC50 113000 µg/l Fresh water	Fish - Oreochromis mossambicus	96 hours
Naphthalene	Acute EC50 1600 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 2350 µg/l Marine water	Crustaceans - Palaemonetes pugio	48 hours
	Acute LC50 213 µg/l Fresh water	Fish - Melanotaenia fluviatilis - Larvae	96 hours

Section 12. Ecological information

1,2,4-Trimethylbenzene	Chronic NOEC 0.67 ppm Fresh water Acute LC50 4910 µg/l Marine water	Fish - Oncorhynchus kisutch Crustaceans - Elasmopus pectenicrus - Adult	40 days 48 hours
Trimethylbenzene	Acute LC50 22.4 mg/L Fresh water Acute LC50 5600 µg/l Marine water	Fish - Tilapia zillii Crustaceans - Palaemonetes pugio	96 hours 48 hours

Persistence and degradability

There is no data available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Gasoline, natural	-	10 to 2500	high
Ethyl Alcohol	-0.32	-	low
Xylene	3.12	8.1 to 25.9	low
Toluene	2.73	90	low
Benzene	2.13	11	low
Ethylbenzene	3.6	-	low
n-Hexane	4	501.187	high
Naphthalene	3.4	36.5 to 168	low
1,2,4-Trimethylbenzene	3.63	243	low
Trimethylbenzene	3.4 to 3.8	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : There is no data available.

Other adverse effects : **Mobility**
More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.
Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.
Persistence/degradability
Majority of components -- Expected to be inherently biodegradable.
More volatile component -- Expected to degrade rapidly in air.
Bioaccumulative potential
Majority of components -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Empty containers or liners may retain some product residues. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Xylene	1330-20-7	Listed	U239
Toluene	108-88-3	Listed	U220
Benzene	71-43-2	Listed	U019
Naphthalene	91-20-3	Listed	U165

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	UN1203	UN1203	UN1203
UN proper shipping name	GASOLINE	GASOLINE	GASOLINE
Transport hazard class(es)	3 	3 	3 
Packing group	II	II	II
Environmental hazards	No.	Yes.	No.
Additional information	The marine pollutant mark is not required when transported on inland waterways in sizes of ≤5 L or ≤5 kg or by road, rail, or inland air in non-bulk sizes. **Reportable quantity** 202.02 lbs / 91.717 kg [33.652 gal / 127.38 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg. **Emergency schedules (EmS)** F-E, S-E	The environmentally hazardous substance mark may appear if required by other transportation regulations.

AERG : 128

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) PAIR**: Naphthalene
TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): All components are listed or exempted.
Clean Water Act (CWA) 307: Toluene; Benzene; Ethylbenzene; Naphthalene
Clean Water Act (CWA) 311: Xylene; Toluene; Benzene; Ethylbenzene; Naphthalene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

Section 15. Regulatory information

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Gasoline, natural	89 - 100	No.	No.	No.	No.	Yes.
Ethyl Alcohol	<11	Yes.	No.	No.	Yes.	No.
Xylene	<5	Yes.	No.	No.	Yes.	No.
Toluene	<5	Yes.	No.	No.	Yes.	Yes.
Benzene	<5	Yes.	No.	No.	Yes.	Yes.
Ethylbenzene	<5	Yes.	No.	No.	Yes.	Yes.
n-Hexane	<5	Yes.	No.	No.	Yes.	Yes.
Naphthalene	<5	Yes.	No.	No.	Yes.	Yes.
1,2,4-Trimethy benzene	<5	Yes.	No.	No.	Yes.	No.
Trimethylbenzene	<5	Yes.	No.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Xylene Toluene Benzene Ethylbenzene n-Hexane Naphthalene 1,2,4-Trimethylbenzene	1330-20-7 108-88-3 71-43-2 100-41-4 110-54-3 91-20-3 95-63-6	<5 <5 <5 <5 <5 <5 <5
Supplier notification	Xylene Toluene Benzene Ethylbenzene n-Hexane Naphthalene 1,2,4-Trimethylbenzene	1330-20-7 108-88-3 71-43-2 100-41-4 110-54-3 91-20-3 95-63-6	<5 <5 <5 <5 <5 <5 <5

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : The following components are listed: Gasoline, natural; Ethyl Alcohol; Xylene; Toluene; Benzene; Ethylbenzene; n-Hexane; Naphthalene; 1,2,4-Trimethylbenzene; Trimethylbenzene

New York : The following components are listed: Xylene; Toluene; Benzene; Ethylbenzene; n-Hexane; Naphthalene

New Jersey : The following components are listed: Gasoline, natural; Ethyl Alcohol; Xylene; Toluene; Benzene; Ethylbenzene; n-Hexane; Naphthalene; 1,2,4-Trimethylbenzene; Trimethylbenzene

Section 15. Regulatory information

Pennsylvania : The following components are listed: Ethyl Alcohol; Xylene; Toluene; Benzene; Ethylbenzene; n-Hexane; Naphthalene; 1,2,4-Trimethylbenzene; Trimethylbenzene

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Toluene	No.	Yes.	No.	7000 µg/day (ingestion) 13000 µg/day (inhalation)
Benzene	Yes.	Yes.	6.4 µg/day (ingestion) 13 µg/day (inhalation)	24 µg/day (ingestion) 49 µg/day (inhalation)
Ethylbenzene	Yes.	No.	41 µg/day (ingestion) 54 µg/day (inhalation)	No.
Naphthalene	Yes.	No.	Yes.	No.

Section 16. Other information

History

Date of issue mm/dd/yyyy : 07/15/2014

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Version : 3

Revised Section(s) : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Prepared by : KMK Regulatory Services Inc.

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER

Petroleum Crude Oil—Light Synthetic

OTHER MEANS OF IDENTIFICATION

UN-Number	UN1268
Synonyms	Premium Synthetic (PSY), Hardisty Synthetic Crude (HSC), Synthetic Sweet Blend (SYN).
Chemical Category	Crude oils—extremely flammable

RECOMMENDED USE

No information available

RESTRICTIONS OF USE

No information available

SUPPLIER INFORMATION

Enbridge Pipelines Inc.
10201 Jasper Avenue
Edmonton, Alberta T5J 3N7
Canada
TEL: 1-780-420-5210

EMERGENCY CONTACT INFORMATION

CHEMTREC	1-800-424-9300 for US 703-527-3887 outside US
CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
1,2,4-Trimethylbenzene	95-63-6	0-5	
Benzene	71-43-2	0-5	
Butane	106-97-8	0-5	
Cyclohexane	110-82-7	0-5	
Decane	124-18-5	0-10	
Distillates (petroleum), hydrotreated middle	64742-46-7	0-60	
Ethylbenzene	100-41-4	0-5	
Fuels, diesel, No. 2	68476-34-6	0-30	
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	0-100	
Heptane	142-82-5	0-7	
Hexane	110-54-3	0-7	
Methylcyclohexane	108-87-2	0-7	
Naphtha (petroleum), hydrotreated light	64742-49-0	0-7	
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	0-60	
Octane	111-65-9	0-7	
o-Xylene	95-47-6	0-5	
Petroleum distillate (naphtha)	8002-05-9	0-100	
Toluene	108-88-3	0-5	
Xylene	1330-20-7	0-5	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen.
- Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment	• Stop leak if you can do it without risk. • Contain and recover liquid when possible. • A vapor suppressing foam may be used to reduce vapors. • Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming. • Use water spray to reduce vapors or divert vapor cloud drift. • A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.
Methods for Cleaning Up	• Clean up spill immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges. • Do not cut drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water.

	Handling	• Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	**Storage**	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
1,2,4-Trimethylbenzene	–	–	TWA 25 ppm TWA 125 mg/m^3
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Butane	STEL 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3
Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm

Ethylbenzene	TLV 20 ppm TLV 87 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 125 ppm STEL 545 mg/m³ IDLH 800 ppm
Fuels, diesel, No. 2	TLV 100 mg/m³	–	–
Heptane	TLV 400 ppm TLV 1640 mg/m³ STEL 500 ppm STEL 2000 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 85 ppm TWA 350 mg/m³ Ceiling 440 ppm Ceiling 1800 mg/m³ IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m³	PEL 500 ppm PEL 1800 mg/m³	TWA 50 ppm TWA 180 mg/m³ IDLH 1100 ppm
Methylcyclohexane	TLV 400 ppm TLV 1610 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 400 ppm TWA 1600 mg/m³ IDLH 1200 ppm
Octane	TLV 300 ppm TLV 1401 mg/m³	PEL 500 ppm PEL 2350 mg/m³	TWA 75 ppm TWA 350 mg/m³ Ceiling 385 ppm Ceiling 1800 mg/m³ IDLH 1000 ppm
o-Xylene	TLV 100 ppm STEL 150 ppm	–	TLV 100 ppm STEL 150 ppm
Petroleum distillate (naptha)	–	–	TWA 350 mg/m³ Ceiling 1800 mg/m³
Toluene	TLV 20 ppm TLV 75 mg/m³	PEL 200 ppm STEL 300 mg/m³	TWA 100 ppm TWA 375 mg/m³ STEL 150 ppm STEL 560 mg/m³ IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m³ STEL 150 ppm STEL 651 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 150 ppm STEL 655 mg/m³ IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES	**Eye and Face**	• Wear face shield and eye protection.
	Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
	Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
	General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION	**Physical State**	Liquid	**Odor**	Petroleum like odor
	Substance Type	Mixture	**Odor Threshold**	No data available
	Appearance	Yellow/green to Brown/black liquid		
PROPERTIES	**pH**	No data available	**Vapor pressure**	No data available
	Melting Point/ Freezing Point	No data available	**Vapor density**	No data available
	Boiling Point/ Boiling Range	-18 to 560°C -0.4 to 1040°F	**Relative density**	No data available
	Flash Point	>-35 °C >-31 °F	**Water Solubility**	Negligible
	Evaporation Rate	No data available	**Partition coefficient: n-octanol/water**	No data available
	Flammability (solid, gas)	No data available	**Decomposition temperature**	No data available
	Upper Flammability Limit	No data available	**Specific Gravity**	No data available
	Lower Flammability Limit	No data available		
	Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure

POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing.
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
1,2,4-Trimethylbenzene	5 g/kg (Rat)	–	18000 mg/m^3 (Rat) 4h
Benzene	=1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Butane	–	–	658 mg/L (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
Decane	–	–	>1369 ppm (Rat) h h 72300 mg/m^3 (Rat) 2 h
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Methylcyclohexane	> 3200 mg/kg (Rat)	–	–
Naphtha, (petroleum), heavy, hydrotreated	= >6 g/kg (Rat)	–	= 8500 mg/m^3 (Rat)
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
o-Xylene	= 3910 mg/kg (Rat)	–	–
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–

Xylenes	= 3500 mg/kg (Rat) > 1700 mg/kg (Rabbit)	> 4350 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene	• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Xylenes	• Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.
Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE	**Sensitization**	• No information available
	Mutagenic Effects	• May cause genetic defects
	Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Fuels, diesel, No. 2	A3	X	–	–	–
Ethylbenzene	A3	–	Group 2B	Evidence	X
Hexane	–	X	–	–	–
Petroleum distillate (naphtha)	–	–	Group 3	–	–
Toluene	A4	–	Group 3	Evidence	–
o-Xylene	A4	–	Group 3	Evidence	–
Xylenes	A4	–	Group 3	Evidence	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY	• Suspected of damaging fertility or the unborn child.
STOT—SINGLE EXPOSURE	• May cause drowsiness and dizziness.
STOT—REPEATED EXPOSURE	• Causes damage to organs through prolonged or repeated exposure.
ASPIRATION HAZARD	May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Decane	EC50 24 h: = 0.043 mg/L (Chlorella vulgaris)	–	EC50 48 h: >90-280 mg/L (Daphnia magna)	–
Distillates (petroleum), hydrotreated middle	–	LC50 96h : 35 mg/L (Pimephales promelas) LC50 96h: >10000 mg/L (Pimephales promelas)	–	–
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)
Fuels, diesel, No. 2	–	LC50 96 h: = 35 mg/L (Pimephales promelas)	–	–
Gas Oils, Petroleum, Hydrodesulfurized	LC50 96 h: = 35 mg/L (Pimephales promelas)	–	LC50 96 h: < 1.00 ppm (Diatomus forbesi)	–
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Methylcyclohexane	–	LC50 96hr: 72.0 mg/l (Golden Shiner)	–	–
Naphtha (petroleum), hydrotreated light	–	–	LC50 96 h: = 2.6 mg/L (Chaetogammarus marinus)	–
Naphtha, (petroleum), heavy, hydrotreated	–	LC50 96 h: = 2200 mg/L (Pimephales promelas)	LC50 96 h: = 2.6 mg/L (Chaetogammarus marinus)	–
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
o-Xylene	EC50 24 h: = 55000 ug/L (Chlorella vulgaris)	–	–	LC50 96h: 1.3 ppm Crangon franciscorum (Shrimp)
Petroleum distillate (naphtha)	–	LC50: 258 mg/L Salmo gairdneri 96 h static	EC50 48 h: < 0.26 mg/L Static (Daphnia magna) EC50 24 h: = 36 mg/L (Daphnia magna)	–
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	–

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
1,2,4-Trimethylbenzene	3.78
Benzene	1.83
Butane	2.89
Cyclohexane	3.44
Decane	5.1
Ethylbenzene	3.118
Heptane	4.66
Hexane	3.90
Methylcyclohexane	3.61
Octane	5.18
o-Xylene	3.12
Toluene	2.65
Xylene	2.77-3.15

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
1,2,4-Trimethylbenzene	Low
Benzene	High
Butane	Low
Cyclohexane	Moderate
Decane	Immobile
Ethylbenzene	Low
Heptane	Moderate
Hexane	High

Octane	Immobile
o-Xylene	Very High to Moderate
Petroleum distillate (naptha)	High
Toluene	High to Moderate
Xylene	Very High to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste	• This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility. • This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP). • This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s). • It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.
Packaging Waste	• Container contents should be completely used and containers should be emptied prior to discard. • Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. • Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner. • To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1268	Petroleum Distillate, N.O.S.	3	I	Emergency response guide number: 128
TDG	UN1268	Petroleum Distillate, N.O.S.	3	I	–
IMO/IMDG	UN1268	Petroleum Distillate, N.O.S.	3	I	EmS No. F-E, S-E
IATA/ICAO	UN1268	Petroleum Distillate, N.O.S.	3	I	ERG Code 3L

SPECIAL RECAUTIONS FOR USER

- None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	1000 lb final RQ; 454 kg final RQ
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	10 lb RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb RQ
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	1000 lb RQ
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	Not Listed
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)— HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed

Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	X
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed

Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	Not Listed
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS #	CLASSIFICATION
1,2,4-Trimethylbenzene	95-63-6	B3
Benzene	71-43-2	B2, D2A, D2B
Butane	106-97-8	A, B1
Cyclohexane	110-82-7	B2, D2B
Decane	124-18-5	B3, D2B
Distillates (petroleum), hydrotreated middle	64742-46-7	Uncontrolled product according to WHMIS classification criteria
Ethylbenzene	100-41-4	B2, D2A, D2B
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	B2, D2B
Hexane	110-54-3	B2, D2A, D2B
Methylcyclohexane	108-87-2	B2
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	B3
Octane	111-65-9	B2, D2B
o-Xylene	95-47-6	B2, D2B

Petroleum distillate (naphtha)	8002-05-9	B2
Toluene	108-88-3	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed

Octane	111-65-9	Not Listed
o-Xylene	95-47-6	Not Listed
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	**Flammability:** 4	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 2	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 5/13/15

REVISION DATE 5/13/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER	Petroleum Crude Oil—Dilbit	
OTHER MEANS OF IDENTIFICATION	**UN-Number**	UN1993
	Synonyms	Dilbit Kearl, Diluted Kearl Bitumen, Kearl Blend, Kearl Dilbit, Kearl Lake Dilbit (KDB)
	Chemical Category	Crude oils—extremely flammable Bitumen Products
RECOMMENDED USE	Feedstock	
RESTRICTIONS OF USE	No information available	
SUPPLIER INFORMATION	Enbridge Pipelines Inc. 10201 Jasper Avenue Edmonton, Alberta T5J 3N7 Canada TEL: 1-780-420-5210	
EMERGENCY CONTACT INFORMATION	**CHEMTREC**	1-800-424-9300 for US 703-527-3887 outside US
	CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
Benzene	71-43-2	0-1.2	
Bitumen	8052-42-4	0-85	
Hexane	110-54-3	0-3.5	
Natural Gas Condensate	68919-39-1	15-40	
Sulfur	7704-34-9	0-3.5	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time. All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation

- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.

Skin

- IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

Eye

- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Ingestion

- Do NOT induce vomiting. Call a physician or poison control center.
- Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media

- SMALL FIRES: Dry chemical, CO_2, water spray or regular foam.
- LARGE FIRE: Water spray, fog or regular foam.

Unsuitable Extinguishing Media

- CAUTION: Use of water spray when fighting fire may be inefficient.
- Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products

- Carbon monoxide, Carbon dioxide (CO2), Nitrogen oxides (NOx), Oxides of sulfur, Hydrogen Sulfide.
- Aldehydes, aromatic and other hydrocarbons.

Sensitivity to Mechanical Impact

- None.

Sensitivity to Static Discharge

- Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen.
- Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions

- Evacuate personnel to safe areas.
- Remove all sources of ignition.
- Deny entry to unauthorized and unprotected personnel.
- Use personal protective equipment.
- Avoid contact with skin, eyes and clothing.
- Stop leak if you can do it without risk.
- Keep people away from and upwind of spill/leak.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Ventilate enclosed areas.
- Do not walk through spilled material.

Protective Equipment

- Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk.
- Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment

- Stop leak if you can do it without risk.
- Contain and recover liquid when possible.
- A vapor suppressing foam may be used to reduce vapors.
- Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming.
- Use water spray to reduce vapors or divert vapor cloud drift.
- A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.

Methods for Cleaning Up

- Clean up spills immediately.
- LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST.
- SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal.
- Use appropriate Personal Protective Equipment (PPE).
- Use clean non-sparking tools to collect absorbed material.
- Vacuum spilled material.
- Try to work upwind of spill.
- All equipment used when handling the product must be grounded.
- Recover and return free product to proper containers
- Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids.
- Do not place spilled materials back in the original container.
- Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling

- This material is a static accumulator. A liquid is typically considered a nonconductive, static accumulator if its conductivity is below 100 pS/m (100x10E-12 Siemens per meter) and is considered a semiconductive, static accumulator if its conductivity is below 10,000 pS/m. Whether a liquid is nonconductive or semiconductive, the precautions are the same. A number of factors, for example liquid temperature, presence of contaminants, anti-static additives and filtration can greatly influence the conductivity of a liquid.
- Hydrogen sulfide (H_2S) may be given off when this material is heated.
- All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces.
- The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes).
- The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits.
- Take precautionary measures against static discharges.

Handling

- Do not cut drill, grind or weld on empty containers since they may contain explosive residues.
- Stay upwind and vent open hatches before uploading.
- Avoid contact with skin, eyes and clothing.
- Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water.
- Wear personal protective equipment.
- Remove and wash contaminated clothing before re-use.
- Do not eat, drink or smoke when using this product.
- Do not take internally.
- Wash thoroughly after handling.
- Empty containers pose a potential fire and explosion hazard.

CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Storage	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Bitumen	TLV 0.5 mg/m^3	–	Ceiling 5 mg/m^3
Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm

APPROPRIATE ENGINEERING CONTROLS

• Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.

Respiratory	• Follow the OSHA respiratory regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid
Substance Type	Mixture
Appearance	Black
Odor	Petroleum/solvent like odor
Odor Threshold	No data available

PROPERTIES

pH	No data available
Melting Point/ Freezing Point	No data available
Boiling Point/ Boiling Range	68 to 1049 °F 20 to 565°C
Flash Point	<-0.4 to 60.8 °F <-18 to 16 °C (Closed Cup)
Evaporation Rate	No data available
Flammability (solid, gas)	No data available
Upper Flammability Limit	No data available
Lower Flammability Limit	No data available
Viscosity	52 to 96 Centistoke (cSt, cS) or mm^2/sec @ 38 °C (100.4 °F)
Vapor pressure	12 to 21 kPa @ 24 °C (75.2 °F)
Vapor density	No data available
Density	900 to 1200 kg/m^3 @ 15.5 °C (59.9°F
Water Solubility	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition temperature	No data available
Decomposition temperature	No data available
Specific Gravity	0.94

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, hydrogen sulfide, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
Benzene	1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Bitumen	>5000 mg/kg (Rat)	–	>94.4 mg/m^3 (Rat)
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Sulfur	–	–	1660 mg/m^3 (Mammal)

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene

• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.

Hexane	• This product may contain hexane at a level of 5.0% Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Hydrogen Sulfide Gas (H_2S)	• Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Bitumen	A4	–	–	–	–
Hexane	–	X	–	–	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY

• Suspected of damaging fertility or the unborn child.

STOT—SINGLE EXPOSURE

• May cause drowsiness and dizziness.

STOT—REPEATED EXPOSURE

• Causes damage to organs through prolonged or repeated exposure.

ASPIRATION HAZARD

May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Sulfur	–	LC50 96h: <14000 ug/l (Lepomis macrochirus)	EC50 48 h: = >5000000 ug/L (Daphnia magna)	–

PERSISTENCE AND DEGRADABILITY

- Low molecular wt. component—Expected to be inherently biodegradable
- High molecular wt. component—Expected to be persistent.

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
Benzene	1.83
Hexane	3.90

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
Benzene	High
Hexane	High

OTHER ADVERSE EFFECTS

- VOC (EPA Method 24): 2.353 lbs/gal

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.
- This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP).
- This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s).
- It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging Waste

- Container contents should be completely used and containers should be emptied prior to discard.
- Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations.
- Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner.
- To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1993	FLAMMABLE LIQUIDS, N.O.S.	3	I	Emergency response guide number: 128
TDG	UN1993	FLAMMABLE LIQUIDS, N.O.S.	3	I	Special Provision: 16
IMO/IMDG	UN1993	FLAMMABLE LIQUIDS, N.O.S.	3	I	EMS No. F-E, S-E
IATA/ICAO	UN1993	FORBIDDEN	–	–	–

SPECIAL RECAUTIONS FOR USER

- None specified

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
Benzene	71-43-2	10 lb RQ

U.S.—CWA (CLEAN WATER ACT)—HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
Benzene	71-43-2	X
Bitumen	8052-42-4	Not Listed
Hexane	110-54-3	Not Listed
Natural gas condensates (petroleum)	68919-39-1	Not Listed
Sulfur	7704-34-9	Not Listed

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
Benzene	71-43-2	X
Bitumen	8052-42-4	Not Listed
Hexane	110-54-3	Not Listed
Natural gas condensates (petroleum)	68919-39-1	Not Listed
Sulfur	7704-34-9	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS #	CLASSIFICATION
Benzene	71-43-2	B2, D2A, D2B
Bitumen	8052-42-4	Not Listed
Hexane	110-54-3	B2, D2A, D2B
Natural gas condensates (petroleum)	68919-39-1	Not Listed
Sulfur	7704-34-9	B4

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
Benzene	71-43-2	X
Bitumen	8052-42-4	Not Listed
Hexane	110-54-3	Not Listed
Natural gas condensates (petroleum)	68919-39-1	Not Listed
Sulfur	7704-34-9	Not Listed

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	**Flammability:** 3	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 2	**Flammability:** 3	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 4/19/15

REVISION DATE 4/19/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER

Petroleum Crude Oil—Sour

OTHER MEANS OF IDENTIFICATION

UN-Number	UN1267
Synonyms	Medium Sour Blend (MSB), Central Alberta Pipeline (CAL 1), Pembina Light Sour (PLS 1), Gibsons Light Sour (GLS 1), Pembina Low Sour (PLO 1), Gibson Sour (MGS 2), Kinder Morgan High Sour (KHE 2), Pembina High Sour (PHO 2), Peace Pipe Sour (SPR 2), Rangeland Sour (RSO 2), Gibsons High Sour (GHE 2), Hardisty Light (MBL 3), Manitoba Medium (MM 4), Wespur Midale (MSM 4), Tundra Light Sour (MLS), Moose Jaw Tops (MJT)
Chemical Category	Crude oils—extremely flammable

RECOMMENDED USE

No information available

RESTRICTIONS OF USE

No information available

SUPPLIER INFORMATION

Enbridge Pipelines Inc.
10201 Jasper Avenue
Edmonton, Alberta T5J 3N7
Canada
TEL: 1-780-420-5210

EMERGENCY CONTACT INFORMATION

CHEMTREC	1-800-424-9300 for US 703-527-3887 outside US
CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
2-Methylbutane (In Liquid form)	78-78-4	0-4	
Benzene	71-43-2	0-5	
Butane	106-97-8	0-5	
Cyclohexane	110-82-7	0-5	
Ethylbenzene	100-41-4	0-2	
Heptane	142-82-5	0-10	
Hexane	110-54-3	0-8	
Hydrogen Sulfide	7783-06-4	0-5	
Isobutane	75-28-5	0-5	
Methylcyclohexane	108-87-2	0-3	
Methylcyclopentane	96-37-7	0-3	
Naphthalene	91-20-3	0-1	
Natural gas condensates (petroleum)	64741-47-5	0-25	
Octane	111-65-9	0-10	
Pentane	109-66-0	0-3	
Petroleum	8002-05-9	0-100	
Toluene	108-88-3	0-5	
Xylene	1330-20-7	0-3	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment	• Stop leak if you can do it without risk. • Contain and recover liquid when possible. • A vapor suppressing foam may be used to reduce vapors. • Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming. • Use water spray to reduce vapors or divert vapor cloud drift. • A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.
Methods for Cleaning Up	• Clean up spill immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges.

	Handling	• Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. • Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	**Storage**	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
2-Methylbutane (In Liquid form)	TWA 600 ppm	–	–
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Butane	STEL 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3

Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm
Ethylbenzene	TLV 20 ppm TLV 87 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 125 ppm STEL 545 mg/m^3 IDLH 800 ppm
Heptane	TLV 400 ppm TLV 1640 mg/m^3 STEL 500 ppm STEL 2000 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 85 ppm TWA 350 mg/m^3 Ceiling 440 ppm Ceiling 1800 mg/m^3 IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m^3 STEL 5 ppm STEL 7 mg/m^3	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m^3 IDLH 100 ppm
Isobutane	TWA 1000 ppm	–	–
Methylcyclohexane	TLV 400 ppm TLV 1610 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 400 ppm TWA 1600 mg/m^3 IDLH 1200 ppm
Naphthalene	TLV 10 ppm STEL 15 ppm	PEL 10 ppm PEL 50 mg/m^3	TWA 10 ppm TWA 50 mg/m^3 STEL 15 ppm STEL 75 mg/m^3
Octane	TLV 300 ppm TLV 1401 mg/m^3	PEL 500 ppm PEL 2350 mg/m^3	TWA 75 ppm TWA 350 mg/m^3 Ceiling 385 ppm Ceiling 1800 mg/m^3 IDLH 1000 ppm
Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m^3 IDLH 1500 ppm
Toluene	TLV 20 ppm TLV 75 mg/m^3	PEL 200 ppm STEL 300 mg/m^3	TWA 100 ppm TWA 375 mg/m^3 STEL 150 ppm STEL 560 mg/m^3 IDLH 500 ppm

Xylenes	TLV 100 ppm TLV 434 mg/m³ STEL 150 ppm STEL 651 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 150 ppm STEL 655 mg/m³ IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid	**Odor**	Petroleum like odor
Substance Type	Mixture	**Odor Threshold**	No data available
Appearance	Yellow/green to Brown/black liquid		

PROPERTIES

pH	No data available	**Vapor Pressure**	No data available
Melting Point/ Freezing Point	No data available	**Vapor Density**	>1 Air=1
Boiling Point/ Boiling Range	-20 to 550°C -4 to 1022°F	**Relative Density**	No data available
Flash Point	-40 to 100 °C -40 to 212 °F	**Water Solubility**	Negligible
Evaporation Rate	No data available	**Partition Coefficient: n-octanol/water**	No data available
Flammability (solid, gas)	No data available	**Autoignition Temperature**	No data available
Upper Flammability Limit	No data available	**Decomposition Temperature**	No data available

Lower Flammability Limit	No data available	**Specific Gravity**	No data available
Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
2-Methylbutane (In Liquid form)	–	–	= 150,000 mg/m^3 (Rat) 2 h
Benzene	1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Butane	–	–	658 mg/L (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h

Hydrogen sulfide			= 444 ppm (Rat)
Isobutane	–	–	= 658,000 mg/m^3 (Rat) 4 h
Methylcyclohexane	> 3200 mg/kg (Rat)	–	–
Naphthalene	490 mg/kg (Rat)	0.05 ml (Rabbit) 24 h	–
Natural gas condensates (petroleum)	–	–	= 600 mg/m^3 (Rat)
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
Pentane	>2000 mg/kg (Rat)	–	364 g/cu (Rat) 4 h
Propane	–	–	>800000 ppm (Rat) 15 min
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–
Xylenes	= 3500 mg/kg (Rat)	> 4350 mg/kg (Rabbit) > 1700 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene	• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.
Hydrogen Sulfide Gas (H_2S)	• Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.

Xylenes	• Acute overexposure or several poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.
Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.
Naphthalene	Naphthalene has been evaluated in two year inhalation studies in both rats and mice. The US National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has been identified as a carcinogen by IARC and NTP.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Ethylbenzene	A3	–	Group 2B	Evidence	X
Hexane	–	X	–	–	–
Naphthalene	A4	X	2B	Evidence	
Petroleum	–		Group 3	Evidence	
Toluene	A4	–	Group 3	Evidence	–
Xylenes	A4	–	Group 3	Evidence	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY

- Suspected of damaging fertility or the unborn child.

STOT—SINGLE EXPOSURE

- May cause drowsiness and dizziness.

STOT—REPEATED EXPOSURE

- Causes damage to organs through prolonged or repeated exposure.

ASPIRATION HAZARD

May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
2-Methylbutane (In Liquid form)			EC50 48 h: = 2.3 mg/L (Daphnia magna)	
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Hydrogen sulfide	–	LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	–
Methylcyclohexane	–	LC50 96hr: 72.0 mg/l (Golden Shiner)	–	–
Naphthalene	EC50 24 h: = 33000 ug/L (Chlorella vulgaris)	LC50 96 h: = 1.4 mg/L (Oncorhynchus gorbuscha)	EC50 48 h: 1600 ug/L (Daphnia magna)	–
Natural gas condensates (petroleum)	–	LC50 96 h: = 119 mg/L static (Alburnus alburnus) LC50 96 h: = 82 mg/L static (Cyprinodon variegatus)	EC50 24 h: = 170 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
Pentane	–	–	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	-

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
2-Methylbutane (In Liquid form)	2.72
Benzene	1.83
Butane	2.89

Cyclohexane	3.44
Ethylbenzene	3.118
Heptane	3.90
Hexane	3.90
Hydrogen Sulfide	0.45
Isobutane	2.76
Methylcyclohexane	3.61
Methylcyclopentane	3.37
Naphthalene	3.30
Octane	5.18
Pentane	3.39
Toluene	2.65
Xylene	2.77-3.15

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
2-Methylbutane (In Liquid form)	Low
Benzene	High
Butane	Low
Cyclohexane	Moderate
Ethylbenzene	Low
Heptane	Moderate
Hexane	High
Isobutane	Very High
Methylcyclopentane	Low
Naphthalene	High to None
Octane	Immobile
Pentane	High
Toluene	High to Moderate
Xylene	Very High to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste	• This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility. • This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP). • This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s). • It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.
Packaging Waste	• Container contents should be completely used and containers should be emptied prior to discard. • Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. • Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner. • To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1267	Petroleum Crude Oil	3	I	Emergency response guide number: 128
TDG	UN1267	Petroleum Crude Oil	3	I	Marine Pullutant
IMO/IMDG	UN1267	Petroleum Crude Oil	3	I	Marine Pullutant
IATA/ICAO	UN1267	Petroleum Crude Oil	3	I	ERG Code 3L

SPECIAL RECAUTIONS FOR USER

• None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Heptane	142-82-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphthalene	91-20-3	100 lb final RQ; 45.4 kg final RQ
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	10 lb RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb RQ
Ethylbenzene	100-41-4	1000 lb RQ
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	100 lb RQ
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphthalene	91-20-3	100 lb RQ
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)— HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphthalene	91-20-3	X
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)— PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	Not Listed
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed

Methylcyclopentane	96-37-7	Not Listed
Naphthalene	91-20-3	X
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS #	CLASSIFICATION
2-Methylbutane (In Liquid form)	78-78-4	B2
Benzene	71-43-2	B2, D2A, D2B
Butane	106-97-8	A, B1
Cyclohexane	110-82-7	B2, D2B
Ethylbenzene	100-41-4	B2, D2A, D2B
Heptane	142-82-5	B2, D2B
Hexane	110-54-3	B2, D2A, D2B
Hydrogen Sulfide	7783-06-4	A, B1, D1A, D2B
Isobutane	75-28-5	A, B1 (listed under Methyl-2 propane)
Methylcyclohexane	108-87-2	B2
Methylcyclopentane	96-37-7	Not Listed
Naphthalene	91-20-3	B4, D2A
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Octane	111-65-9	B2, D2B
Pentane	109-66-0	B2
Petroleum	8002-05-9	B2
Toluene	108-88-3	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L
Naphthalene	91-20-3	1.1 µg/L (listed under Polycyclic aromatic hydrocarbons (PAHs))

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L
Naphthalene	91-20-3	1.4 µg/L (listed under Polycyclic aromatic hydrocarbons (PAHs))

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
2-Methylbutane (In Liquid form)	78-78-4	X
Benzene	71-43-2	X
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Isobutane	75-28-5	X
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphthalene	91-20-3	X
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	X
Petroleum	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 3	**Flammability:** 4	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 3	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 5/7/15

REVISION DATE 5/7/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER	Petroleum Crude Oil—Sweet	
OTHER MEANS OF IDENTIFICATION	**UN-Number**	UN1267
	Synonyms	Mixed Sweet Blend (MSW) , Pembina (P), Gibson Light (MGL), Joarcam (MLN), Pembina Sweet Blend (PSB), Rangeland Sweet (RSW), Rainbow Light (RA), Federated (FD), Light Smiley (MSY), Manitoba Sweet Tundra (MST)
	Chemical Category	Crude oils—extremely flammable
RECOMMENDED USE	No information available	
RESTRICTIONS OF USE	No information available	
SUPPLIER INFORMATION	Enbridge Pipelines Inc. 10201 Jasper Avenue Edmonton, Alberta T5J 3N7 Canada TEL: 1-780-420-5210	
EMERGENCY CONTACT INFORMATION	**CHEMTREC**	1-800-424-9300 for US 703-527-3887 outside US
	CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 3
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
1,2,4-Trimethylbenzene	95-63-6	0-1	
2-Methylbutane (In Liquid form)	78-78-4	0-30	
Benzene	71-43-2	0-3	
Butane	106-97-8	0-5	
Cyclohexane	110-82-7	0-5	
Cyclopentane	287-92-3	0-5	
Decane	124-18-5	0-5	
Ethane	74-84-0	0-60	
Ethylbenzene	100-41-4	0-5	
Heptane	142-82-5	0-20	
Hexane	110-54-3	0-20	
Hydrogen Sulfide	7783-06-4	0-1	
Isobutane	75-28-5	0-5	
Methylcyclohexane	108-87-2	0-6	
Methylcyclopentane	96-37-7	0-6	
Natural Gas Condensate	68919-39-1	0-100	
Natural Gas Condensates (petroleum)	64741-47-5	0-25	
Nonane	111-84-2	0-6	
Octane	111-65-9	0-15	
Pentane	109-66-0	0-30	
Petroleum	8002-05-9	0-100	
Propane	74-98-6	0-60	
Toluene	108-88-3	0-5	
Xylene	1330-20-7	0-5	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment	• Stop leak if you can do it without risk. • Contain and recover liquid when possible. • A vapor suppressing foam may be used to reduce vapors. • Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming. • Use water spray to reduce vapors or divert vapor cloud drift. • A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.
Methods for Cleaning Up	• Clean up spill immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges.

	Handling	• Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. • Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	**Storage**	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
1,2,4-Trimethylbenzene	TWA 25 ppm	–	TWA 25 ppm TWA 125 mg/m^3
2-Methylbutane (In Liquid form)	TWA 600 ppm	–	–
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Benzene, trimethyl-	TLV 25 ppm	–	–

Butane	STEL 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3
Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm
Cyclopentane	TLV 600 ppm	–	TWA 600 ppm TWA 1720 mg/m^3
Ethane	TLV 1000 ppm (listed under Aliphatic hydrocarbon gases: Alkane C1-4)	–	–
Ethylbenzene	TLV 20 ppm TLV 87 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 125 ppm STEL 545 mg/m^3 IDLH 800 ppm
Heptane	TLV 400 ppm TLV 1640 mg/m^3 STEL 500 ppm STEL 2000 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 85 ppm TWA 350 mg/m^3 Ceiling 440 ppm Ceiling 1800 mg/m^3 IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m^3 STEL 5 ppm STEL 7 mg/m^3	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m^3 IDLH 100 ppm
Isobutane	TWA 1000 ppm		
MethylCyclohexane	TLV 400 ppm TLV 1610 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 400 ppm TWA 1600 mg/m^3 IDLH 1200 ppm
Nonane	TLV 200 ppm TLV 1050 mg/m^3	–	TWA 200 ppm TWA 1050 mg/m^3
Octane	TLV 300 ppm TLV 1401 mg/m^3	PEL 500 ppm PEL 2350 mg/m^3	TWA 75 ppm TWA 350 mg/m^3 Ceiling 385 ppm Ceiling 1800 mg/m^3 IDLH 1000 ppm
Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m^3 IDLH 1500 ppm

Propane	TLV 1000 ppm listed under Aliphatic hydrocarbon gases: Alkane C1-4)	TWA 1800 ppm TWA 1800 mg/m^3	TWA 1000 ppm TWA 1800 mg/m^3
Toluene	TLV 20 ppm TLV 75 mg/m^3	PEL 200 ppm STEL 300 mg/m^3	TWA 100 ppm TWA 375 mg/m^3 STEL 150 ppm STEL 560 mg/m^3 IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m^3 STEL 150 ppm STEL 651 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 150 ppm STEL 655 mg/m^3 IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid	**Odor**	Petroleum like odor
Substance Type	Mixture	**Odor Threshold**	No data available
Appearance	Yellow/green to Brown/black liquid		

PROPERTIES

pH	No data available	**Vapor pressure**	10 to 103 kPa @ 37.9°C
Melting Point/ Freezing Point	No data available	**Vapor density**	>1 Air=1
Boiling Point/ Boiling Range	-20 to 722°C -4 to 1331.6°F	**Relative density**	No data available

Flash Point	-40 to 100 °C -40 to 212 °F	**Water Solubility**	Negligible
Evaporation Rate	No data available	**Partition coefficient: n-octanol/water**	No data available
Flammability (solid, gas)	No data available	**Autoignition temperature**	No data available
Upper Flammability Limit	No data available	**Decomposition temperature**	No data available
Lower Flammability Limit	No data available	**Specific Gravity**	0.65-1.1
Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
1,2,4-Trimethylbenzene	5 g/kg (Rat)	–	18000 mg/m^3 (Rat) 4h
2-Methylbutane (In Liquid form)	–	–	= 150,000 mg/m^3 (Rat) 2 h
Benzene	1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Butane	–	–	658 mg/L (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
Cyclopentane	11400 mg/kg (Rat)	–	72 g/m^3 (Mouse)
Decane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rat)	–
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Hydrogen sulfide	–	–	= 444 ppm (Rat)
Isobutane	–	–	= 658,000 mg/m^3 (Rat) 4 h
MethylCyclohexane	> 3200 mg/kg (Rat)	–	–
Natural gas condensates (petroleum)	–	–	= 600 mg/m^3 (Rat)
Nonane	–	–	= 3200 ppm (Rat) 4 h
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
Pentane	>2000 mg/kg (Rat)	–	364 g/cu (Rat) 4 h
Petroleum	>4300 mg/kg (Rat)	–	–
Propane	–	–	>800000 ppm (Rat) 15 min
Hydrogen sulfide	–	–	= 444 ppm (Rat)
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–
Xylenes	= 3500 mg/kg (Rat)	> 4350 mg/kg (Rabbit) > 1700 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene	• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.
Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Hydrogen Sulfide Gas (H_2S)	• Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.
Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.

Xylenes	• Excessive exposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Ethylbenzene	A3	–	Group 2B	Evidence	X
Hexane	–	X	–	–	–
Toluene	A4	–	Group 3	Evidence	–
Xylenes	A4	–	Group 3	Evidence	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY

• Suspected of damaging fertility or the unborn child.

STOT—SINGLE EXPOSURE

• May cause drowsiness and dizziness.

STOT—REPEATED EXPOSURE

• Causes damage to organs through prolonged or repeated exposure.

ASPIRATION HAZARD

May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)
2-Methylbutane (In Liquid form)			EC50 48 h: = 2.3 mg/L (Daphnia magna)	
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Cyclopentane			EC50 48 h: 150 nmol/cu m (Daphnia magna)	LC50 24h: 280 mmol/cu m Artemia salina (Brine Shrimp)
Decane	EC50 24 h: = 0.043 mg/L (Chlorella vulgaris)	–	EC50 48 h: = 0.029 mg/L (Daphnia magna)	–
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Hydrogen sulfide	–	LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	–
MethylCyclohexane	–	LC50 96hr: 72.0 mg/l (Golden Shiner)	–	–
Natural gas condensates (petroleum)	–	LC50 96 h: = 119 mg/L static (Alburnus alburnus) LC50 96 h: = 82 mg/L static (Cyprinodon variegatus)	EC50 24 h: = 170 mg/L (Daphnia magna)	–
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
Pentane	–	–	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	-

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
1,2,4-Trimethylbenzene	3.78
2-Methylbutane (In Liquid form)	2.72
Benzene	1.83
Butane	2.89
YCyclohexane	3.44
Cyclopentane	3.00
Decane	5.1
Ethane	1.81
Ethylbenzene	3.118
Heptane	4.66
Hexane	3.90
Hydrogen Sulfide	0.45
Isobutane	2.76
Methylcyclohexane	3.61
Methylcyclopentane	3.37
Nonane	5.65
Octane	5.18
Pentane	3.39
Propane	2.36
Toluene	2.65
Xylene	2.77-3.15

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
1,2,4-Trimethylbenzene	Low
2-Methylbutane (In Liquid form)	Low
Benzene	High
Butane	Low
Cyclohexane	Moderate
Cyclopentane	Moderate
Decane	Immobile
Ethane	Very High
Ethylbenzene	Low
Heptane	Moderate
Hexane	High
Isobutane	Very High
Methylcyclopentane	Low
Nonane	Immobile
Octane	Immobile
Pentane	High
Propane	Moderate
Toluene	High to Moderate
Xylene	Very High to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.
- This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP).
- This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s).
- It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging Waste

- Container contents should be completely used and containers should be emptied prior to discard.
- Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations.
- Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner.
- To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1267	Petroleum Crude Oil	3	I	Emergency response guide number: 129
TDG	UN1267	Petroleum Crude Oil	3	I	Marine Pullutant
IMO/IMDG	UN1267	Petroleum Crude Oil	3	I	Marine Pullutant
IATA/ICAO	UN1267	Petroleum Crude Oil	3	I	ERG Code 3L

SPECIAL RECAUTIONS FOR USER

- None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Heptane	142-82-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Propane	74-98-6	Not Listed
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS#	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	10 lb RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb RQ
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	1000 lb RQ
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	100 lb RQ
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Propane	74-98-6	Not Listed
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
HydrogenSulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed

Propane	74-98-6	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	Not Listed
Isobutane	75-28-5	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
Propane	74-98-6	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS#	CLASSIFICATION	
1,2,4-Trimethylbenzene	95-63-6	B3	
2-Methylbutane (In Liquid form)	78-78-4	B2	
Benzene	71-43-2	B2, D2A, D2B	
Butane	106-97-8	A, B1	
Cyclohexane	110-82-7	B2, D2B	
Cyclopentane	287-92-3	B2	
Decane	124-18-5	B3, D2B	
Ethane	74-84-0	A, B1	
Ethylbenzene	100-41-4	B2, D2A, D2B	
Heptane	142-82-5	B2, D2B	
Hexane	110-54-3	B2, D2A, D2B	
Hydrogen Sulfide	7783-06-4	A, B1, D1A, D2B	
Isobutane	75-28-5	A, B1 (listed under Methyl-2 propane)	
Methylcyclohexane	108-87-2	B2	
Methylcyclopentane	96-37-7	Not Listed	
Natural Gas Condensate	68919-39-1	Not Listed	
Natural gas condensates (petroleum)	64741-47-5	Not Listed	
Nonane	111-84-2	B2, D2B	
Octane	111-65-9	B2, D2B	should this row be left in the layout?
Pentane	109-66-0	B2	
Petroleum	8002-05-9	B2	
Propane	74-98-6	A, B1	
Toluene	108-88-3	B2, D2A, D2B	
Xylene	1330-20-7	B2, D2A, D2B	

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
2-Methylbutane (In Liquid form)	78-78-4	X
Benzene	71-43-2	X
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Cyclopentane	287-92-3	Not Listed
Decane	124-18-5	Not Listed
Ethane	74-84-0	X
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Isobutane	75-28-5	X
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Natural Gas Condensate	68919-39-1	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Nonane	111-84-2	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	X

Petroleum	8002-05-9	Not Listed
Propane	74-98-6	X
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	**Flammability:** 4	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 2	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 5/6/15

REVISION DATE 5/6/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

MATERIAL SAFETY DATA SHEET

SECTION 1 ◆ PRODUCT AND COMPANY IDENTIFICATION

Explorer Pipeline Company
6846 South Canton
P.O. Box 2650
Tulsa, Oklahoma 74101

FOR EMERGENCY SOURCE INFORMATION CONTACT:
- (918) 493 - 5100
- CHEMTREC: (800) 424-9300 (24 hour contact)
- CANUTEC: (613) 996-6666
- SETIQ: 91-800-00214

TRADE NAMES/SYNONYMS:	CHEMICAL FAMILY:	EPL Code:
Natural Gasoline	Petroleum Hydrocarbon	1A, 1B, and 14

This material safety data sheet represents the composite characteristics and properties of fungible petroleum hydrocarbons and other related substances transported by explorer pipeline company. The information presented was compiled from one or more product shipper sources and is intended to provide health and safety guidance for these fungible products. Individual shipper and manufacturer MSDSs are available at Explorer Pipeline Company's, Tulsa, Oklahoma, offices.

SECTION 2 ✷ HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Danger Extremely Flammable!!

- Natural gasoline (C5-C8) is a colorless liquid with a strong hydrocarbon odor;
- Natural gasoline is a volatile and extremely flammable liquid and may cause flash fires;
- Keep away from heat, sparks and open flame;
- Natural gasoline can also contain significant concentrations of benzene which has been shown to cause cancer or be toxic to blood forming organs;
- May cause irritation to eyes, skin, and respiratory system;
- Avoid liquid, mist and vapor contact;
- Wash thoroughly after handling and avoid breathing vapors or mist;
- Use only with adequate ventilation;
- Long-term exposure to completely vaporized gasoline has caused cancer in laboratory animals;
- Vapors or liquid penetration of skin can cause central nervous system (CNS) depression and/or other body systems;
- Contains petroleum distillates! If swallowed, do not induce vomiting since aspiration into the lungs will cause chemical pneumonia; and
- Obtain prompt medical attention. Keep Out of Reach of Children!

SECTION 3 ▼ COMPOSITION/INFORMATION OF INGREDIENTS

INGREDIENT	CAS NUMBER	PERCENTAGE (%)
n-Pentane Isopentane	109-66-0 /78-78-4	25-65
n-Butane Isobutane	75-28-5 / 106-97-8/	1 - 55
C6 Hydrocarbons	----------	1 - 30
C7 Hydrocarbons	----------	1 - 12
C8 Hydrocarbons	----------	1 - 3
Benzene	71-43-2	0 - 1

ACUTE

SUMMARY OF ACUTE HAZARDS: Aspiration into the lungs will cause chemical pneumonia. Liquid, mist, or vapors can cause eye, skin and respiratory tract irritation and CNS depression.

GETTING IT IN YOUR EYE...

- Mild eye irritation may result from contact with liquid, mist, and/or vapors.

GETTING IT ON YOUR SKIN...

- Liquid can penetrate skin to cause central nervous system depression.
- Vapor penetration can also cause systematic effects.
- Skin irritation or more serious disorders may occur upon prolonged and repeated contact due to skin defatting.

SWALLOWING IT...

- Irritation of the mouth, throat, and gastrointestinal tract leading to nausea, vomiting, diarrhea and restlessness.
- CNS Depression similar to that caused by vapor inhalation.

BREATHING IT...

- Exposure can cause irritation to the nose, throat, and lungs and signs of CNS depression (dizziness, drowsiness, loss of coordination, coma and death), depending on the concentration/duration of exposure

CHRONIC

- Long-term exposure to unleaded gasoline has also produced kidney damage in laboratory animals. The exact relationship between these results and possible human effects is not known.
- Persons with pre-existing skin disorders, impaired liver or kidney function, or CNS and chronic respiratory diseases should avoid exposure to this material.

CANCER, REPRODUCTIVE AND GENETIC EFFECTS

- An A.P.I.- sponsored study has shown that rats and mice developed cancer following chronic inhalation exposure to the vapors of unleaded gasoline.
- This material may contain benzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP.

See Toxicological Information (Section 11) For More Information

SECTION 4 ✣ FIRST AID MEASURES

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids, Get Medical Aid.

SKIN: Quickly remove contaminated clothing and immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.

INGESTION: Do not induce vomiting. Call a physician and/or transport to an emergency facility immediately.

INHALATION: Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration (CPR). If breathing is difficult, give oxygen.

NOTE TO PHYSICIAN: TREAT SYMPTOMATICALLY AND SUPPORTIVELY

SECTION 5 ⌘ FIRE FIGHTING MEASURES

EXTREMELY FLAMMABLE! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or explode in confined spaces. Being heavier than air, flammable vapors may travel long distances along the ground before reaching a point of ignition and flashing back.

FLASH POINT:(Method Used) -45 °F	**FLAMMABLE LIMITS:** LEL: 1.6% UEL: 13.0%

AUTOIGNITION TEMPERATURE: 536 °F

EXTINGUISHING MEDIA: Water fog, dry chemical, foam, or Carbon Dioxide (CO_2). Use water spray to cool nearby containers and structure exposed to fire. Water fog or spray are of value in cooling tanks and containers but may not achieve extinguishment.

HAZARDOUS REACTIONS/DECOMPOSITION: Burning or excessive heating may produce carbon monoxide and carbon dioxide, also other harmful gases/vapors including oxides and/or other compounds of chlorine, manganese, and bromine.

SPECIAL INSTRUCTIONS: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment. This may include self-contained breathing apparatus to protect against the hazardous

effects of combustion products and oxygen deficiencies. If firefighters cannot work upwind to the fire, respiratory protective equipment must be worn. Cool tanks and containers exposed to fire with water. Burning liquid will float on water. Notify appropriate authorities if liquid enters sewer/waterways.

SECTION 6 ❖ ACCIDENTAL RELEASE MEASURES

- Contain spill.
- Remove all ignition sources and safely stop flow of spill.
- Evacuate all non-essential personnel. Use proper protective equipment.
- Blanket with foam or use water fog to disperse vapors.
- Pads and absorbent material can be used.
- Gasoline will float on water and resulting runoff may create an explosion or fire hazard.
- Comply with all applicable laws.
- Spills may need to be reported to the National Response Center (800/424-8802) and other local, state or federal agencies.
- Gasoline or contaminated materials may be hazardous to human and other life.

SECTION 7 ✂ HANDLING AND STORAGE

Prior to working with this product workers should be trained on its proper handling and storage

- For use only as a fuel. Do not use product as a cleaning agent.
- Store and transport in accordance with all applicable laws.
- Keep away from heat, sparks, and open flame!
- Keep containers closed and out of closed vehicles.
- Containers should be able to withstand pressures expected from warming or cooling in storage. Ground all drums and transfer vessels when handling.
- All electrical equipment in gasoline storage and/or handling areas should be installed in accordance with applicable requirements of the National Electrical Code, N.F.P.A.
- Keep out of reach of children! Empty containers retain some liquid/vapor residues; hazard precautions must be observed when handling empties.
- Use of any hydrocarbon fuel in spaces without adequate ventilation may result in generation of hazardous levels of vapor and/or inadequate oxygen levels.

SECTION 8 ⊕ EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Local exhaust ventilation may be necessary to control any air contaminants to within there exposure limits (see below) during the use of this product

OTHER HYGIENIC AND WORK PRACTICES: Use good personal hygiene practices. In case of skin contact, wash with mild soap and water or a waterless hand cleaner. Immediately remove soaked clothing and wash thoroughly before reuse. Discard gasoline-soaked shoes. Control occupational exposure below the 0.5 ppm Benzene Permissible Exposure Limit (PEL) Action Level rather than the 300 PPM gasoline Threshold Limit Value –Time Weighted Average (TLV-TWA). Never siphon gasoline by mouth.

EXPOSURE LIMITS

OSHA PEL		ACGIH TLV (2009)	
GASOLINE (BULK HANDLING)			
TWA	STEL	TWA	STEL
Not Applicable (N.A.)	N.A.	300 ppm	N.A.
N-PENTANE			
TWA	STEL	TWA	STEL
1000 ppm	N.A.	600 ppm	N.A.
ISOPENTANE			
TWA	STEL	TWA	STEL
N.A.	N.A.	600 ppm	N.A.
N-BUTANE/ ISOBUTANE			
TWA	STEL	TWA	STEL

N.A.	N.A.	1000 ppm	N.A.

BENZENE

TWA	STEL	TWA	STEL
1 ppm	5 ppm	0.5 ppm	2.5 ppm

PERSONAL PROTECTIVE EQUIPMENT

- **EYES:** Eye protection (ANSI Z87.1 approved) should be worn whenever there is a likelihood of misting or splashing/spraying liquid. Suitable eyewash station should be available. Contact lenses must not be worn.
- **SKIN:** Avoid prolonged and/or repeated skin contact. If conditions or frequency of use make contact likely, wear clean and impervious protective clothing such as gloves, boots, and facial protection.
- **RESPIRATORY PROTECTION:** A NIOSH approved air purifying respirator (APR) with properly selected cartridges may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by APRs is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known or any other circumstances where APRs may not provide adequate protection.

SECTION 9 ϟ PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT (760 MM HG): 80-390 °F	**PERCENT VOLATILE BY VOLUME:** Slight - 100%
SPECIFIC GRAVITY (H_2O = 1): 0.6-0.7	**VISCOSITY UNITS, TEMP:** Unavailable
EVAPORATION RATE (BuAc = 1): Unavailable	**VAPOR DENSITY (AIR =1):** 1-5
VAPOR PRESSURE AT 25°C: 510 - 760 mm Hg	**SOLUBILITY IN WATER:** 0.1 - 1% at 77 °F (25 °C)
APPEARANCE AND ODOR: Clear colorless liquid, with hydrocarbon odor.	

SECTION 10 ¤ STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under normal temperatures and pressures

CONDITIONS TO AVOID: Avoid open Flames, welding arcs or other high temperatures.

OTHER PHYSICAL AND CHEMICAL PROPERTIES: If uninhibited, gasoline will cause rusting of copper and alloys containing copper.

MATERIALS TO AVOID:

- Strong acids, Alkalis, and Oxidizers such as liquid chlorine and oxygen.

HAZARDOUS POLYMERIZATION: Has not been reported

SECTION 11 ⊛ TOXICOLOGICAL INFORMATION

The variable composition makes it impossible to set a specific exposure limit for all compositions of this material. Specific exposure limits for potential components such as benzene should be applied based on air monitoring to assure employees are not exposed to excessive vapor levels of components individually or collectively.

BENZENE

Benzene is known to be a human carcinogen based on sufficient evidence in humans. Case reports and case series have reported leukemia (mostly acute myelogenous leukemia) in individuals exposed to benzene. The strongest epidemiological evidence that benzene causes cancer is from several cohort studies in various industries and geographical locations, which found that occupational exposure to benzene, increased the risk of mortality from leukemia.

TOXICITY

Type Of Dose	Specie	Result	Type Of Dose	Specie	Result	Type Of Dose	Specie	Result
$LD_{50(oral)}$	Mouse	4700 mg/kg	$LC_{50(inh)}$	Mouse	9980 ppm	$TD_{LO(oral)}$	Human	50 mg/kg

CARCINOGENICITY

IARC	Sufficient evidence in animals	Sufficient evidence in humans	Group 1: classifiable as a human carcinogen
NTP	Carcinogen		
California (Prop 65): Listed as carcinogen	**NIOSH:** Potential Occupational Carcinogen	**ACGIH:** A1 - Confirmed human carcinogen	**OSHA:** Select Carcinogen

MUTAGENICITY, TERATOGENICITY AND REPRODUCTIVE EFFECTS

Repeated or prolonged breathing of benzene vapor has been associated with the development of chromosomal damage in experimental animals and various blood diseases in humans ranging from aplastic anemia to leukemia (a form of cancer). All of these diseases can be fatal. In some individuals, benzene exposure can sensitize cardiac tissue to epinephrine which may precipitate fatal ventricular fibrillation.
No birth defects have been shown to occur in pregnant laboratory animals exposed to doses not toxic to the mother.

BUTANES AND PENTANES

These compounds are anesthetics. Ingestion may cause nausea, vertigo bronchial, intestinal irritation and CNS depression. Acute inhalation may cause euphoria, dizziness and numbness of limbs.

TOXICITY

Type Of Dose	Specie	Result
$LD_{50(oral)}$	Rat	No data available

SKIN IRRITATION: No data available

EYE IRRITATION: No data available

CARCINOGENICITY

IARC	NTP	California(Prop 65)	NIOSH	ACGIH	OSHA
Not listed	Not listed	Not listed	Not listed	Not listed	Not listed

MUTAGENICITY, TERATOGENICITY AND REPRODUCTIVE EFFECTS

- No data available

SECTION 12 ❋ ECOLOGICAL INFORMATION

ACUTE EFFECTS: Ingredients are typically moderate (Benzene) to toxicity to aquatic life. Insufficient data are available to evaluate or predict the short-term effects to birds or land animals.
CHRONIC EFFECTS: Ingredients are typically moderate (Benzene) to toxicity to aquatic life. Insufficient data are available to evaluate or predict the long-term effects to birds or land animals.
DISTRIBUTION AND PERSISTENCE IN THE ENVIRONMENT: No data available.

SECTION 13 ✣ DISPOSAL CONSIDERATIONS

Maximize product recovery for reuse. Dispose of product, contaminated material, and storage tank water bottoms as an EPA "Ignitable hazardous waste" (D001), unless proven otherwise. Use approved treatment, transporters, and disposal sites in compliance with all laws. Spill material is biodegradable if gradually exposed to microorganisms.

SECTION 14 ★ TRANSPORTATION INFORMATION

Not Meant To Be All Inclusive - Check Local, State, And Federal Laws And Regulations

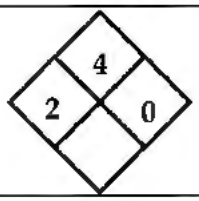
Agency	Shipping Name	Packing Group	Hazard Class	UN/NA #
U.S. DOT	Gasoline	II	3	UN 1203

SECTION 15 ☽ REGULATORY INFORMATION

CERCLA RQ's (40 CFR Part 302)	Benzene – 10 pounds
RCRA	Benzene - U019
SARA (40 CFR Part 355) TPQ's	None of the ingredients are listed
SARA Title III Section 313	Benzene listed
California's Prop 65	Whole gasoline, benzene
OSHA	All ingredients are listed as hazardous under 29 CFR 1910.1200

SECTION 16 ❁ OTHER INFORMATION

NFPA 704 LABEL:



HMIS LABEL

2-4-0

MSDS REVISIONS: None

MSDS CREATION DATE:

REVISION #0: 02/12/10

DISCLAIMER

The information in this MSDS was obtained from sources which we believe are reliable. **HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS ACCURACY.** Some conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. **FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.** All product measurements such as flash point, *etc.* are considered approximate values. All data provided by Explorer Pipeline Company.

This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, such as refined petroleum hydrocarbon mixtures, this MSDS information may not be applicable.

MSDS DEVELOPER: Cass Willard

Cass Willard, CIH

DATE: 08/12/10

REDACTED SUBMITTAL - PUBLIC COPY

Material Safety Data Sheet (Canada)
Natural Gas Liquids

Section 1 – Material Identification and Use

Material Name: NATURAL GAS LIQUIDS
Use: Feedstock, fuel
WHMIS Classification: Class A; Class B, Div. 1 and Div. 2; Class D, Div. 2, Sub-Div. A and B
TDG: **UN:** 1075 **Class:** 2.1 **Packing Group:** N.Av.
Shipping Name: LIQUIFIED PETROLEUM GASES
Manufacturer/Supplier: ENCANA COPORATION
500 Centre Street SE
CALGARY, ALBERTA, T2P 2S5
Emergency Telephone: CANUTEC: 1-613-996-6666
Chemical Family: Liquified aliphatic paraffinic and aromatic hydrocarbons

Section 2 – Hazardous Ingredients of Materials

Hazardous Ingredients	Approximate Concentrations %	C.A.S. Nos.	LD50/LC50 Specify Species & Route	Exposure Limits
Natural Gas Condensates	25-85	68919-39-1	LC50, rat, >5610 mg/m3	300 & 500 ppm (STEL) (AB, TLV & BC)
Butane	10-40	106-97-8	LC50, rat, 4 hrs, 658 g/m^3	1000/ 600 (750) ppm (AB & TLV/ BC (STEL))
Propane	5-35	74-9-86	N.Av.	1000 ppm (AB & BC)
Ethane	<10	74-8-40	N.Av.	1000 ppm (AB & BC)
Benzene	0.1-1	71-43-2	LD50, rat, oral, 930 mg/kg LC50, rat, 4 hrs, 13200 ppm	0.5 & 2.5 ppm (STEL) (AB, TLV & BC)

All exposure levels are 8-hour time-weighted exposure limits unless otherwise indicated. STEL is a short-term exposure limit over a 15 minute time-weighted average. Gasoline exposure levels presented for Natural Gas Condensates.

Section 3 – Physical Data for Material

Physical State: Liquids and liquified gas
Specific Gravity: 0.54
Vapour Density (air=1): >2
Percent Volatiles, by volume: 100
Freezing Pt. (deg.C): -164
Vapour Pressure: 15000 @ 20°C
Odour Threshold (ppm): N.Av.
Evaporation Rate: N.Av.
Boiling Pt. (deg.C): -26
Coefficient of Water/Oil Distribution: <0.1
Odour & Appearance: colorless, odourless (or may have a mercaptan odour)
(N.AV. = not available N.App. = not applicable)

Section 4 – Fire and Explosion

Flammability: Yes **Conditions**: Product will ignite at normal temperatures.
Means of Extinction: Foam, CO_2, dry chemical. Explosive accumulations can build up in areas of poor ventilation.
Special Procedures: Use water spray to cool fire-exposed containers, and to disperse gas if leak has not ignited. If safe to do so, cut off fuel and allow flame to burn out.
Flash Point (deg.C): <-50 to -135
Upper Explosive Limit (% by vol.): 13
Lower Explosive Limit (% by vol.): 2
Auto-Ignition Temp. (deg.C): >400
Sensitivity to Impact: No
Sensitivity to Static Discharge: Yes, may ignite
TDG Flammability Classification: 2.1
Hazardous Combustion Products: Carbon monoxide and carbon dioxide

Section 5 – Reactivity Data

Chemical Stability: Yes **Conditions**: N.App.
Incompatibility: Yes **Substances**: Chlorine and other strong oxidizing agents
Reactivity: Yes **Conditions**: Heat, strong sunlight
Hazardous Decomposition Products: Carbon dioxide, carbon monoxide

Section 6 – Toxicological Properties of Product

Routes of Entry:
Skin Absorption: Yes **Skin Contact**: Yes (liquid) **Eye Contact**: Yes
Inhalation: **Acute**: Yes **Chronic**: Yes **Ingestion**: Yes (liquid)
Effects of Acute Exposure: Inhalation can cause headache, disorientation, dizziness, drowsiness and possibly unconsciousness. As concentration increases, oxygen deficiency and asphyxiation may occur. Rapidly expanding gas or vaporized liquid may cause frostbite to skin and eyes. Absorbed through intact skin. Contact of liquid with eyes may cause severe irritation.
Effects of Chronic Exposure: Due to presence of benzene, long term or high dose rate exposures may increase the risk of anemia and leukemia.
Sensitization to Product: No.
Irritancy: N.Av.
Synergistic Materials: None reported
Carcinogenicity: Yes **Reproductive Effects**: Possibly **Teratogenicity**: Possibly **Mutagenicity**: Possibly

Section 7 – Preventative Measures

Personal Protective Equipment: Use a NIOSH approved positive pressure self-contained breathing apparatus or supplied air breathing apparatus when concentrations may exceed exposure limits. Use approved gas detectors; however, note that combustible gas detection will likely not offer warning against overexposure to this product.
Respiratory: SCBA, SABA or cartridge APR
Eye: Full facepiece SCBA or SABA
Footwear: Covered footwear such as steel-toed boots. **Clothing** Fire retardant garments that meet NFPA 2112.
Engineering Controls: Use only in well ventilated areas. Mechanical ventilation required in confined areas. Equipment must be explosion proof.
Leaks & Spills: If safe to do so, stop gas flow. Remove all ignition sources. Provide clearing ventilation if possible. Prevent from entering confined spaces. Use appropriate personal protective equipment. Contact applicable regulatory authorities.
Waste Disposal: Controlled burning or venting in accordance with regulatory requirements.
Handling Procedures & Equipment: Avoid contact with liquid. Avoid inhalation. Bond and ground all transfers. Avoid sparking conditions. Industrial hygiene monitoring such as that detailed in NIOSH Methodology 1501 is required when handling or working near this material.
Storage Requirements: Store in a cool, dry, well ventilated area away from heat, strong sunlight and ignition sources.
Special Shipping Information: N.Av.

Section 8 – First aid Measures

Skin: If freeze burn occurs, gently bathe affected area in warm water (38 – 43 deg. C.) Do not rub. Get medical attention.
Eye: Immediately flush with large amounts of luke warm water for 15 minutes, lifting upper and lower lids at intervals. Seek medical attention if irritation persists.
Inhalation: Ensuring own safety, remove victim to fresh air. Give oxygen, artificial respiration, or CPR if needed. Seek immediate medical attention.
Ingestion: Ingestion of liquid causes freeze burns to mouth, throat, esophagus and lungs. Get immediate medical attention.

Section 9 – Preparation Date of MSDS

Prepared By: Encana Environment, Health and Safety (EH&S)
Phone Number: (403) 645-2000 Preparation Date: July 1, 2014 Expiry Date: July 1, 2017

Section 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name:	Synthetic Crude Oil
Synonyms:	Not available.
Product Use:	Refinery feedstock.
Manufacturer/Supplier:	Husky Oil Operations Ltd. PO Box 6525 Station 'D' Calgary, Alberta T2P 3G7
Phone Number:	403-298-6111
Emergency Phone:	877-262-2111
Date of Preparation:	January 21, 2014

Section 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

DANGER
FLAMMABLE LIQUID AND VAPOR. HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. CANCER HAZARD – CAN CAUSE CANCER. IRRITATING TO EYES AND SKIN.

Colour: Straw coloured.
Physical State: Liquid.
Odour: Petroleum.

WHMIS	Personal Protection Equipment	TDG (Ground)
		

Potential Health Effects: See Section 11 for more information.

Likely Routes of Exposure: Eye contact. Skin contact. Inhalation. Ingestion. Skin absorption.

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. This product contains small amounts of Hydrogen sulphide which may accumulate in confined spaces. Inhalation of Hydrogen sulphide may cause loss of sense of smell, major irritation of the respiratory tract, headache, nausea, vomiting, dizziness, and fluid buildup in the lungs (pulmonary edema), which can be fatal. At 300 ppm unconsciousness may occur after 20 minutes. From 300 to 500 ppm, death can occur within 1 to 4 hours of continuous exposure. At 500 ppm the respiratory system is paralyzed, the victim collapses almost instantaneously, and death can occur after exposure of only 30 to 60 minutes. Above 500 ppm Hydrogen sulphide may cause immediate loss of consciousness; death is rapid, and possibly immediate.

Eye: Causes eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision. Hydrogen sulphide may cause eye irritation at 1-20 ppm and acute conjunctivitis at higher concentrations. Above 50 ppm H2S, eye irritation may include symptoms of redness, severe swelling, tearing, sensitivity to light and the appearance of 'Halos' around lights.

Skin: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May be fatal if swallowed and enters airways. May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Medical Conditions Aggravated By Exposure: Not available.

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Nervous system.

Potential Environmental Effects: See Section 12 for more information.

This material is considered hazardous by the OSHA Hazard Communication Standard, (29 CFR 1910.1200).

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient(s)	CAS No.	% wt./wt.
Gas oils (petroleum), hydrodesulfurized	64742-79-6	60 - 100
Naphtha (petroleum), hydrotreated heavy	64742-48-9	10 - 30
Naphtha (petroleum), hydrotreated light	64742-49-0	3 - 7
Butane	106-97-8	1 - 5
Hydrogen sulfide (H2S)	7783-06-4	0.001 - 0.01

Section 4: FIRST AID MEASURES

Inhalation: If inhaled: Call a poison center or doctor if you feel unwell.

Eye Contact: If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Skin Contact: If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Ingestion: If swallowed: Immediately call a poison center or doctor. If vomiting occurs naturally, have victim lean forward to reduce the risk of aspiration. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If breathing or the heart stops, trained personnel should immediately begin artificial respiration (AR) or cardiopulmonary resuscitation (CPR) respectively. Get medical attention immediately.

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show the label or MSDS where possible).

Note to Physicians: Symptoms may not appear immediately. For inhalation of Hydrogen Sulphide, consider oxygen.

Section 5: FIRE FIGHTING MEASURES

Flammability: Flammable liquid by WHMIS criteria. Class IB flammable liquid by OSHA criteria. Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water. When heated, this material may evolve toxic and flammable Hydrogen sulphide.

If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Fire involving Tanks or Car/Trailer Loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Means of Extinction

Suitable Extinguishing Media: Small Fire: Dry chemical, CO_2, water spray or regular foam.

Large Fire: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk.

Unsuitable Extinguishing Media: Do not use straight streams. CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

Products of Combustion: Oxides of carbon. Oxides of sulphur.

Protection of Firefighters: Inhalation or contact with material may irritate or burn skin and eyes. Fire may produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or suffocation. Runoff from fire control or dilution water may cause pollution. Hydrogen sulphide is heavier than air and may collect in low lying areas and confined spaces. Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

Explosion Data

Sensitivity to Mechanical Impact: This material is not sensitive to mechanical impact.

Sensitivity to Static Discharge: This material is sensitive to static discharge.

Section 6: ACCIDENTAL RELEASE MEASURES

Emergency Procedures: As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded.

Personal Precautions: Do not touch or walk through spilled material. Use personal protection recommended in Section 8.Don full-face, positive pressure, self-contained breathing apparatus.

Environmental Precautions: Prevent entry into waterways, sewers, basements or confined areas.

Methods for Containment: Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors.

Methods for Clean-Up: Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Other Information: See Section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Handling:
Do not swallow. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat, sparks, open flames, and hot surfaces. – No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wash thoroughly after handling. See Section 8 for information on Personal Protective Equipment.

Storage:
Store in a well-ventilated place. Store locked up. Store away from incompatible materials. See Section 10 for information on Incompatible Materials. Keep out of the reach of children. Head spaces in storage containers may contain toxic hydrogen sulphide gas. Structural materials and lighting and ventilation systems should be corrosion resistant.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines
Component

Gas oils (petroleum), hydrodesulfurized [CAS No. 64742-79-6]

ACGIH: A2; Exposure by all routes should be carefully controlled to levels as low as possible (2009); For Mineral oil, excluding metal working fluids; Poorly and mildly refined

OSHA: 5 mg/m³ (TWA); For Oil mist, mineral.

Naphtha (petroleum), hydrotreated heavy [CAS No. 64742-48-9]

ACGIH: 100 ppm (TWA); (1980); For Stoddard solvent

OSHA: 100 ppm (TWA), 400 mg/m³ (TWA); For Petroleum distillates (Naphtha).

Naphtha (petroleum), hydrotreated light [CAS No. 64742-49-0]

ACGIH: 100 ppm (TWA); (1980); For Stoddard solvent

OSHA: 100 ppm (TWA), 400 mg/m³ (TWA); For Petroleum distillates (Naphtha).

Butane [CAS No. 106-97-8]

ACGIH: 1000 ppm (TWA); (2001)

OSHA: 800 ppm (TWA) [Vacated];

Hydrogen sulfide (H2S) [CAS No. 7783-06-4]

ACGIH: 1 ppm (TWA); 5 ppm (STEL); (2009);

OSHA: 20 ppm (C); 50 ppm (Peak) (Maximum duration: 10 mins. once only if no other meas. exp. occurs.)
10 ppm (TWA); 15 ppm (STEL) [Vacated];

Benzene [CAS No. 71-43-2]

ACGIH: 0.5 ppm (TWA); 2.5 ppm (STEL); Skin; A1; BEI (1996)

OSHA: 1 ppm (TWA); 5 ppm (STEL);

Toluene [CAS No. 108-88-3]

ACGIH: 20 ppm (TWA); A4; BEI (2006)

OSHA: 200 ppm (TWA); 300 ppm (C); 500 ppm (Peak) (Maximum duration: 10 minutes.)
100 ppm (TWA); 150 ppm (STEL) [Vacated];

Ethylbenzene [CAS No. 100-41-4]

ACGIH: 20 ppm (TWA); A3; BEI (2010)

OSHA: 100 ppm (TWA), 435 mg/m³ (TWA);
125 ppm (STEL) [Vacated];

Xylene [CAS No. 1330-20-7]

ACGIH: 100 ppm (TWA); 150 ppm (STEL); A4; BEI (1992)

OSHA: 100 ppm (TWA), 435 mg/m³ (TWA);
150 ppm (STEL) [Vacated];

TWA: Time-Weighted Average
STEL: Short-Term Exposure Limit
C: Ceiling

Engineering Controls: Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapour, gas, etc.) below recommended exposure limits. Use explosion-proof electrical, ventilating, and lighting equipment.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye/Face Protection:	Wear chemical goggles. Ensure that eyewash stations are close to the workstation location. Use equipment for eye protection that meets the standards referenced by OSHA regulations in 29 CFR 1910.133 for Personal Protective Equipment.
Hand Protection:	Wear protective gloves. Neoprene or nitrile gloves are recommended. Consult manufacturer specifications for further information.
Skin and Body Protection:	Wear protective clothing. Flame resistant clothing that meets the NFPA 2112 and CAN/CGSB 155.20 standards is recommended in areas where material is stored or handled.
Respiratory Protection:	If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate NIOSH/MSHA approved air-purifying respirator with organic vapor cartridge, or self-contained breathing apparatus must be used. Supplied air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.
General Hygiene Considerations:	Handle according to established industrial hygiene and safety practices.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear liquid
Colour:	Straw coloured.
Odour:	Petroleum.
Odour Threshold:	0.0047 ppm, (Hydrogen sulphide)
Physical State:	Liquid.
pH:	Not available.
Viscosity:	Not available.
Melting Point:	Not available.
Boiling Point:	Not available.
Flash Point:	20 °C (68 °F) (PMCC)
Evaporation Rate:	Not available.
Lower Flammability Limit:	Not available.
Upper Flammability Limit:	Not available.
Vapor Pressure:	15 to 35 kPa at 20 °C (68 °F)

Vapor Density:	Not available.
Specific Gravity:	0.86 (Water = 1)
Density:	Not available.
Solubility in Water:	Insoluble in cold water.
Coefficient of Water/Oil Distribution:	Not available.
Auto-ignition Temperature:	Not available.
Percent Volatile, wt. %:	Not available.
VOC content, wt. %:	Not available.

Section 10: STABILITY AND REACTIVITY

Stability:	Stable under normal storage conditions.
Conditions of Reactivity:	Contact with incompatible materials. Exposure to heat.
Incompatible Materials:	Strong acids. Strong oxidizers. Halogens.
Hazardous Decomposition Products:	Oxides of carbon. Oxides of nitrogen. Aldehydes. Hazardous sulphur dioxide, and related oxides of sulphur may be generated upon combustion.
Possibility of Hazardous Reactions:	None known.

Section 11: TOXICOLOGICAL INFORMATION

EFFECTS OF ACUTE EXPOSURE

Component Toxicity

Component	CAS No.	LD_{50} oral	LD_{50} dermal	LC_{50}
Gas oils (petroleum), hydrodesulfurized	64742-79-6	Not available.	Not available.	Not available.
Naphtha (petroleum), hydrotreated heavy	64742-48-9	Not available.	Not available.	Not available.
Naphtha (petroleum), hydrotreated light	64742-49-0	Not available.	Not available.	Not available.
Butane	106-97-8	Not available.	Not available.	658000 mg/m³ (rat); 4H
Hydrogen sulfide	7783-06-4	Not available.	Not available.	444 ppm (rat); 4H
Benzene	71-43-2	930 mg/kg (rat)	> 9400 µl/kg (rabbit)	10000 ppm (rat); 7H
Toluene	108-88-3	600 mg/kg (rat)	14.1 mL/kg (rabbit)	49000 mg/m³ (rat); 4H
Ethylbenzene	100-41-4	3500 mg/kg (rat)	17800 µl/kg (rabbit)	Not available.
Xylene	1330-20-7	4300 mg/kg (rat)	> 1700 mg/kg (rabbit)	5000 ppm (rat); 4H

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. This product contains small amounts of Hydrogen sulphide which may accumulate in confined spaces. Inhalation of Hydrogen sulphide may cause loss of sense of smell, major irritation of the respiratory tract, headache, nausea, vomiting, dizziness, and fluid buildup in the lungs (pulmonary edema), which can be fatal. At 300 ppm unconsciousness may occur after 20 minutes. From 300 to 500 ppm, death can occur within 1 to 4 hours of continuous exposure. At 500 ppm the respiratory system is paralyzed, the victim collapses almost instantaneously, and death can occur after exposure of only 30 to 60 minutes. Above 500 ppm Hydrogen sulphide may cause immediate loss of consciousness; death is rapid, and possibly immediate.

Eye: Causes eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision. Hydrogen sulphide may cause eye irritation at 1-20 ppm and acute conjunctivitis at higher concentrations. Above 50 ppm H2S, eye irritation may include symptoms of redness, severe swelling, tearing, sensitivity to light and the appearance of 'Halos' around lights.

Skin: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May be fatal if swallowed and enters airways. May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Skin Sensitization: Not available.

Respiratory Sensitization: Not available.

EFFECTS OF CHRONIC EXPOSURE

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Spleen. Liver. Kidneys. Nervous system.

Chronic Effects: Prolonged or repeated contact may dry skin and cause irritation. Exposure to Naphtha may damage the blood-forming organs resulting in fatigue and anaemia (RBC), decreased resistance to infection, and/or excessive bruising and bleeding (platelet effect). Peripheral nerve damage may be evidenced by impairment of motor function (incoordination, unsteady walk, or muscle weakness in the extremities, and/or loss of sensation in the arms and legs). Auditory system effects may include temporary hearing loss and/or ringing in the ears. Hydrogen sulphide may reduce lung function; cause neurological effects such as headaches, nausea, depression and personality changes; eye and mucous membrane irritation: damage to cardiovascular system. Reports of chronic poisoning with Benzene, Toluene, Ethylbenzene or Xylene describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated exposure of the eyes to high concentrations of

Xylenes vapour may cause reversible eye damage. Chronic inhalation exposure to xylene causes mid-frequency hearing loss in laboratory animals. Xylene reacts synergistically with n-hexane to enhance hearing loss.

Carcinogenicity: May cause cancer. Gas oils cause cancer in laboratory animals. This material contains Benzene which may cause aplastic anemia or acute myelogenous leukemia (AML). Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumour composed of cells of the type normally found in the bone marrow).

Component Carcinogenicity

Component	ACGIH	IARC	NTP	OSHA	Prop 65
Gas oils (petroleum), hydrodesulfurized	A2	Group 1	List 1	OSHA Carcinogen.	Listed.
Benzene	A1	Group 1	List 1	OSHA Carcinogen.	Listed.
Toluene	A4	Group 3	Not listed.	Not listed.	Not listed.
Ethylbenzene	A3	Group 2B	Not listed.	OSHA Carcinogen.	Listed.
Xylene	A4	Group 3	Not listed.	Not listed.	Not listed.

Mutagenicity: May cause heritable genetic damage.

Reproductive Effects: Not available.

Developmental Effects

Teratogenicity: Not available.

Embryotoxicity: Possible risk of harm to the unborn child. Benzene and Xylene have caused adverse fetal effects in laboratory animals. Exposure to Toluene may affect the developing fetus.

Toxicologically Synergistic Materials: Xylene reacts synergistically with n-hexane to enhance hearing loss.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Not available.

Persistence / Degradability: Not available.

Bioaccumulation / Accumulation: Not available.

Mobility in Environment: Not available.

Section 13: DISPOSAL CONSIDERATIONS

Disposal Instructions: Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: TRANSPORT INFORMATION

U.S. Department of Transportation (DOT)

Proper Shipping Name:	UN1267, PETROLEUM CRUDE OIL, 3, PG I
Class:	3
UN Number:	UN1267
Packing Group:	I
Label Code:	

Canada Transportation of Dangerous Goods (TDG)

Proper Shipping Name:	UN1267, PETROLEUM CRUDE OIL, 3, PG I
Class:	3
UN Number:	UN1267
Packing Group:	I
Label Code:	

Section 15: REGULATORY INFORMATION

Chemical Inventories

US (TSCA)
The components of this product are in compliance with the chemical notification requirements of TSCA.

Canada (DSL)
The components of this product are in compliance with the chemical notification requirements of the NSN Regulations under CEPA, 1999.

Federal Regulations

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

WHMIS Classification:
Class B2 - Flammable Liquids.
Class D2A - Carcinogenicity.
Class D2A - Embryotoxicity.
Class D2A - Mutagenicity.
Class D2B - Skin irritant.
Class D2B - Eye irritant.

Hazard Symbols:

United States
This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SARA Title III

Component	Section 302 (EHS) TPQ (lbs.)	Section 304 EHS RQ (lbs.)	CERCLA RQ (lbs.)	Section 313	RCRA CODE	CAA 112(r) TQ (lbs.)
Butane	Not listed.	Not listed.	Not listed.	Not listed.	Not listed.	10000
Hydrogen sulfide	500	100	100	313s	U135	10000
Benzene	Not listed.	Not listed.	10	313	U019	Not listed.
Toluene	Not listed.	Not listed.	1000	313	U220	Not listed.
Ethylbenzene	Not listed.	Not listed.	1000	313	Not listed.	Not listed.
Xylene	Not listed.	Not listed.	100	313	U239	Not listed.

State Regulations
Massachusetts
US Massachusetts Commonwealth's Right-to-Know Law (Appendix A to 105 Code of Massachusetts Regulations Section 670.000)

Component	CAS No.	RTK List
Gas oils (petroleum), hydrodesulfurized	64742-79-6	Listed.
Naphtha (petroleum), hydrotreated heavy	64742-48-9	Listed.
Naphtha (petroleum), hydrotreated light	64742-49-0	Listed.
Butane	106-97-8	Listed.
Hydrogen sulfide (H2S)	7783-06-4	E
Benzene	71-43-2	E
Toluene	108-88-3	Listed.
Ethylbenzene	100-41-4	Listed.
Xylene	1330-20-7	Listed.

Note: E = Extraordinarily Hazardous Substance

New Jersey
US New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Component	CAS No.	RTK List
Gas oils (petroleum), hydrodesulfurized	64742-79-6	Listed.
Butane	106-97-8	SHHS
Hydrogen sulfide (H2S)	7783-06-4	SHHS

Benzene	71-43-2	SHHS
Toluene	108-88-3	SHHS
Ethylbenzene	100-41-4	SHHS
Xylene	1330-20-7	SHHS

Note: SHHS = Special Health Hazard Substance

Pennsylvania

US Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Component	CAS No.	RTK List
Gas oils (petroleum), hydrodesulfurized	64742-79-6	Listed.
Naphtha (petroleum), hydrotreated heavy	64742-48-9	Listed.
Naphtha (petroleum), hydrotreated light	64742-49-0	Listed.
Butane	106-97-8	Listed.
Hydrogen sulfide (H2S)	7783-06-4	E
Benzene	71-43-2	ES
Toluene	108-88-3	E
Ethylbenzene	100-41-4	E
Xylene	1330-20-7	E

Note: E = Environmental Hazard; S = Special Hazardous Substance

California

California Prop 65: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Component	Type of Toxicity
Gas oils (petroleum), hydrodesulfurized	cancer
Benzene	cancer; developmental, male
Toluene	developmental; female
Ethylbenzene	cancer

Section 16: OTHER INFORMATION

Disclaimer: The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

MSDS Expiry Date (Canada): January 20, 2017

Version: 2.0

MSDS Prepared by: **Deerfoot Consulting Inc.**

Phone: (403) 720-3700

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : SUNCOR OSC

Synonyms : Sweet Crude Oil, Synthetic Crude Oil, Petroleum Crude

Manufacturer or supplier's details

SUNCOR ENERGY INC.
P.O. Box 2844, 150 - 6th Avenue South-West
Calgary Alberta T2P 3E3
Canada

Emergency telephone number

Suncor Energy: +1 403-296-3000;
Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use : Refinery Feedstock

Prepared by : Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	liquid
Colour	amber
Odour	Hydrocarbon or "rotten egg" if H2S present, but odour is an unreliable warning, since it may deaden the sense of smell.
Hazard Summary	Flammable liquid Irritating to skin. May cause cancer. May cause harm to the unborn child. May cause heritable genetic damage. May damage the peripheral nervous system.

Potential Health Effects

Primary Routes of Entry : Inhalation
Eye contact
Skin Absorption
Skin contact
Ingestion

Target Organs : Respiratory system
Central nervous system
Peripheral nervous system

Inhalation : May cause respiratory tract irritation.

Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.
High concentration of vapours may induce unconsciousness.

Skin : May cause skin irritation.
Prolonged or repeated contact may cause dermatitis, reddening of skin and a chapped appearance.

Eyes : May cause eye irritation.

Ingestion : Aspiration hazard if swallowed - can enter lungs and cause damage.
Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Chronic Exposure : May damage the peripheral nervous system.
Symptoms include tingling sensations in fingers and toes and muscle weakness.

Aggravated Medical Condition : None known.

Carcinogenicity:

IARC Group 1: Carcinogenic to humans

1,3-BUTADIENE 106-99-0

Benzene 71-43-2

ACGIH Confirmed human carcinogen

Benzene 71-43-2

Suspected human carcinogen

1,3-BUTADIENE 106-99-0

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
fuel, diesel no. 2	68476-34-6	0 - 100 %
Gas oils (oil sand), hydrotreated	128683-29-4	0 - 100 %
Naphtha (oil sand), hydrotreated	128683-33-0	0 - 100 %
butane	106-97-8	0 - 3 %
pentane	109-66-0	0 - 3 %
isobutane	75-28-5	0 - 3 %

xylene	1330-20-7	1 - 2 %
isopentane	78-78-4	0 - 3 %
n-hexane	110-54-3	1 - 2 %
toluene	108-88-3	0.1 - < 1 %
1,3-butadiene	106-99-0	0.1 - < 1 %
benzene	71-43-2	0.1 - < 1 %

Product may contain 0 - 50ppm hydrogen sulphide.

SECTION 4. FIRST AID MEASURES

If inhaled	:	Move to fresh air. Artificial respiration and/or oxygen may be necessary. Seek medical advice.
In case of skin contact	:	In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognized skin cleanser. Wash clothing before reuse. Seek medical advice.
In case of eye contact	:	Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.
If swallowed	:	Rinse mouth with water. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Seek medical advice.
Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Carbon dioxide (CO2) Dry chemical Foam Water fog.
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray. Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), smoke and irritating vapours as products of incomplete combustion.

Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest. Keep away from heat and sources of ignition. Keep container closed when not in use.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
butane	106-97-8	TWA	1,000 ppm	CA AB OEL
		TWA	600 ppm	CA BC OEL
		STEL	750 ppm	CA BC OEL
		TWAEV	800 ppm 1,900 mg/m3	CA QC OEL
pentane	109-66-0	TWAEV	120 ppm 350 mg/m3	CA QC OEL
xylene	1330-20-7	TWA	100 ppm	ACGIH
		STEL	150 ppm	ACGIH
		TWA	100 ppm 435 mg/m3	OSHA Z-1
		TWA	100 ppm	ACGIH
		STEL	150 ppm	ACGIH
isopentane	78-78-4	TWA	600 ppm 1,770 mg/m3	CA AB OEL
n-hexane	110-54-3	TWA	50 ppm 176 mg/m3	CA AB OEL
		TWA	20 ppm	CA BC OEL
		TWAEV	50 ppm 176 mg/m3	CA QC OEL
		TWA	50 ppm	ACGIH
1,3-butadiene	106-99-0	TWA	2 ppm 4.4 mg/m3	CA AB OEL
		TWA	2 ppm	CA BC OEL
		TWAEV	2 ppm 4.4 mg/m3	CA QC OEL
		TWA	2 ppm	ACGIH
benzene	71-43-2	TWA	0.5 ppm 1.6 mg/m3	CA AB OEL
		STEL	2.5 ppm 8 mg/m3	CA AB OEL
		TWA	0.5 ppm	CA BC OEL
		STEL	2.5 ppm	CA BC OEL
		TWA	0.5 ppm	CA ON OEL
		STEL	2.5 ppm	CA ON OEL
		TWAEV	1 ppm 3 mg/m3	CA QC OEL
		STEV	5 ppm 15.5 mg/m3	CA QC OEL
		TWA	0.5 ppm	ACGIH
		STEL	2.5 ppm	ACGIH

Engineering measures : Use only in well-ventilated areas.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe

working limits of the selected respirator.

Filter type	:	Wear a NIOSH-approved respirator/breathing apparatus in situations where there may be potential for airborne exposure.
Hand protection		
Material	:	neoprene, nitrile. Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.
Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	amber
Odour	:	Hydrocarbon or "rotten egg" if H2S present, but odour is an unreliable warning, since it may deaden the sense of smell.
Odour Threshold	:	No data available
pH	:	No data available
Melting point	:	No data available
Boiling point/boiling range	:	estimated 30 - 550 °C (86 - 1022 °F)
Flash point	:	< -35 °C (-31 °F)
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available

Flammability	:	Easily ignites under almost all normal temperature conditions. Extremely flammable in presence of open flames, sparks, shocks, heat, oxidizing materials. Vapours are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks), and may travel considerable distance to sources of ignition and flash back.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	No data available
Relative vapour density	:	No data available
Relative density	:	No data available
Density	:	estimated 0.71 - 0.91 g/cm3
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	Pow: < 1
Viscosity		
Viscosity, kinematic	:	No data available
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Vapours may form explosive mixtures with air. Runoff to sewer may create fire or explosion hazard. Liquid may accumulate static charge.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents.
Hazardous decomposition products	:	May release COx, hydrocarbons, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Inhalation Eye contact Skin Absorption Skin contact Ingestion

Acute toxicity

Product:

Acute oral toxicity : Remarks: No data available

Acute inhalation toxicity : Remarks: No data available

Acute dermal toxicity : Remarks: No data available

Components:

fuel, diesel no. 2:
Acute inhalation toxicity : LC50 Rat: 4.1 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

butane:
Acute inhalation toxicity : LC50 Rat: 658 mg/l
Exposure time: 4 h
Test atmosphere: gas

pentane:
Acute oral toxicity : LD50 Rat: > 2,000 mg/kg,

Acute inhalation toxicity : LC50 Rat: 364 mg/l
Exposure time: 4 h
Test atmosphere: vapour

isobutane:
Acute inhalation toxicity : LC50 Rat: 658,000 mg/m3
Exposure time: 4 h
Test atmosphere: gas

xylene:
Acute oral toxicity : LD50 Rat: 4,300 mg/kg,

Acute inhalation toxicity : LC50 Rat: 5000 ppm
Exposure time: 4 h
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 Rabbit: > 1,700 mg/kg,

isopentane:
Acute inhalation toxicity : LC50 Rat: 280 mg/l
Exposure time: 4 h
Test atmosphere: vapour

n-hexane:
Acute oral toxicity : LD50 Rat: 15,840 mg/kg,

Acute inhalation toxicity : LC50 Rat: 48000 ppm
Exposure time: 4 h

Test atmosphere: dust/mist

Acute dermal toxicity : LD50 Rabbit: > 3,295 mg/kg,

toluene:
Acute oral toxicity : LD50 Rat: 5,580 mg/kg,

Acute inhalation toxicity : LC50 Rat: 7585 ppm
Exposure time: 4 h
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 Rabbit: 12,125 mg/kg,

benzene:
Acute oral toxicity : LD50 Rat: 2,990 mg/kg,

Acute inhalation toxicity : LC50 Rat: 13700 ppm
Exposure time: 4 h
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 Rabbit: > 8,240 mg/kg,

Skin corrosion/irritation

Product:
Remarks: No data available

Components:

xylene:
Result: Skin irritation

isopentane:
Result: Mild skin irritation

toluene:
Result: Moderate skin irritant

benzene:
Result: Moderate skin irritant

Serious eye damage/eye irritation

Product:

Remarks: No data available

Components:

isopentane:
Result: Mild eye irritation

toluene:
Result: Mild eye irritation

benzene:
Result: Moderate eye irritation

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

Aspiration toxicity

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Components:
n-hexane :

Toxicity to fish	:	LC50 (Fish): 4.12 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia (water flea)): 3.87 mg/l Exposure time: 48 h

Persistence and degradability

Product:

Biodegradability : Remarks: No data available

Bioaccumulative potential

Components:

butane :

Partition coefficient: n-octanol/water : log Pow: 2.89

pentane :

Partition coefficient: n-octanol/water : log Pow: 3.39

isobutane :

Partition coefficient: n-octanol/water : log Pow: 2.76

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of as hazardous waste in compliance with local and national regulations.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

Contaminated packaging : Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR

UN/ID No. : 1267
Proper shipping name : Petroleum crude oil
Class : 3
Packing group : I
Labels : 3
Packing instruction (cargo aircraft) : 361

IMDG-Code

UN number	:	1267
Proper shipping name	:	PETROLEUM CRUDE OIL
Class	:	3
Packing group	:	I
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

TDG

UN number	:	1267
Proper shipping name	:	PETROLEUM CRUDE OIL
Class	:	3
Packing group	:	I
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

WHMIS Classification : B2: Flammable liquid
D2A: Very Toxic Material Causing Other Toxic Effects
D2B: Toxic Material Causing Other Toxic Effects

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:
DSL On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to

the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Material Safety Data Sheet

SUNCOR OSH

V00000003972

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	SUNCOR OSH
Synonyms	:	Sour Crude Blend, Sour Crude Oil
Manufacturer or supplier's details		SUNCOR ENERGY INC. P.O. Box 2844, 150 - 6th Avenue South-West Calgary Alberta T2P 3E3 Canada
Emergency telephone number		Suncor Energy: +1 403-296-3000; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Refinery Feedstock
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Form	liquid
Colour	brown
Odour	hydrocarbon-like
Hazard Summary	Flammable liquid Contains material which may cause cancer based on animal data. Contains material that may cause adverse reproductive effects. Irritating to eyes and skin. May cause sensitisation by skin contact.

Potential Health Effects

Primary Routes of Entry	:	Inhalation Eye contact Skin contact Ingestion Skin Absorption
Target Organs	:	Respiratory system Central nervous system Eyes Skin
Inhalation	:	Inhalation of high vapour concentrations may cause

symptoms like headache, dizziness, tiredness, nausea and vomiting.
Inhalation may cause central nervous system effects.

Skin : May cause allergic skin reaction.
May cause skin irritation.

Eyes : May cause eye irritation.

Ingestion : Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
Aspiration hazard if swallowed - can enter lungs and cause damage.

Chronic Exposure : This product may cause adverse reproductive effects.

Aggravated Medical Condition : None known.

Carcinogenicity:

IARC Group 2A: Probably carcinogenic to humans
Gas oils, petroleum, heavy vacuum 64741-57-7

OSHA No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

NTP No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
gas oils (petroleum), heavy vacuum	64741-57-7	85 - 92 %
Naphtha (oil sand), hydrotreated	128683-33-0	8 - 15 %
sulfur	7704-34-9	<= 3.3 %
butane	106-97-8	0.5 - 1.5 %
xylene	1330-20-7	0.1 - 0.3 %
toluene	108-88-3	0.1 - 0.2 %

Product may contain trace amounts of hydrogen sulphide

SECTION 4. FIRST AID MEASURES

If inhaled	:	Move to fresh air. Artificial respiration and/or oxygen may be necessary. Seek medical advice.
In case of skin contact	:	In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognized skin cleanser. Wash contaminated clothing before reuse. Seek medical advice.
In case of eye contact	:	Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.
If swallowed	:	Rinse mouth with water. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Seek medical advice.
Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Carbon dioxide (CO2) Foam Dry chemical
Unsuitable extinguishing media	:	No information available.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), sulphur oxides (SOx), sulphur compounds (H2S), hydrocarbons, smoke and irritating vapours as products of incomplete combustion.
Specific extinguishing methods	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.

Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Persons with a history of skin sensitisation problems or asthma, allergies, chronic or recurrent respiratory disease should not be employed in any process in which this mixture is being used. Smoking, eating and drinking should be prohibited in the application area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest. Use only with adequate ventilation. Keep away from heat and sources of ignition. Keep container closed when not in use.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
butane	106-97-8	TWA	1,000 ppm	CA AB OEL
		TWA	600 ppm	CA BC OEL
		STEL	750 ppm	CA BC OEL
		TWAEV	800 ppm 1,900 mg/m3	CA QC OEL
		TWA	800 ppm 1,900 mg/m3	NIOSH REL
		TWA	800 ppm 1,900 mg/m3	OSHA P0
		TWA	800 ppm	NIOSH REL

			1,900 mg/m3	
		TWA	800 ppm 1,900 mg/m3	OSHA P0
xylene	1330-20-7	TWA	100 ppm	ACGIH
		STEL	150 ppm	ACGIH
		TWA	100 ppm	ACGIH
		STEL	150 ppm	ACGIH
toluene	108-88-3	TWA	50 ppm 188 mg/m3	CA AB OEL
		TWA	20 ppm	CA BC OEL
		TWAEV	50 ppm 188 mg/m3	CA QC OEL
		TWA	20 ppm	ACGIH
		TWA	100 ppm 375 mg/m3	NIOSH REL
		ST	150 ppm 560 mg/m3	NIOSH REL
		TWA	200 ppm	OSHA Z-2
		CEIL	300 ppm	OSHA Z-2
		Peak	500 ppm	OSHA Z-2
		TWA	100 ppm 375 mg/m3	OSHA P0
		STEL	150 ppm 560 mg/m3	OSHA P0
		TWA	20 ppm	ACGIH
		TWA	100 ppm 375 mg/m3	NIOSH REL
		ST	150 ppm 560 mg/m3	NIOSH REL
		TWA	200 ppm	OSHA Z-2
		CEIL	300 ppm	OSHA Z-2
		Peak	500 ppm	OSHA Z-2
		TWA	100 ppm 375 mg/m3	OSHA P0
		STEL	150 ppm 560 mg/m3	OSHA P0
hydrogen sulphide	7783-06-4	TWA	10 ppm 14 mg/m3	CA AB OEL
		(c)	15 ppm 21 mg/m3	CA AB OEL
		C	10 ppm	CA BC OEL
		TWA	10 ppm	CA ON OEL
		STEL	15 ppm	CA ON OEL
		TWAEV	10 ppm 14 mg/m3	CA QC OEL
		STEV	15 ppm 21 mg/m3	CA QC OEL
		TWA	1 ppm	ACGIH
		STEL	5 ppm	ACGIH
		C	10 ppm 15 mg/m3	NIOSH REL
		CEIL	20 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		TWA	10 ppm 14 mg/m3	OSHA P0

		STEL	15 ppm 21 mg/m3	OSHA P0
		TWA	1 ppm	ACGIH
		STEL	5 ppm	ACGIH
		C	10 ppm 15 mg/m3	NIOSH REL
		CEIL	20 ppm	OSHA Z-2
		Peak	50 ppm	OSHA Z-2
		TWA	10 ppm 14 mg/m3	OSHA P0
		STEL	15 ppm 21 mg/m3	OSHA P0

Engineering measures : Use only in well-ventilated areas.

Personal protective equipment

Respiratory protection : Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : Wear a NIOSH-approved respirator/breathing apparatus in situations where there may be potential for airborne exposure.

Hand protection
Material : polyvinyl alcohol (PVA), neoprene, nitrile rubber.
Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing problems.
Ensure that eyewash stations and safety showers are close to the workstation location.

Skin and body protection : Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.

Protective measures : Wash contaminated clothing before re-use.
No special protective equipment required.

Hygiene measures : Remove and wash contaminated clothing and gloves, including the inside, before re-use.
Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	brown
Odour	:	hydrocarbon-like
Odour Threshold	:	No data available
pH	:	No data available
Melting point/range	:	No data available
Initial boiling point and boiling range	:	> 58 °C (> 136 °F) Method: ASTM D-86
Flash point	:	< -35 °C (-31 °F) Method: ASTM D 93
Fire Point	:	No data available
Auto-Ignition Temperature	:	No data available
Evaporation rate	:	No data available
Flammability	:	Easily ignites under almost all normal temperature conditions. Extremely flammable in presence of open flames, sparks, shocks, heat, oxidizing materials. Vapours are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks), and may travel considerable distance to sources of ignition and flash back.
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	18.4 kPaMethod: ASTM D 323A
Relative vapour density	:	> 1(Air = 1.0)
Relative density	:	0.9 - 0.94
Density	:	0.9 - 0.94 g/cm3 (15.5 °C / 59.9 °F)
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	Pow: < 1
Viscosity		
Viscosity, kinematic	:	35.4 mm2/s (30 °C / 86 °F)
		22.5 mm2/s (40 °C / 104 °F)
		14.6 mm2/s (50 °C / 122 °F)
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Vapours may form explosive mixtures with air. Runoff to sewer may create

fire or explosion hazard. Liquid may accumulate static charge.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents.
Hazardous decomposition products	:	May release COx, SOx, H2S, hydrocarbons, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Components:

butane:

Acute inhalation toxicity	:	LC50 Rat: 658 mg/l Exposure time: 4 h Test atmosphere: gas

xylene:

Acute oral toxicity	:	LD50 Rat: 4,300 mg/kg,
Acute inhalation toxicity	:	LC50 Rat: 5000 ppm Exposure time: 4 h Test atmosphere: vapour
Acute dermal toxicity	:	LD50 Rabbit: > 1,700 mg/kg,

toluene:

Acute oral toxicity	:	LD50 Rat: 636 mg/kg,
Acute inhalation toxicity	:	LC50 Rat: 7585 ppm

Exposure time: 4 h
Test atmosphere: vapour

Acute dermal toxicity : LD50 Rabbit: 12,125 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Components:

sulfur:
Result: Moderate skin irritant

xylene:
Result: Skin irritation

toluene:
Result: Moderate skin irritant

Serious eye damage/eye irritation

Product:

Remarks: No data available

Components:

sulfur:
Result: Moderate eye irritation

toluene:
Result: Mild eye irritation

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

gas oils (petroleum), heavy vacuum:
Naphtha (oil sand), hydrotreated:
sulfur:
butane:
xylene:
toluene:

STOT - single exposure

No data available

STOT - repeated exposure

No data available

Aspiration toxicity

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

No data available

Bioaccumulative potential

Product:

Partition coefficient: n-octanol/water	:	Pow: < 1

Components:

butane :

Partition coefficient: n-octanol/water	:	log Pow: 2.89

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company.

Dispose of as hazardous waste in compliance with local and national regulations.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR

UN/ID No.	:	1267
Proper shipping name	:	Petroleum crude oil
Class	:	3
Packing group	:	II
Labels	:	3
Packing instruction (cargo aircraft)	:	364

IMDG-Code

UN number	:	1267
Proper shipping name	:	PETROLEUM CRUDE OIL
Class	:	3
Packing group	:	II
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

49 CFR

UN/ID/NA number	:	1267
Proper shipping name	:	Petroleum crude oil
Class	:	3
Packing group	:	II
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

TDG

UN number	:	1267
Proper shipping name	:	PETROLEUM CRUDE OIL
Class	:	3
Packing group	:	II
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

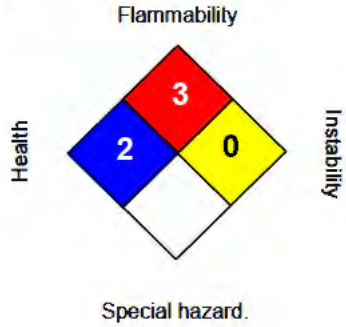
WHMIS Classification : B2: Flammable liquid
D2A: Very Toxic Material Causing Other Toxic Effects
D2B: Toxic Material Causing Other Toxic Effects
Flammable liquid
Carcinogen
Reproductive hazard
Moderate skin irritant
Moderate eye irritant
Skin sensitiser

The components of this product are reported in the following inventories:
DSL All components of this product are on the Canadian DSL.

SECTION 16. OTHER INFORMATION

Further information

NFPA:



HMIS III:

HEALTH	2*
FLAMMABILITY	3
PHYSICAL HAZARD	0
PERSONAL PROTECTION	H

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and

is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Material Safety Data Sheet

SUNCOR OSJ

V00000003989

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	SUNCOR OSJ
Synonyms	:	Light Virgin Distillate, LVGO
Manufacturer or supplier's details		SUNCOR ENERGY INC. P.O. Box 2844, 150 - 6th Avenue South-West Calgary Alberta T2P 3E3 Canada
Emergency telephone number		Suncor Energy: +1 403-296-3000; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Refinery Feedstock
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	liquid
Colour	amber
Odour	Hydrocarbon or "rotten egg" if H2S present, but odour is an unreliable warning, since it may deaden the sense of smell.
Hazard Summary	Combustible liquid. Toxic by inhalation. Irritating to skin. May cause cancer.

Potential Health Effects

Primary Routes of Entry	:	Inhalation Eye contact Skin Absorption Skin contact Ingestion
Target Organs	:	Respiratory system Central nervous system
Inhalation	:	Harmful if inhaled. May cause respiratory tract irritation. Inhalation may cause central nervous system effects. Symptoms of overexposure may be headache, dizziness,

tiredness, nausea and vomiting.
High concentration of vapours may induce unconsciousness.
Symptoms of hydrogen sulfide overexposure include respiratory tract irritation and shortness of breath.

Skin : Causes moderate skin irritation.
Prolonged skin contact may defat the skin and produce dermatitis.

Eyes : May cause eye irritation.

Ingestion : Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
Aspiration hazard if swallowed - can enter lungs and cause damage.

Aggravated Medical Condition : None known.

Carcinogenicity:

IARC Group 2A: Probably carcinogenic to humans

Gas oils, petroleum, light vacuum	64741-58-8
Distillates (petroleum), straight-run middle	64741-44-2

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical Name	CAS-No.	Concentration (%)
Gas oils (petroleum), light vacuum	64741-58-8	50 - 100 %
Distillates (petroleum), straight-run middle	64741-44-2	0 - 50 %
Condensates (petroleum), vacuum tower	64741-49-7	0 - 50 %
sulfur	7704-34-9	<= 3 %

Product may contain 0 - 200 ppm hydrogen sulphide.

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.

Seek medical advice.

In case of skin contact	:	In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognized skin cleanser. Wash clothing before reuse. Seek medical advice.
In case of eye contact	:	Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.
If swallowed	:	Rinse mouth with water. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Seek medical advice.
Most important symptoms and effects, both acute and delayed	:	First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Carbon dioxide (CO2) Foam Dry chemical
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray. Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), smoke and irritating vapours as products of incomplete combustion.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas.

Material can create slippery conditions.

Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Remove all sources of ignition. Soak up with inert absorbent material. Non-sparking tools should be used. Ensure adequate ventilation. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Do not ingest. Keep away from heat and sources of ignition. Keep container closed when not in use.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct sunlight.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

Engineering measures : Use only in well-ventilated areas.

Personal protective equipment

Respiratory protection	:	Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
Filter type	:	Wear a NIOSH-approved respirator/breathing apparatus in situations where there may be potential for airborne exposure.

Hand protection

Material	:	neoprene, nitrile, polyvinyl alcohol (PVA). Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.
Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	amber
Odour	:	Hydrocarbon or "rotten egg" if H2S present, but odour is an unreliable warning, since it may deaden the sense of smell.
Odour Threshold	:	No data available
pH	:	No data available
Melting point	:	No data available
Boiling point/boiling range	:	110 - 450 °C (230 - 842 °F) Method: ASTM D-2887
Flash point	:	50 °C (122 °F) Method: ASTM D 93
Auto-Ignition Temperature	:	248 - 267 °C (478 - 513 °F) Method: ASTM E659
Evaporation rate	:	No data available
Flammability	:	Easily ignites under almost all normal temperature conditions. Extremely flammable in presence of open flames, sparks,

		shocks, heat, oxidizing materials. Vapours are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks), and may travel considerable distance to sources of ignition and flash back.
Upper explosion limit	:	No data available
Lower explosion limit	:	0.32 - 0.39 %(V) Method: ASTM E681
Vapour pressure	:	< 0.1 kPaMethod: ASTM D 323A
Relative vapour density	:	No data available
Relative density	:	0.89
Density	:	0.89 g/cm3
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	Pow: < 1
Viscosity		
Viscosity, kinematic	:	No data available
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Vapours may form explosive mixtures with air. Runoff to sewer may create fire or explosion hazard. Liquid may accumulate static charge.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents.
Hazardous decomposition products	:	May release COx, NOx, SOx, H2S, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Inhalation Eye contact Skin Absorption Skin contact Ingestion

Acute toxicity

Product:

Acute oral toxicity : Remarks: No data available

Acute inhalation toxicity : Remarks: No data available

Acute dermal toxicity : Remarks: No data available

Components:

Gas oils (petroleum), light vacuum:
Acute inhalation toxicity : LC50 Rat: 4.1 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

Distillates (petroleum), straight-run middle:
Acute oral toxicity : LD50 Rat: > 5,000 mg/kg,

Acute inhalation toxicity : LC50 Rat: 1.78 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

Acute dermal toxicity : LD50 Rabbit: > 2,000 mg/kg,

Condensates (petroleum), vacuum tower:
Acute inhalation toxicity : LC50 Rat: 4.1 mg/l
Exposure time: 4 h
Test atmosphere: dust/mist

sulfur:
Acute dermal toxicity : LD50 Rabbit: > 2,000 mg/kg,

Skin corrosion/irritation

Product:

Remarks: No data available

Components:

Distillates (petroleum), straight-run middle:
Result: Moderate skin irritant

sulfur:
Result: Moderate skin irritant

Serious eye damage/eye irritation

Product:

Remarks: No data available

Components:

Distillates (petroleum), straight-run middle:

Result: Mild eye irritation

sulfur:
Result: Moderate eye irritation

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

Aspiration toxicity

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

Components:

Distillates (petroleum), straight-run middle :

Partition coefficient: n-octanol/water	:	Remarks: No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.
Contaminated packaging	:	Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR

UN/ID No.	:	1268
Proper shipping name	:	Petroleum distillates, n.o.s.
Class	:	3
Packing group	:	III
Labels	:	3
Packing instruction (cargo aircraft)	:	366

IMDG-Code

UN number	:	1268
Proper shipping name	:	PETROLEUM DISTILLATES, N.O.S.
Class	:	3
Packing group	:	III
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

TDG

UN number	:	1268
Proper shipping name	:	PETROLEUM DISTILLATES, N.O.S.
Class	:	3

Packing group	:	III
Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

Special precautions for user

Not applicable

SECTION 15. REGULATORY INFORMATION

WHMIS Classification : B3: Combustible Liquid
D1B: Toxic Material Causing Immediate and Serious Toxic Effects
D2A: Very Toxic Material Causing Other Toxic Effects
D2B: Toxic Material Causing Other Toxic Effects

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All components of this product are on the Canadian DSL.

SECTION 16. OTHER INFORMATION

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds
Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228
For Product Safety Information: 1 905-804-4752

Prepared by : Product Safety: +1 905-804-4752

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

FLINT HILLS resources®

MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**CRUDE OIL - CANADA**
Version #	05
Issue date	01-21-2011
Revision date	03-27-2014
MSDS number	7958
Synonym(s)	PETROLEUM CRUDE * RAW CRUDE
Supplier	Flint Hills Resources Canada, LP 1510, 111-5th Avenue SW Calgary, AB T2P 3Y6 CANADA
Telephone numbers – 24 hour emergency assistance	
Flint Hills Resources Canada, LP	403-716-7600
Chemtrec (United States)	800-424-9300
Canutec (Canada)	613-996-6666
Telephone numbers – general assistance	
8-5 (M-F, MST)	403-716-7600
8-5 (M-F, CST) MSDS Assistance	316-828-7988
Email:	msdsrequest@fhr.com

2. Hazards Identification

Emergency overview

DANGER!

BLACK, BROWN OR GREENISH LIQUID WITH AROMATIC OR PETROLEUM ODOR

HEALTH HAZARDS
CONTAINS HYDROGEN SULFIDE GAS. MAY BE FATAL IF INHALED
GAS MAY EVOLVE FROM THIS MATERIAL AND ACCUMULATE IN CONFINED SPACES
MAY BE HARMFUL OR FATAL IF SWALLOWED
MAY CAUSE LUNG DAMAGE
BREATHING HIGH CONCENTRATIONS CAN CAUSE IRREGULAR HEARTBEATS WHICH MAY BE FATAL
DANGER-CONTAINS BENZENE-CANCER HAZARD
CAN CAUSE LEUKEMIA AND OTHER BLOOD DISORDERS
MAY BE IRRITATING TO THE SKIN AND EYES
OVEREXPOSURE MAY CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION
SEE "TOXICOLOGICAL INFORMATION" (SECTION 11) FOR MORE INFORMATION

FLAMMABILITY HAZARDS
EXTREMELY FLAMMABLE LIQUID AND VAPOR
VAPOR MAY CAUSE FLASH FIRE OR EXPLOSION
FLAMMABLE AND POISONOUS GAS MAY EVOLVE FROM THIS MATERIAL AND ACCUMULATE IN CONFINED SPACES

REACTIVITY HAZARDS
STABLE

Potential health effects

Routes of exposure

Inhalation, ingestion, skin and eye contact.

Eyes

Contact may cause pain and severe reddening and inflammation of the conjunctiva. Effects may become more serious with repeated or prolonged contact.

Vapors may cause eye irritation and sensitivity to light.

Skin Contact may cause reddening, itching and inflammation. Skin contact may cause harmful effects in other parts of the body.

Inhalation HIGHLY TOXIC.

May be harmful or fatal if inhaled.

Hydrogen sulfide can cause respiratory paralysis and death, depending on the concentration and duration of exposure. Do not rely on ability to smell vapors, since odor fatigue rapidly occurs. Effects of overexposure include irritation of the nose and throat, nausea, vomiting, diarrhea, abdominal pain and signs of nervous system depression (e.g. headache, drowsiness, dizziness, loss of coordination and fatigue), irregular heartbeats, pulmonary edema, weakness and convulsions.

Breathing of the mists, vapors or fumes may irritate the nose, throat and lungs.

May cause central nervous system depression or effects.

Overexposure to this material may cause systemic damage including target organ effects listed under "Toxicological Information" (Section 11).

Ingestion Swallowing this material may be harmful. May cause irritation of the mouth, throat and gastrointestinal tract. Symptoms may include salivation, pain, nausea, vomiting and diarrhea.

Aspiration into lungs may cause chemical pneumonia and lung damage.

Exposure may also cause central nervous system symptoms similar to those listed under "Inhalation" (see Inhalation section).

3. Composition / Information on Ingredients

Components	CAS #	Percent
CRUDE OIL	8002-05-9	100 %
N-HEXANE	110-54-3	5 - 8 %
BENZENE	71-43-2	1 - 5 %
TOLUENE	108-88-3	1 - 5 %
XYLENE	1330-20-7	1 - 5 %
HYDROGEN SULFIDE	7783-06-4	1 - 4 %
ETHYLBENZENE	100-41-4	1 - 3 %
POLYCYCLIC AROMATIC COMPOUNDS	130498-29-2	< 0.1 %

Composition comments Values do not reflect absolute minimums and maximums; these values are typical which may vary from time to time.

This Material Safety Data Sheet is intended to communicate potential health hazards and potential physical hazards associated with the product(s) covered by this sheet, and is not intended to communicate product specification information. For product specification information, contact your Flint Hills Resources, LP representative.

4. First Aid Measures

First aid procedures

Eye contact Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Get medical attention if irritation persists.

Skin contact Immediately wash skin with plenty of soap and water after removing contaminated clothing and shoes. Get medical attention if irritation develops or persists. Place contaminated clothing in closed container for storage until laundered or discarded. If clothing is to be laundered, inform person performing operation of contaminant's hazardous properties. Discard contaminated leather goods.

Inhalation Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear and give oxygen. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR).

Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Ingestion

Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips to prevent aspiration and monitor for breathing difficulty.

Never give anything by mouth to an unconscious person.

Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Notes to physician

INHALATION: Inhalation exposure can produce toxic effects. Treat intoxications as hydrogen sulfide exposures. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested this material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended.

5. Fire Fighting Measures

Flammable properties

Material will burn in a fire.

Extremely flammable. Vapors form flammable or explosive mixtures with air at room temperature. Vapor or gas may spread to distant ignition sources and flash back.

Explosion hazard if exposed to extreme heat.

Extinguishing media

Suitable extinguishing media

Use water spray, dry chemical, carbon dioxide or fire-fighting foam for Class B fires to extinguish fire.

Protection of firefighters

Specific hazards arising from the chemical

Combustion may produce COx, SOx, reactive hydrocarbons irritating vapors, and other decomposition products in the case of incomplete combustion.

Fire fighting equipment/instructions

Shut off source of flow, if possible.

Evacuate area and fight fire from a safe distance.

If leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor, cool adjacent structures, and to protect personnel attempting to stop a leak.

Containers can build up pressure if exposed to heat (fire). Stay away from storage tank ends. Withdraw immediately in case of rising sound from venting safety device or any discoloration of storage tank due to fire.

Be aware that a BLEVE (Boiling Liquid Expanding Vapor Explosion) may occur unless surfaces are kept cool with water.

Firefighters must wear NIOSH approved positive pressure breathing apparatus (SCBA) with full face mask and full protective equipment.

Explosion data

Sensitivity to static discharge

None known.

Sensitivity to mechanical impact

None known.

6. Accidental Release Measures

Environmental precautions

Eliminate all sources of ignition. Isolate hazard area and deny entry. If material is released to the environment, take immediate steps to stop and contain release. Caution should be exercised regarding personnel safety and exposure to the released material. Notify local, provincial and/or federal authorities, if required.

Other information

Keep unnecessary people away, isolate area for at least 50 meters (164 feet) in all directions to preserve public safety. For large spills, if downwind consider initial evacuation for at least 300 meters (1000 feet).

Keep ignition sources out of area and shut off all ignition sources. Absorb spill with inert material (e. g. dry sand or earth) then place in a chemical waste container. Large Spills: Dike far ahead of liquid spill for later disposal.

Use vapor suppressing foam to reduce vapors. Stop leak when safe to do so.

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind. IF TANK, RAILCAR OR TANK TRUCK IS INVOLVED IN A FIRE, isolate for 800 meters (1/2 mile) in all directions. Evacuate area endangered by release as required. (See Exposure Controls/Personal Protection, Section 8.)

7. Handling and Storage

Handling

Bond and ground lines and equipment (tank, transfer lines, pump, floats, etc.) used during transfer to reduce the possibility of static spark-initiated fire or explosion. Use non-sparking tools. Do not cut, grind, drill, weld or reuse containers unless adequate precautions are taken against these hazards.

Good personal hygiene practices such as properly handling contaminated clothing, using wash facilities before entering public areas and restricting eating, drinking and smoking to designated areas are essential for preventing personal chemical contamination. Avoid contact with skin or eyes. Do not breathe fumes or vapor.

Storage

Store in tightly closed containers in a cool, dry, isolated, well-ventilated area away from heat, sources of ignition and incompatibles. Avoid contact with strong oxidizers.

Empty containers may contain material residue. Do not reuse without adequate precautions.

Hydrogen sulfide can build up in the head space of storage vessels containing this material. Use appropriate respiratory protection to prevent exposure. See Exposure Controls/Personal Protection (Section 8).

When entering a storage vessel that has previously contained this material, it is recommended that the atmosphere be monitored for the presence of hydrogen sulfide. See Occupational exposure limits (Section 8) for exposure limits.

Do not eat, drink or smoke in areas of use or storage.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH Biological Exposure Indices

Components	Type	Value	Form
BENZENE (CAS 71-43-2)	BEI	25 µg/g	
ETHYLBENZENE (CAS 100-41-4)	BEI	0.7 g/g	
N-HEXANE (CAS 110-54-3)	BEI	0.4 mg/l	
TOLUENE (CAS 108-88-3)	BEI	0.3 mg/g	o-Cresol in urine
		0.03 mg/l	Urine
		0.02 mg/l	Blood
XYLENE (CAS 1330-20-7)	BEI	1.5 g/g	

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
BENZENE (CAS 71-43-2)	STEL	2.5 ppm	Skin
	TWA	0.5 ppm	Skin
ETHYLBENZENE (CAS 100-41-4)	STEL	125 ppm	
	TWA	20 ppm	
HYDROGEN SULFIDE (CAS 7783-06-4)	STEL	5 ppm	
	TWA	1 ppm	
N-HEXANE (CAS 110-54-3)	TWA	50 ppm	Skin
POLYCYCLIC AROMATIC COMPOUNDS (CAS 130498-29-2)	TWA	0.2 mg/m3	Coal tar pitch volatiles (benzene soluble fraction)

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
TOLUENE (CAS 108-88-3)	TWA	20 ppm	
XYLENE (CAS 1330-20-7)	STEL	150 ppm	
	TWA	100 ppm	

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
BENZENE (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
ETHYLBENZENE (CAS 100-41-4)	STEL	125 ppm
	TWA	100 ppm
HYDROGEN SULFIDE (CAS 7783-06-4)	Ceiling	15 ppm
	TWA	10 ppm
N-HEXANE (CAS 110-54-3)	TWA	50 ppm
TOLUENE (CAS 108-88-3)	TWA	50 ppm
XYLENE (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
BENZENE (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
ETHYLBENZENE (CAS 100-41-4)	TWA	20 ppm
HYDROGEN SULFIDE (CAS 7783-06-4)	Ceiling	10 ppm
N-HEXANE (CAS 110-54-3)	TWA	20 ppm
TOLUENE (CAS 108-88-3)	TWA	20 ppm
XYLENE (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value	Form
BENZENE (CAS 71-43-2)	STEL	2.5 ppm	
	TWA	0.5 ppm	
ETHYLBENZENE (CAS 100-41-4)	TWA	20 ppm	
HYDROGEN SULFIDE (CAS 7783-06-4)	STEL	5 ppm	
	TWA	1 ppm	
N-HEXANE (CAS 110-54-3)	TWA	50 ppm	
POLYCYCLIC AROMATIC COMPOUNDS (CAS 130498-29-2)	TWA	0.2 mg/m3	Coal tar pitch volatiles (benzene soluble fraction)
TOLUENE (CAS 108-88-3)	TWA	20 ppm	
XYLENE (CAS 1330-20-7)	STEL	150 ppm	
	TWA	100 ppm	

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
BENZENE (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
ETHYLBENZENE (CAS 100-41-4)	TWA	20 ppm
HYDROGEN SULFIDE (CAS 7783-06-4)	STEL	15 ppm
	TWA	10 ppm

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
N-HEXANE (CAS 110-54-3)	TWA	50 ppm
TOLUENE (CAS 108-88-3)	TWA	20 ppm
XYLENE (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
BENZENE (CAS 71-43-2)	STEL	5 ppm
	TWA	1 ppm
ETHYLBENZENE (CAS 100-41-4)	STEL	125 ppm
	TWA	100 ppm
HYDROGEN SULFIDE (CAS 7783-06-4)	STEL	15 ppm
	TWA	10 ppm
N-HEXANE (CAS 110-54-3)	TWA	50 ppm
TOLUENE (CAS 108-88-3)	STEL	150 ppm
	TWA	100 ppm
XYLENE (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Components	Type	Value
BENZENE (CAS 71-43-2)	STEL	5 ppm
	TWA	1 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
ETHYLBENZENE (CAS 100-41-4)	TWA	100 ppm
N-HEXANE (CAS 110-54-3)	TWA	500 ppm
XYLENE (CAS 1330-20-7)	TWA	100 ppm

US. OSHA Table Z-1-A (29 CFR 1910.1000)

Components	Type	Value
TOLUENE (CAS 108-88-3)	TWA	200 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value	Form
BENZENE (CAS 71-43-2)	TWA	1 ppm	
CRUDE OIL (CAS 8002-05-9)	TWA	500 ppm	
HYDROGEN SULFIDE (CAS 7783-06-4)	Ceiling	20 ppm	
POLYCYCLIC AROMATIC COMPOUNDS (CAS 130498-29-2)	TWA	0.2 mg/m3	Coal tar pitch volatiles (benzene soluble fraction)
TOLUENE (CAS 108-88-3)	Ceiling	300 ppm	
	TWA	200 ppm	

Exposure guidelines NOTE: Only ingredients with validated exposure limits are shown in section 8.

Canada - Alberta OELs: Skin designation

BENZENE (CAS 71-43-2)	Can be absorbed through the skin.
N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.
TOLUENE (CAS 108-88-3)	Can be absorbed through the skin.

Canada - British Columbia OELs: Skin designation

BENZENE (CAS 71-43-2)	Can be absorbed through the skin.
N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.
XYLENE (CAS 1330-20-7)	Can be absorbed through the skin.

Canada - Manitoba OELs: Skin designation

BENZENE (CAS 71-43-2)	Can be absorbed through the skin.
N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.

Canada - Ontario OELs: Skin designation

BENZENE (CAS 71-43-2)	Can be absorbed through the skin.
N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.

Canada - Quebec OELs: Skin designation

N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.
TOLUENE (CAS 108-88-3)	Can be absorbed through the skin.

Canada - Saskatchewan OELs: Skin designation

N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.
TOLUENE (CAS 108-88-3)	Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

BENZENE (CAS 71-43-2)	Can be absorbed through the skin.
N-HEXANE (CAS 110-54-3)	Can be absorbed through the skin.

Engineering controls Ventilation and other forms of engineering controls are the preferred means for controlling exposures.

Personal protective equipment

Eye / face protection Keep away from eyes. Eye contact can be avoided by using chemical safety glasses, goggles and/or face shield. Have eye washing facilities readily available where eye contact can occur.

Skin protection Dermal exposure to this chemical may add to the overall exposure.

Avoid skin contact with this material. Use appropriate chemical protective gloves when handling. Additional protective clothing may be necessary.

Respiratory protection The use of air purifying respirators is not recommended where hydrogen sulfide levels may exceed exposure limits. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection. See OSHA 29 CFR 1910.134 for more information regarding respiratory protection and Assigned Protection Factors (APFs).

9. Physical & Chemical Properties

Appearance	
Physical state	Liquid.
Form	Not applicable
Color	Black, Brown, or green.
Odor	Aromatic or petroleum
Odor threshold	0.1 - 0.5 ppm
pH	Not available
Vapor pressure	Not available
Vapor density	> 1
Boiling point	< 100 °F (< 37.8 °C)
Melting point/Freezing point	Not available
Solubility (water)	Insoluble
Specific gravity	0.7 - 0.95 at 60/60 °F (15.6/15.6 °C)
Relative density	Not available.
Flash point	> -40 °F (> -40 °C)
Flammability limits in air, upper, % by volume	10 %
Flammability limits in air, lower, % by volume	1 %
Auto-ignition temperature	Not available
VOC	Not available
Evaporation rate	Variable
Viscosity	Varies
Percent volatile	Not available
Partition coefficient (n-octanol/water)	Not available

Pour point	Varies
Bulk density	5.84 - 7.85 Lb./Gal.
Molecular weight	Not available
Molecular formula	Mixture

Other data

Chemical family	Hydrocarbon Mixture

10. Chemical Stability & Reactivity Information

Chemical stability	Stable under normal conditions of use.
Conditions to avoid	Avoid unventilated areas, heat, open flames, sparks and ungrounded electrical equipment.
Incompatible materials	Avoid contact with strong acids and oxidizers. See precautions under Handling & Storage (Section 7).
Hazardous decomposition products	Not anticipated under normal conditions.
Possibility of hazardous reactions	Not anticipated under normal conditions.

11. Toxicological Information

Carcinogenicity

ACGIH Carcinogens

BENZENE (CAS 71-43-2)	A1 Confirmed human carcinogen.
ETHYL BENZENE (CAS 100-41-4)	A3 Confirmed animal carcinogen with unknown relevance to humans.
TOLUENE (CAS 108-88-3)	A4 Not classifiable as a human carcinogen.
XYLENE (O, M AND P ISOMERS) (CAS 1330-20-7)	A4 Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

BENZENE (CAS 71-43-2)	1 Carcinogenic to humans.
CRUDE OIL (CAS 8002-05-9)	3 Not classifiable as to carcinogenicity to humans.
ETHYLBENZENE (CAS 100-41-4)	2B Possibly carcinogenic to humans.
TOLUENE (CAS 108-88-3)	3 Not classifiable as to carcinogenicity to humans.
XYLENE (CAS 1330-20-7)	3 Not classifiable as to carcinogenicity to humans.

Toxicological data

BENZENE: Studies of Workers Overexposed to Benzene: Studies of workers exposed to benzene show clear evidence that overexposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Some studies suggest overexposure to benzene may also be associated with other blood disorders including myelodysplastic syndrome. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely overexposed to benzene. Studies in Laboratory Animals: Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations. Benzene has been classified as a proven human carcinogen by OSHA and a Group 1 (Carcinogenic to Humans) material by IARC.

ETHYLBENZENE: Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). The incidence of tumors was also elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals have demonstrated evidence of ototoxicity (hearing loss) following exposure levels as low as 300 ppm for 5 days. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

HYDROGEN SULFIDE: Hydrogen sulfide gas has an unpleasant odor that diminishes with increased exposure. Eye irritation may occur at levels above 4 ppm. Olfactory fatigue occurs rapidly at levels of 50 ppm or higher. Odor is not a reliable warning property. Respiratory effects include irritation with possible pulmonary edema at levels above 50 ppm. At 500 ppm immediate loss of consciousness and death can occur.

NIOSH has determined that 100 ppm hydrogen sulfide is immediately dangerous to life and health (IDLH).

N-HEXANE: Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure.

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs): Cancer is the most significant endpoint for PAHs. Certain PAHs are weak carcinogens which become carcinogenic after undergoing metabolism. Chronic or repeated exposure increases the likelihood of tumor initiation. Increased incidence of tumors of the skin, bladder, lung and gastrointestinal tract have been described in individuals overexposed to certain PAHs. Overexposure to PAHs has also been associated with photosensitivity and eye irritation. Inhalation overexposure of PAHs has been associated with respiratory tract irritation, cough, and bronchitis. Dermal overexposure has been associated with precancerous lesions, erythema, dermal burns, photosensitivity, acneiform lesions and irritation. Oral overexposure to PAHs has been associated with precancerous growths of the mouth (leukoplakia). Mild nephrotoxicity, congestion and renal cortical hemorrhages and elevated liver function tests, changes in the immune system and other effects have been observed in rats exposed to high levels of PAHs by ingestion.

TOLUENE: Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Abuse of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system, and can cause CNS depression, cardiac arrhythmias, and death. Studies of workers indicate longterm exposure may be related to impaired color vision and hearing. Some studies of workers suggest longterm exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest longterm exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals have been largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Adverse effects on the liver, kidney, thymus and nervous system were observed in animal studies following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

XYLENES, ALL ISOMERS: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross overexposure. Effects from Prolonged or Repeated Exposure: Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. The relevance of these observations to humans is not clear at this time. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

CRUDE OIL: Lifetime dermal studies in rodents have shown in an increase in skin tumors with some crude oils. The International Agency for Research on Cancer (IARC) has concluded that there is limited evidence of carcinogenicity in animals and inadequate evidence of carcinogenicity in humans. The Overall IARC evaluation for crude oil is: "not classifiable as to its carcinogenicity to humans (Group 3)." Exposure to this material or its components may cause the following specific symptoms, depending on the concentration and duration of exposure: skin pigmentation changes, hyperkeratosis, folliculitis, warts, and anemia.

Exposure to this material may cause adverse effects or damage to the following organs or organ systems: blood, bone marrow, central nervous system, auditory system, peripheral nervous system, heart, immune system, kidneys, liver, lungs, lymphatic system, thymus, pituitary gland, thyroid, mucous membranes, respiratory tract, reproductive organs, testes, skin, and eyes.

12. Ecological Information

Ecotoxicological data

Product		Species	Test Results
CRUDE OIL - CANADA			
Aquatic			
Fish	LC50	Cutthroat trout (Oncorhynchus clarki)	2.1 - 4.3 mg/l, 96 hours

Ecotoxicity Toxic to aquatic organisms.

Persistence and degradability Not readily biodegradable.

Bioaccumulation / Accumulation May bioaccumulate in aquatic organisms.

Mobility in environmental media May partition into air, soil and water.

13. Disposal Considerations

Disposal instructions The transportation, storage, treatment and disposal of RCRA waste material must be conducted in compliance with federal regulations. Check state and local regulations for any additional requirements as these may be more restrictive than federal laws and regulations. Chemical additions, processing or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate or otherwise inappropriate. Disposal of this material must be conducted in compliance with all federal, state and local regulations.

In Canada, wastes should be disposed of according to federal, provincial and local regulations.

For additional handling information and protection of employees, see Section 7 (Handling and Storage) and Section 8 (Exposure Controls/Personal Protection).

14. Transport Information

General The above description may not cover shipping in all cases, please consult 49 CFR 100-185 for specific shipping information or Transport Compliance Specialist (CSO).

TDG

UN number	UN1267
UN proper shipping name	PETROLEUM CRUDE OIL (CRUDE OIL - CANADA)
Hazard class	3
Packing group	II
Marine pollutant	D
ERG code	128

15. Regulatory Information

Canadian regulations

All ingredients are on the Canadian Domestic Substance List (DSL), or are not required to be listed on the DSL.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation (CPR) and the MSDS contains all the information required by the CPR.

WHMIS status

Controlled

WHMIS classification

B2 - Flammable Liquids
D1A - Immediate/Serious-VERY TOXIC
D2B - Other Toxic Effects-TOXIC

WHMIS labeling

16. Other Information

HMIS® ratings

Health: 3*
Flammability: 3
Physical hazard: 0
Personal protection:
* Indicates chronic health hazard

NFPA ratings

Health: 3
Flammability: 3
Instability: 0

Disclaimer

NOTICE: The information presented herein is based on data considered to be accurate as of the date of preparation of this Material Safety Data Sheet. Adequate training and instruction should be given by you to your employees and affected personnel. Appropriate warnings and safe handling procedures should be provided by you to handlers and users. Additionally, the user should review this information, satisfy itself as to its suitability and completeness, and pass on the information to its employees or customers in accordance with the applicable federal, state, provincial or local hazard communication requirements. This MSDS may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, expressed or implied, is made as to the accuracy or comprehensiveness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, vendor neither assumes nor retains any responsibility for any damage or injury resulting from abnormal use, from any failure to adhere to appropriate practices, or from any hazards inherent in the nature of the material. Moreover, unless an employee or a customer accesses or receives a MSDS directly from the company, there is no assurance that a document obtained from alternate sources is the most currently available MSDS.

This data sheet contains changes from the previous version in section(s):

This document has undergone significant changes and should be reviewed in its entirety.

Completed by

Flint Hills Resources, LP - Operations EH&S

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER

Petroleum Crude Oil—Heavy

OTHER MEANS OF IDENTIFICATION

UN-Number	UN1267
Synonyms	Premium Conventional Heavy (PCH), Conventional Heavy (CHV)
Chemical Category	Crude oils—extremely flammable

RECOMMENDED USE

No information available

RESTRICTIONS OF USE

No information available

SUPPLIER INFORMATION

Enbridge Pipelines Inc.
10201 Jasper Avenue
Edmonton, Alberta T5J 3N7
Canada
TEL: 1-780-420-5210

EMERGENCY CONTACT INFORMATION

CHEMTREC	1-800-424-9300 for US 703-527-3887 outside US
CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
Petroleum distillate (naphtha)	8002-05-9	60-100	
Natural Gas Condensates (petroleum)	64741-47-5	60-100	
Asphalt	8052-42-4	50-90	
Butane	106-97-8	0-10	
Pentane	109-66-0	0-7	
Octane	111-65-9	0-5	
Nonane	111-84-2	0-5	
Heptane	142-82-5	0-5	
2-Methylbutane	78-78-4	0-5	
Isobutane	75-28-5	0-5	
Hexane	110-54-3	0-5	
Decane	124-18-5	0-5	
Benzene	71-43-2	0-2	
Xylene	1330-20-7	0-1	
Toluene	108-88-3	0-1	
Ethylbenzene	100-41-4	0-1	
1,2,4-Trimethylbenzene	95-63-6	0-1	
Hydrogen Sulfide	7783-06-4	0-1	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

	Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/ attention.
	Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.
MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED	**Refer to Section 11 - Toxicological Information**	
INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY	**Note to the Physician**	• Aspiration hazard. Symptoms may be delayed. • Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias. • Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA	**Suitable Extinguishing Media**	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
	Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.
FIREFIGHTING PROCEDURES		• FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. • FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out. • Stay upwind. • Ventilate closed spaces before entering. • Fire fighters should wear complete protective clothing including self-contained breathing apparatus. • FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. • FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions. • Move containers from fire area if you can do it without risk. • LARGE FIRES: Use water spray or fog; do not use straight streams. • LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn. • LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flashback.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen.
- Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.
Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do not wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment

- Stop leak if you can do it without risk.
- Contain and recover liquid when possible.
- A vapor suppressing foam may be used to reduce vapors.
- Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming.
- Use water spray to reduce vapors or divert vapor cloud drift.
- A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.

Methods for Cleaning Up

- Clean up spill immediately.
- LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST.
- SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal.
- Use appropriate Personal Protective Equipment (PPE).
- Use clean non-sparking tools to collect absorbed material.
- Vacuum spilled material.
- Try to work upwind of spill.
- All equipment used when handling the product must be grounded.
- Recover and return free product to proper containers
- Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids.
- Do not place spilled materials back in the original container.
- Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling

- All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces.
- The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes).
- The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits.
- Take precautionary measures against static discharges.

	Handling	• Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. • Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	**Storage**	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
Petroleum distillate (naphtha)	–	–	TWA 350 mg/m^3 IDLH 1100 ppm Ceiling 1800 mg/m^3
Asphalt	TLV 0.5 mg/m^3		Ceiling 5 mg/m^3
Butane	STEL 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3

Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m^3 IDLH 1500 ppm
Octane	TLV 300 ppm TLV 1401 mg/m^3	PEL 500 ppm PEL 2350 mg/m^3	TWA 75 ppm TWA 350 mg/m^3 Ceiling 385 ppm Ceiling 1800 mg/m^3 IDLH 1000 ppm
Nonane	TLV 200 ppm TLV 1050 mg/m^3	–	TWA 200 ppm TWA 1050 mg/m^3
Heptane	TLV 400 ppm TLV 1640 mg/m^3 STEL 500 ppm STEL 2000 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 85 ppm TWA 350 mg/m^3 Ceiling 440 ppm Ceiling 1800 mg/m^3 IDLH 750 ppm
2-Methylbutane	TWA 600 ppm	–	–
Isobutane	TWA 1000 ppm	–	–
Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm
Decane	–	–	–
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m^3 STEL 150 ppm STEL 651 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 150 ppm STEL 655 mg/m^3 IDLH 900 ppm
Toluene	TLV 20 ppm TLV 75 mg/m^3	PEL 200 ppm STEL 300 mg/m^3	TWA 100 ppm TWA 375 mg/m^3 STEL 150 ppm STEL 560 mg/m^3 IDLH 500 ppm
Ethylbenzene	TLV 20 ppm TLV 87 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 125 ppm STEL 545 mg/m^3 IDLH 800 ppm

1,2,4-Trimethylbenzene	TWA 25 ppm		TWA 25 ppm TWA 125 mg/m^3
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m^3 STEL 5 ppm STEL 7 mg/m^3	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m^3 IDLH 100 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid	**Odor**	Petroleum like odor
Substance Type	Mixture	**Odor Threshold**	No data available
Appearance	Brown		

PROPERTIES

pH	No data available	**Vapor pressure**	No data available
Melting Point/ Freezing Point	No data available	**Vapor density**	2.5 to 5.0 Air=1
Boiling Point/ Boiling Range	34 to 260°C 93.2 to 500°F	**Relative density**	No data available
Flash Point	-40 to 260 °C -40 to 500 °F	**Water Solubility**	Negligible
Evaporation Rate	No data available	**Partition coefficient: n-octanol/water**	No data available
Flammability (solid, gas)	No data available	**Autoignition temperature**	No data available
Upper Flammability Limit	No data available	**Decomposition temperature**	No data available

Lower Flammability Limit	No data available	**Specific Gravity**	0.65-0.98
Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
Asphalt	>5000 mg/kg (Rat)	–	>94.4 mg/m^3 (Rat)
Butane	–	–	658 mg/L (Rat) 4 h
Pentane	>2000 mg/kg (Rat)	–	364 g/cu (Rat) 4 h
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
Nonane	–	–	= 3200 ppm (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
2-Methylbutane	–	–	= 150,000 mg/m^3 (Rat) 2 h

Isobutane			= 658,000 mg/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Decane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	–
Benzene	1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Xylenes	= 3500 mg/kg (Rat)	> 4350 mg/kg (Rabbit) > 1700 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
1,2,4-Trimethylbenzene	5 g/kg (Rat)	–	18000 mg/m^3 (Rat) 4h
Hydrogen sulfide	–	–	= 444 ppm (Rat)

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene

- Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.

Hydrogen Sulfide Gas (H_2S)

- Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.

Hexane

- This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.

Xylenes

- Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.

Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Petroleum distillate (naphtha)	A2	–	Group 3		–
Asphalt	A4	–	Group 2B	Reasonably Anticipated	–
Hexane	–	X	–	–	–
Benzene	A1	X	Group 1	Known	X
Xylenes	A4	–	Group 3	Evidence	
Toluene	A4	–	Group 3	Evidence	–
Ethylbenzene	A3	–	Group 2B	Evidence	X

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY	• Suspected of damaging fertility or the unborn child.
STOT—SINGLE EXPOSURE	• May cause drowsiness and dizziness.
STOT—REPEATED EXPOSURE	• Causes damage to organs through prolonged or repeated exposure.
ASPIRATION HAZARD	May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Petroleum distillate (naphtha)	–	LC50: 258 mg/L Salmo gairdneri 96 h static	EC50 48 h: < 0.26 mg/L Static (Daphnia magna) EC50 24 h: = 36 mg/L (Daphnia magna)	–
Natural gas condensates (petroleum)	–	LC50 96 h: = 119 mg/L static (Alburnus alburnus) LC50 96 h: = 82 mg/L static (Cyprinodon variegatus)	EC50 24 h: = 170 mg/L (Daphnia magna)	–
Butane	–	–	–	–
Pentane	–	LC50 96 h: = 11.59 mg/L (Pimephales promelas) LC50 96 h: = 9.87 mg/L (Oncorhynchus mykiss) LC50 96 h: = 9.99 mg/L (Lepomis macrochirus)	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–
2-Methylbutane			EC50 48 h: = 2.3 mg/L (Daphnia magna)	
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Decane	EC50 24 h: = 0.043 mg/L (Chlorella vulgaris)	–	EC50 48 h: = 0.029 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	-
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)
Hydrogen sulfide	–	LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	–

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
Asphalt	6.006
Butane	2.89
Pentane	3.39
Octane	5.18
Heptane	4.66
2-Methylbutane	2.72
Isobutane	2.76
Hexane	3.90
Decane	5.1
Benzene	1.83
Xylene	2.77-3.15
Toluene	2.65
Ethylbenzene	3.118

1,2,4-Trimethylbenzene	3.78
Hydrogen Sulfide	0.45

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
Petroleum distillate (naphtha)	High
Butane	Low
Pentane	High
Octane	Immobile
Nonane	Immobile
Heptane	Moderate
2-Methylbutane	Low
Isobutane	Very High
Hexane	High
Decane	Immobile
Benzene	High
Xylene	Very High to Moderate
Toluene	High to Moderate
Ethylbenzene	Low
1,2,4-Trimethylbenzene	Low

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.
- This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP).
- This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s).
- It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging Waste	• Containers should be completely used and containers should be emptied prior to discard. • Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. • Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner. • To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1267	Petroleum Crude Oil	3	I	Emergency response guide number: 128
TDG	UN1267	Petroleum Crude Oil	3	I	Marine Pullutant
IMO/IMDG	UN1267	Petroleum Crude Oil	3	I	Marine Pullutant
IATA/ICAO	UN1267	Petroleum Crude Oil	3	I	ERG Code 3L

SPECIAL RECAUTIONS FOR USER

• None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed

Isobutane	75-28-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Decane	124-18-5	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed
Isobutane	75-28-5	Not Listed
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	10 lb RQ
Xylene	1330-20-7	100 lb RQ
Toluene	108-88-3	1000 lb RQ
Ethylbenzene	100-41-4	1000 lb RQ
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
HydrogenSulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed
Isobutane	75-28-5	Not Listed
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	X
Xylene	1330-20-7	X
Toluene	108-88-3	X
Ethylbenzene	100-41-4	X
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Pentane	109-66-0	Not Listed
Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	Not Listed
Isobutane	75-28-5	Not Listed
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	X
Xylene	1330-20-7	Not Listed
Toluene	108-88-3	X
Ethylbenzene	100-41-4	X
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS #	CLASSIFICATION
Petroleum distillate (naphtha)	8002-05-9	B2
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	A, B1
Pentane	109-66-0	B2

Octane	111-65-9	B2, D2B
Nonane	111-84-2	B2, D2B
Heptane	142-82-5	B2, D2B
2-Methylbutane	78-78-4	B2
Isobutane	75-28-5	A, B1 (listed under Methyl-2 propane)
Hexane	110-54-3	B2, D2A, D2B
Decane	124-18-5	B3, D2B
Benzene	71-43-2	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B
Toluene	108-88-3	B2, D2A, D2B
Ethylbenzene	100-41-4	B2, D2A, D2B
1,2,4-Trimethylbenzene	95-63-6	B3
Hydrogen Sulfide	7783-06-4	A, B1, D1A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Natural gas condensates (petroleum)	64741-47-5	Not Listed
Asphalt	8052-42-4	Not Listed
Butane	106-97-8	X
Pentane	109-66-0	X

Octane	111-65-9	Not Listed
Nonane	111-84-2	Not Listed
Heptane	142-82-5	Not Listed
2-Methylbutane	78-78-4	X
Isobutane	75-28-5	X
Hexane	110-54-3	Not Listed
Decane	124-18-5	Not Listed
Benzene	71-43-2	X
Xylene	1330-20-7	X
Toluene	108-88-3	X
Ethylbenzene	100-41-4	X
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Hydrogen Sulfide	7783-06-4	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	**Flammability:** 4	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 2	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 5/4/15

REVISION DATE 5/4/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER

Petroleum Crude Oil—Light Synthetic

OTHER MEANS OF IDENTIFICATION

UN-Number	UN1268
Synonyms	Premium Synthetic (PSY), Hardisty Synthetic Crude (HSC), Synthetic Sweet Blend (SYN).
Chemical Category	Crude oils—extremely flammable

RECOMMENDED USE

No information available

RESTRICTIONS OF USE

No information available

SUPPLIER INFORMATION

Enbridge Pipelines Inc.
10201 Jasper Avenue
Edmonton, Alberta T5J 3N7
Canada
TEL: 1-780-420-5210

EMERGENCY CONTACT INFORMATION

CHEMTREC	1-800-424-9300 for US 703-527-3887 outside US
CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
1,2,4-Trimethylbenzene	95-63-6	0-5	
Benzene	71-43-2	0-5	
Butane	106-97-8	0-5	
Cyclohexane	110-82-7	0-5	
Decane	124-18-5	0-10	
Distillates (petroleum), hydrotreated middle	64742-46-7	0-60	
Ethylbenzene	100-41-4	0-5	
Fuels, diesel, No. 2	68476-34-6	0-30	
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	0-100	
Heptane	142-82-5	0-7	
Hexane	110-54-3	0-7	
Methylcyclohexane	108-87-2	0-7	
Naphtha (petroleum), hydrotreated light	64742-49-0	0-7	
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	0-60	
Octane	111-65-9	0-7	
o-Xylene	95-47-6	0-5	
Petroleum distillate (naphtha)	8002-05-9	0-100	
Toluene	108-88-3	0-5	
Xylene	1330-20-7	0-5	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO_2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen.
- Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions	• Evacuate personnel to safe areas. • Remove all sources of ignition. • Deny entry to unauthorized and unprotected personnel. • Use personal protective equipment. • Avoid contact with skin, eyes and clothing. • Stop leak if you can do it without risk. • Keep people away from and upwind of spill/leak. • Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. • Ventilate enclosed areas. • Do not walk through spilled material.
Protective Equipment	• Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk. • Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment	• Stop leak if you can do it without risk. • Contain and recover liquid when possible. • A vapor suppressing foam may be used to reduce vapors. • Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming. • Use water spray to reduce vapors or divert vapor cloud drift. • A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.
Methods for Cleaning Up	• Clean up spill immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges. • Do not cut drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water.

	Handling	• Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.
CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES	**Storage**	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
	Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides, chlorine.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
1,2,4-Trimethylbenzene	–	–	TWA 25 ppm TWA 125 mg/m^3
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Butane	STEL 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3
Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm

Ethylbenzene	TLV 20 ppm TLV 87 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 125 ppm STEL 545 mg/m³ IDLH 800 ppm
Fuels, diesel, No. 2	TLV 100 mg/m³	–	–
Heptane	TLV 400 ppm TLV 1640 mg/m³ STEL 500 ppm STEL 2000 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 85 ppm TWA 350 mg/m³ Ceiling 440 ppm Ceiling 1800 mg/m³ IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m³	PEL 500 ppm PEL 1800 mg/m³	TWA 50 ppm TWA 180 mg/m³ IDLH 1100 ppm
Methylcyclohexane	TLV 400 ppm TLV 1610 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 400 ppm TWA 1600 mg/m³ IDLH 1200 ppm
Octane	TLV 300 ppm TLV 1401 mg/m³	PEL 500 ppm PEL 2350 mg/m³	TWA 75 ppm TWA 350 mg/m³ Ceiling 385 ppm Ceiling 1800 mg/m³ IDLH 1000 ppm
o-Xylene	TLV 100 ppm STEL 150 ppm	–	TLV 100 ppm STEL 150 ppm
Petroleum distillate (naptha)	–	–	TWA 350 mg/m³ Ceiling 1800 mg/m³
Toluene	TLV 20 ppm TLV 75 mg/m³	PEL 200 ppm STEL 300 mg/m³	TWA 100 ppm TWA 375 mg/m³ STEL 150 ppm STEL 560 mg/m³ IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m³ STEL 150 ppm STEL 651 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 150 ppm STEL 655 mg/m³ IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES	**Eye and Face**	• Wear face shield and eye protection.
	Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
	Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
	General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION	**Physical State**	Liquid	**Odor**	Petroleum like odor
	Substance Type	Mixture	**Odor Threshold**	No data available
	Appearance	Yellow/green to Brown/black liquid		
PROPERTIES	**pH**	No data available	**Vapor pressure**	No data available
	Melting Point/ Freezing Point	No data available	**Vapor density**	No data available
	Boiling Point/ Boiling Range	-18 to 560°C -0.4 to 1040°F	**Relative density**	No data available
	Flash Point	>-35 °C >-31 °F	**Water Solubility**	Negligible
	Evaporation Rate	No data available	**Partition coefficient: n-octanol/water**	No data available
	Flammability (solid, gas)	No data available	**Decomposition temperature**	No data available
	Upper Flammability Limit	No data available	**Specific Gravity**	No data available
	Lower Flammability Limit	No data available		
	Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure

POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing.
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
1,2,4-Trimethylbenzene	5 g/kg (Rat)	–	18000 mg/m^3 (Rat) 4h
Benzene	=1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Butane	–	–	658 mg/L (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
Decane	–	–	>1369 ppm (Rat) h h 72300 mg/m^3 (Rat) 2 h
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Methylcyclohexane	> 3200 mg/kg (Rat)	–	–
Naphtha, (petroleum), heavy, hydrotreated	= >6 g/kg (Rat)	–	= 8500 mg/m^3 (Rat)
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
o-Xylene	= 3910 mg/kg (Rat)	–	–
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–

Xylenes	= 3500 mg/kg (Rat) > 1700 mg/kg (Rabbit)	> 4350 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene	• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Xylenes	• Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.
Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE	**Sensitization**	• No information available
	Mutagenic Effects	• May cause genetic defects
	Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Fuels, diesel, No. 2	A3	X	–	–	–
Ethylbenzene	A3	–	Group 2B	Evidence	X
Hexane	–	X	–	–	–
Petroleum distillate (naphtha)	–	–	Group 3	–	–
Toluene	A4	–	Group 3	Evidence	–
o-Xylene	A4	–	Group 3	Evidence	–
Xylenes	A4	–	Group 3	Evidence	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY	• Suspected of damaging fertility or the unborn child.
STOT—SINGLE EXPOSURE	• May cause drowsiness and dizziness.
STOT—REPEATED EXPOSURE	• Causes damage to organs through prolonged or repeated exposure.
ASPIRATION HAZARD	May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Decane	EC50 24 h: = 0.043 mg/L (Chlorella vulgaris)	–	EC50 48 h: >90-280 mg/L (Daphnia magna)	–
Distillates (petroleum), hydrotreated middle	–	LC50 96h : 35 mg/L (Pimephales promelas) LC50 96h: >10000 mg/L (Pimephales promelas)	–	–
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)
Fuels, diesel, No. 2	–	LC50 96 h: = 35 mg/L (Pimephales promelas)	–	–
Gas Oils, Petroleum, Hydrodesulfurized	LC50 96 h: = 35 mg/L (Pimephales promelas)	–	LC50 96 h: < 1.00 ppm (Diatomus forbesi)	–
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Methylcyclohexane	–	LC50 96hr: 72.0 mg/l (Golden Shiner)	–	–
Naphtha (petroleum), hydrotreated light	–	–	LC50 96 h: = 2.6 mg/L (Chaetogammarus marinus)	–
Naphtha, (petroleum), heavy, hydrotreated	–	LC50 96 h: = 2200 mg/L (Pimephales promelas)	LC50 96 h: = 2.6 mg/L (Chaetogammarus marinus)	–
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
o-Xylene	EC50 24 h: = 55000 ug/L (Chlorella vulgaris)	–	–	LC50 96h: 1.3 ppm Crangon franciscorum (Shrimp)
Petroleum distillate (naphtha)	–	LC50: 258 mg/L Salmo gairdneri 96 h static	EC50 48 h: < 0.26 mg/L Static (Daphnia magna) EC50 24 h: = 36 mg/L (Daphnia magna)	–
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	–

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
1,2,4-Trimethylbenzene	3.78
Benzene	1.83
Butane	2.89
Cyclohexane	3.44
Decane	5.1
Ethylbenzene	3.118
Heptane	4.66
Hexane	3.90
Methylcyclohexane	3.61
Octane	5.18
o-Xylene	3.12
Toluene	2.65
Xylene	2.77-3.15

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
1,2,4-Trimethylbenzene	Low
Benzene	High
Butane	Low
Cyclohexane	Moderate
Decane	Immobile
Ethylbenzene	Low
Heptane	Moderate
Hexane	High

Octane	Immobile
o-Xylene	Very High to Moderate
Petroleum distillate (naptha)	High
Toluene	High to Moderate
Xylene	Very High to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste	• This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility. • This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP). • This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s). • It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.
Packaging Waste	• Container contents should be completely used and containers should be emptied prior to discard. • Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. • Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner. • To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1268	Petroleum Distillate, N.O.S.	3	I	Emergency response guide number: 128
TDG	UN1268	Petroleum Distillate, N.O.S.	3	I	–
IMO/IMDG	UN1268	Petroleum Distillate, N.O.S.	3	I	EmS No. F-E, S-E
IATA/ICAO	UN1268	Petroleum Distillate, N.O.S.	3	I	ERG Code 3L

SPECIAL RECAUTIONS FOR USER

- None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	1000 lb final RQ; 454 kg final RQ
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	10 lb RQ
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	1000 lb RQ
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	1000 lb RQ
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	Not Listed
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)— HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed

Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	X
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed

Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed
Octane	111-65-9	Not Listed
o-Xylene	95-47-6	Not Listed
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed

X= The component is listed

CANADA-WHMIS—CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS #	CLASSIFICATION
1,2,4-Trimethylbenzene	95-63-6	B3
Benzene	71-43-2	B2, D2A, D2B
Butane	106-97-8	A, B1
Cyclohexane	110-82-7	B2, D2B
Decane	124-18-5	B3, D2B
Distillates (petroleum), hydrotreated middle	64742-46-7	Uncontrolled product according to WHMIS classification criteria
Ethylbenzene	100-41-4	B2, D2A, D2B
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	B2, D2B
Hexane	110-54-3	B2, D2A, D2B
Methylcyclohexane	108-87-2	B2
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	B3
Octane	111-65-9	B2, D2B
o-Xylene	95-47-6	B2, D2B

Petroleum distillate (naphtha)	8002-05-9	B2
Toluene	108-88-3	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Decane	124-18-5	Not Listed
Distillates (petroleum), hydrotreated middle	64742-46-7	Not Listed
Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas Oils, Petroleum, Hydrodesulfurized	64742-79-6	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphtha, (petroleum), heavy, hydrotreated	64742-48-9	Not Listed

Octane	111-65-9	Not Listed
o-Xylene	95-47-6	Not Listed
Petroleum distillate (naphtha)	8002-05-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	**Flammability:** 4	**Instability:** 0	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 2	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 5/13/15

REVISION DATE 5/13/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

Material Safety Data Sheet

Statoil Cheecham Blend

1. Product and Company Identification

Prepared on: 22-01-2014/ LBN

Use: Refinary Feed.
The product is a complex combination of hydrocarbons having carbon numbers predominantly in the range of C1 through C30 and boiling in the range of approximately 20℃ to >565℃. (Petroleum Crude, Diluted Bitumen, Blended Bitumen.)

Manufacturer/supplier:
Statoil
Leismer SE2-079-10-W4M Conklin, Alberta
T0A 2C0 Canada
Tel: Fax:
Emergency Phone: +1-877-5PSCNOW (+1-877-577-2669)
The emergency telephone is open 24 hours.

2. Composition/Information on Ingredients

CAS No.	Designation	LD50 / LC50 of Ingredient	w/w%
64741-56-6	Residues (petroleum) vacuum	N/A	35-50
68955-27-1	Distillates (petroleum), petroleum residues vacuum: Heavy Fuel oil	N/A	10-30
64742-49-0	Naphtha (petroleum), hydrotreated light: Low boiling point hydrogen treated naphtha	N/A	0-30
64741-47-5	Natural gas condensates (petroleum): Low boiling point naphtha-unspecified	N/A	0.05-30
64741-44-2	Distillates (petroleum), straight-run middle	N/A	7-15
64741-41-9	Naphtha (petroleum), heavy straight-run: Low boiling point naphtha	N/A	0.1-5
110-54-3	n-Hexane	LD50, oral, rat: 25000 mg/kg LC50, inhalation, rat: 48000 ppm	0-5
71-43-2	Benzene	LD50, oral, rat: 930 mg/kg LC50, inhalation, mouse: 9980 ppm	0.01-1
108-88-3	Toluene	LD50, oral, rat: 3500 mg/kg LC50, inhalation, rat: 4000 ppm/4h	0.01-1
100-41-4	Ethylbenzene	LD50, oral, rat: 3500 mg/kg LC50, inhalation, rat: 4000 ppm/4h	0.01-1
1330-20-7	Xylene	LD50, oral, mouse: 1590 mg/kg LC50, inhalation, rat: 6350 ppm/4h	0.01-1

3. Hazards Identification

Routes of Entry:
Inhalation, skin contact

Potential Health and Environmental effects:
Highly flammable. May cause cancer. May cause heritable genetic damage. Harmful: May cause lung damage if swallowed. Vapours may cause drowsiness and dizziness. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

4. First Aid Measures

By inhalation:
Seek fresh air. Seek medical advice in case of persistent discomfort.

By ingestion:
Wash out mouth thoroughly and drink 1-2 glasses of water in small sips. Do not induce vomiting. If vomiting occurs, keep head low so that stomach contents do not enter lungs. Seek medical advice immediately.

By skin contact:
Remove contaminated clothing. Wash skin with soap and water. Seek medical advice in case of persistent discomfort.

By eye contact:
Flush with water (preferably using eye wash equipment) until irritation subsides. Seek medical advice if symptoms persist.

By burns:
Flush with water until pain ceases. Remove clothing that is not stuck to the skin - seek medical advice/transport to hospital. If possible, continue flushing until medical attention is obtained.

Other information:
When obtaining medical advice, show the safety data sheet or label. Symptoms: See section 11.

5. Firefighting Measures

Flammability Yes	**If yes, under which conditions?** Combustible liquid. Keep away from heat, sparks and flames.

Means of Extinction
Extinguish with powder, foam, carbon dioxide or water mist. Do not use water stream, as it may spread the fire. Use water or water mist to cool non-ignited stock. Move containers from danger area if it can be done without risk. Avoid inhalation of vapour and flue gases - seek fresh air.

Flashpoint (°C) and Method	**Upper Flammable Limit (% by volume)**	**Lower Flammable Limit (% by volume)**
-35 (PMCC)	N/A	N/A
Autoignition Temperature (°C)	**Explotion Data - Sensitivity to Impact**	**Explotion Data - Sensitivity to Static Discharge**
537	Not sensitive	Static spark may cause ignition

Hazardous Combustion Products
Nitrous gases, Carbon monoxide and Carbon dioxide.

6. Accidental Release Measures

Use the same personal protective equipment as stated in section 8. Smoking and open flames prohibited. Prevent spillage from entering drains and/or surface water. Contain and absorb spill with sand or other absorbent, non-flammable material and transfer to suitable waste containers. See section 13 for instructions on disposal. Notify proper authorities in case of contamination of soil or aquatic environment or discharge to drains.

7. Handling and Storage

Handling:
Smoking and open flames prohibited. See section 8 for information about precautions for use and personal protective equipment.

Storage:
Store safely, out of reach of children and away from food, animal feeding stuffs, medicines, etc. Do not store together with oxidizing agents. Keep in tightly closed original packaging. Do not expose to heat (e.g. sunlight).

8. Exposure Control/Personal Protection

Design of technical systems:
Work under effective process ventilation (e.g. local exhaust ventilation). Running water and eye wash equipment should be available. Smoking and open flames prohibited. Take precautionary measures against static discharges. Use spark-free tools and explosion proof equipment. Wash hands before breaks, before using restroom facilities, and at the end of work. Do not store, use and/or consume foods, beverages or tobacco products in the work room. Store personal protective equipment separately from other clothing.

Respiratory protection:
In case of insufficient ventilation, wear respiratory protective equipment. Use air-supplying respiratory protective equipment as the product contains liquids with a low boiling point which are poorly adsorbed on charcoal filters.

Hand and body protection:
Wear protective gloves made of nitrile rubber.) Change gloves immediately if contaminated, and wash hands with soap and water.

Eye protection:
Wear safety goggles if there is a risk of eye splash.

Occupational exposure limits:

Substance	Exposure limit	Remarks
Ethylbenzene	TWA: 20 ppm	OHS (2B)
Xylenes	TWA: 100 ppm STEL: 150 ppm	OHS
Toluene	TWA: 20 ppm	OHS (R)
n-Hexane	TWA: 20 ppm	OHS(Skin)
Benzene	TWA: 0.5 ppm STEL: 2.5 ppm	OHS(Skin,,A1,1)

TWA: time-weighted average STEL: short-term exposure limit

Remarks:
1: Carcinogenic to humans
2B: Possibly carcinogenic to humans
A1: Confirmed human carcinogen
R: The substance has an adverse reproductive effect
Skin: possibility of significant uptake through the skin

Control methods:
Compliance with the stated occupational exposure limits may be checked by occupational hygiene measurements.

9. Physical and Chemical Properties

Appearance: Dark brown Liquid
Odor: Characteristic (rotten egg if hydrogen sulphide is present)
Odor threshold: N/A
Physical state: Liqiud
pH: N/A
Melting/freezing point: N/A
Boiling point: 20- >565°C
Flash point: -35°C
Evaporation rate: N/A
Flammability: N/A
Upper/lower flammability or explosive limits: N/A
Vapor pressure: 38.0 kPa
Vapor density: N/A
Specific gravity or relative density: 0.9286
Solubility: Negligible in water
Partition coefficient: n-octanol/water: < 1
Auto-ignition temperature: appr. 537°C
Decomposition temperature: N/A

10. Stability and Reactivity

Chemical Stability	If no, under which conditions?
Stable Yes	
Incompatibility with Other Substances Yes	**If yes, which ones?** Oxidizing agents
Reactivity, and Under What Conditions? N/A	
Hazardous Decomposition Products N/A	

11. Toxicological Information

Immediate effects

Inhalation:
The product releases organic solvent vapours which may cause lethargy and dizziness. At high concentrations, the vapours may cause headache and intoxication. Inhalation of vapours may cause irritation to the upper airways.

Ingestion:
May cause chemical pneumonia if ingested or vomited. Irritates mucous membranes in mouth and gastrointestinal tract.

Skin contact:
Degreases the skin. Long-term exposure may cause irritation and possible infection. Can be absorbed through the skin with the same symptoms as for inhalation.

Eye contact:
Temporary irritation.

Sensitisation:
Skin, respiratory: None.

Long-term effects

Cancer:
The product contains benzene and ethylbenzene which may cause cancer.

Risk of damage to reproduction, teratogenicity and embryotoxicity:
The product contains toluene, which is a suspected reproductive hazard.

Risk of damage to the central nervous system:
Prolonged or repeated inhalation of vapours may cause damage to the central nervous system.

Risk of damage to genes:
The product contains benzene and toluene which may cause heritable genetic damage.

Risk of irreversible damages:
Synergistic effects: None known.

12. Ecological Information

Avoid discharge to drain or surface water.

Ecotoxicity:
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Mobility:
The product contains a substance which is insoluble in water, and it will consequently spread on water surfaces.

13. Disposal Considerations

Unusable material should be properly drummed. Consult local, provincial, and federal agencies for proper methods of disposal. Do not contaminate water supply when disposing of wastes or containers.

14. Transport Information

The product must be transported in accordance with national and/or international rules for transport of dangerous goods by road and sea according to TDG and IMDG.

PIN: 1267
TDG: UN 1267 ; PETROLEUM CRUDE OIL ; 3 ; I ;
IMDG: UN 1267 ; PETROLEUM CRUDE OIL ; 3 ; I

Label TDG: 3 Flash point: -35°C Label IMDG: 3 IMDG EmS.: F-E, S-E

15. Regulatory Information

WHMIS Symbol:

WHMIS Classification:
B2; D2A

This product has been classified in accordance with the hazard critiria of the *Controlled Products Regulations (CPR)* and the MSDS contains all of the information required by the *CPR* .

16. Other Information

Restrictions in use:
None.

Training advise:
No special training is required, but a thorough knowledge of this safety data sheet should be a prerequisite condition.

Sources:
OHS Guidelines Part 5, Table of Exposure Limits for Chemical and Biological Substances, May 2013. Consult local authorities for acceptable exposure limits.

Other information:
This safety data sheet was prepared from information provided by the supplier about the product at the time of preparation (e.g. data sheets and the like).
N/A: Not available or not applicable.

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ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER	Petroleum Crude Oil—Synbit	
OTHER MEANS OF IDENTIFICATION	**UN-Number**	UN1267
	Synonyms	Statoil Cheecham Synbit (SCS), Surmont Heavy Blend (SHB), Christina SynBit (CSB), MacKay River Heavy (MKH), Long Lake Heavy Synbit Blend (PSH)
	Chemical Category	Crude oils—extremely flammable
RECOMMENDED USE	No information available	
RESTRICTIONS OF USE	No information available	
SUPPLIER INFORMATION	Enbridge Pipelines Inc. 10201 Jasper Avenue Edmonton, Alberta T5J 3N7 Canada TEL: 1-780-420-5210	
EMERGENCY CONTACT INFORMATION	**CHEMTREC**	1-800-424-9300 for US 703-527-3887 outside US
	CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION

Skin Irritation	Category 2
Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 1B
Carcinogenicity	Category 1A
Reproductive Toxicity	Category 2
Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
Specific Target Organ Toxicity (Repeated Exposure)	Category 1
Aspiration Toxicity	Category 1
Flammable liquids	Category 1

LABEL ELEMENTS

Signal Word

Danger

Hazard Pictograms

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.
- May cause drowsiness or dizziness.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- Keep container tightly closed.
- No smoking.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF EXPOSED or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower and soap.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If SKIN irritation occurs: Get medical advice/attention.
- If EYE irritation persists: Get medical advice/attention.

Storage/Disposal

- Store locked up and keep cool.
- Store in a well-ventilated place. Keep container tightly closed.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
1,2,4-Trimethylbenzene	95-63-6	0-1	
1-Propanethiol	107-03-9	0-1	
2-Butanethiol	513-53-1	0-1	
2-Propanethiol	75-33-2	0-1	
Benzene	71-43-2	0-1	
Bitumen	8052-42-4	0-80	
Butane	106-97-8	0-1.2	
Cyclohexane	110-82-7	0-1	
Distillates, petroleum, petroleum residues vacuum	68955-27-1	0-30	
Ethanethiol	75-08-1	0-1	
Ethylbenzene	100-41-4	0-5	
Fuels, diesel, No. 2	68476-34-6	0-15	
Gas oil, blend	64741-44-2	0-15	
Heavy straight-run (petroluem) naphtha	64741-41-9	0-5	
Heptane	142-82-5	0-2.5	
Hexane	110-54-3	0-5	
Hydrogen Sulfide	7783-06-4	0-0.1	
Methanethiol	74-93-1	0-1	
Methylcyclohexane	108-87-2	0-1	
Methylcyclopentane	96-37-7	0-1	
Naphtha (petroleum), hydrotreated light	64742-49-0	0-30	
Naphthalene	91-20-3	0-5	
Natural Gas Condensates (petroleum)	64741-47-5	0-30	
n-Butanethiol	109-79-5	0-1	
Octane	111-65-9	0-2.5	
Pentane	109-66-0	0-1.5	

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
Petroleum	8002-05-9	0-60	
p-Xylene	106-42-3	0-1	
Residues (petroleum), vacuum	64741-56-6	0-50	
Sulfur	7704-34-9	0-3.5	
Toluene	108-88-3	0-1	
Xylene	1330-20-7	0-1	
Hydrocarbon Diluent	–	0-50	
Bitumen	128683-24-9	0-80	
Naphtha (oil sand), hydrotreated	128683-33-0	0-15	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation
- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.

Skin
- IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

Eye
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Ingestion
- Do NOT induce vomiting. Call a physician or poison control center.
- Aspiration hazard if swallowed—can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician
- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media

- SMALL FIRES: Dry chemical, CO_2, water spray or regular foam.
- LARGE FIRE: Water spray, fog or regular foam.

Unsuitable Extinguishing Media

- CAUTION: Use of water spray when fighting fire may be inefficient.
- Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.

- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products

- Carbon monoxide. Carbon dioxide (CO_2). Nitrogen oxides (NOx). Oxides of sulfur.
- Aldehydes, aromatic and other hydrocarbons.

Sensitivity to Mechanical Impact

- None.

Sensitivity to Static Discharge

- Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions

- Evacuate personnel to safe areas.
- Remove all sources of ignition.
- Deny entry to unauthorized and unprotected personnel.
- Use personal protective equipment.
- Avoid contact with skin, eyes and clothing.
- Stop leak if you can do it without risk.
- Keep people away from and upwind of spill/leak.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Ventilate enclosed areas.
- Do not walk through spilled material.

Protective Equipment

- Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk.
- Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment

- Stop leak if you can do it without risk.
- Contain and recover liquid when possible.
- A vapor suppressing foam may be used to reduce vapors.
- Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming.
- Use water spray to reduce vapors or divert vapor cloud drift.
- A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.

Methods for Cleaning Up	• Clean up spills immediately. • LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST. • SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal. • Use appropriate Personal Protective Equipment (PPE). • Use clean non-sparking tools to collect absorbed material. • Vacuum spilled material. • Try to work upwind of spill. • All equipment used when handling the product must be grounded. • Recover and return free product to proper containers • Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids. • Do not place spilled materials back in the original container. • Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling	• All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces. • The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). • The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits. • Take precautionary measures against static discharges.
Handling	• Do not cut drill, grind or weld on empty containers since they may contain explosive residues. • Stay upwind and vent open hatches before uploading. • Avoid contact with skin, eyes and clothing. • Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. • Wear personal protective equipment. • Remove and wash contaminated clothing before re-use. • Do not eat, drink or smoke when using this product. • Do not take internally. • Wash thoroughly after handling. • Empty containers pose a potential fire and explosion hazard.

CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Storage	• Ventilate enclosed areas. • Store in a well-ventilated place. • Keep container tightly closed. • Store locked up. • Avoid shock, impact, friction, and rough handling. Do not use sparking tools. • Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources. • Keep away from sources of ignition. • No Smoking. • Do not enter confined spaces such as tanks or pits without following proper entry procedures. • Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. • Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments. • Keep away from open flames, hot surfaces and sources of ignition. • Keep product and empty container away from heat and sources of ignition. • Storage containers should be grounded and bonded. • Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge. • Store away from incompatible materials.
Incompatible Products	• Strong oxidizers such as nitrates, chlorates, peroxides.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
1,2,4-Trimethylbenzene	–	–	TWA 25 ppm TWA 125 mg/m^3
1-Propanethiol	–	–	Ceiling 0.5 ppm Ceiling 1.6 mg/m^3
2-Butanethiol	TLV 0.5 mg/m^3	PEL 10 ppm PEL 35 mg/m^3	Ceiling 0.5 ppm Ceiling 1.8 mg/m^3
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Bitumen	TLV 0.5 mg/m^3	–	Ceiling 5 mg/m^3
Butane	TLV 1000 ppm	–	TWA 800 ppm TWA 1900 mg/m^3
Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm

Ethanethiol	TLV 0.5 ppm	Ceiling 10 ppm Ceiling 25 mg/m³	Ceiling 0.5 ppm Ceiling 1.3 mg/m³
Ethylbenzene	TLV 20 ppm TLV 87 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 125 ppm STEL 545 mg/m³ IDLH 800 ppm
Fuels, diesel, No. 2	TLV 100 mg/m³	–	–
Heptane	TLV 400 ppm TLV 1640 mg/m³ STEL 500 ppm STEL 2000 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 85 ppm TWA 350 mg/m³ Ceiling 440 ppm Ceiling 1800 mg/m³ IDLH 750 ppm
Hexane	TLV 50 ppm TLV 176 mg/m³	PEL 500 ppm PEL 1800 mg/m³	TWA 50 ppm TWA 180 mg/m³ IDLH 1100 ppm
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m³ STEL 5 ppm STEL 7 mg/m³	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m³ IDLH 100 ppm
Methanethiol	TLV 0.5 ppm	Ceiling 10 ppm Ceiling 20 mg/m³	Ceiling 0.5 ppm Ceiling 1 mg/m³
Methylcyclohexane	TLV 400 ppm TLV 1610 mg/m³	PEL 500 ppm PEL 2000 mg/m³	TWA 400 ppm TWA 1600 mg/m³ IDLH 1200 ppm
Naphthalene	TLV 10 ppm STEL 15 ppm	PEL 10 ppm PEL 50 mg/m³	TWA 10 ppm TWA 50 mg/m³ STEL 15 ppm STEL 75 mg/m³
Octane	TLV 300 ppm TLV 1401 mg/m³	PEL 500 ppm PEL 2350 mg/m³	TWA 75 ppm TWA 350 mg/m³ Ceiling 385 ppm Ceiling 1800 mg/m³ IDLH 1000 ppm
Pentane	TLV 600 ppm TLV 1770 mg/m³	PEL 1000 ppm PEL 2950 mg/m³	TWA 120 ppm TWA 350 mg/m³ Ceiling 610 ppm Ceiling 1800 mg/m³ IDLH 1500 ppm
Petroleum	–	–	TWA 350 mg/m³ Ceiling 1800 mg/m³

p-Xylene	TLV 100 ppm TLV 434 mg/m^3 STEL 150 ppm STEL 651 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 150 ppm STEL 655 mg/m^3 IDLH 900 ppm
Toluene	TLV 20 ppm TLV 75 mg/m^3	PEL 200 ppm STEL 300 mg/m^3	TWA 100 ppm TWA 375 mg/m^3 STEL 150 ppm STEL 560 mg/m^3 IDLH 500 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m^3 STEL 150 ppm STEL 651 mg/m^3	PEL 100 ppm PEL 435 mg/m^3	TWA 100 ppm TWA 435 mg/m^3 STEL 150 ppm STEL 655 mg/m^3 IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid	**Odor**	Rotten egg, petroleum like odor
Substance Type	Mixture	**Odor Threshold**	No data available
Appearance	Bark black/brown		

PROPERTIES

pH	No data available	**Vapor pressure**	5 to 76 kPa @ 37.8 C (100.04 F)
Melting Point/ Freezing Point	No data available	**Vapor density**	1.0 to 5.0 Air=1

Boiling Point/ Boiling Range	10 to 120 °F -12 to 565°C	**Relative Density**	No data available
Flash Point	-45.4 to 338 °F -43 to 170 °C	**Water Solubility**	Negligible
Evaporation Rate	No data available	**Partition coefficient: n-octanol/water**	No data available
Flammability (solid, gas)	No data available	**Autoignition temperature**	>482 °F >250°C
Upper Flammability Limit	No data available	**Decomposition temperature**	No data available
Lower Flammability Limit	No data available	**Specific Gravity**	0.9026-0.9400
Viscosity	No data available		

Section 10: Stability and Reactivity

REACTIVITY	Chlorine Dioxide
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides, chlorine
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, sulfur dioxide, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE

Inhalation	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
Eye Contact	• Causes serious eye irritation.
Skin Contact	• Causes skin irritation.
Ingestion	• Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. • Potential for aspiration if swallowed. • Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
1,2,4-Trimethylbenzene	5 g/kg (Rat)	–	18000 mg/m^3 (Rat) 4h
1-Propanethiol	= 1790 mg/kg (Rat)	–	–
2-Propanethiol	–	–	130 g/m^3 (Mouse) 1h
Benzene	=1800 mg/kg (Rat)	–	13050 - 14380 ppm (Rat) 4 h
Bitumen	>5000 mg/kg (Rat)	–	>94.4 mg/m^3 (Rat)
Butane	–	–	658 mg/L (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
Ethanethiol	= 682 mg/kg (Rat)	500 mg (Rabbit) 24h	4420 ppm (Rat) 4h
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Gas oil, blend	–	= 500 mg (Rabbit)	= 1700 mg/m^3 (Rat) 4 h
Heptane	–	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
Hydrogen sulfide	–	–	= 444 ppm (Rat)
Methylcyclohexane	> 3200 mg/kg (Rat)	–	–
Naphthalene	490 mg/kg (Rat)	0.05 ml (Rabbit) 24 h	–
Natural gas condensates (petroleum)	–	–	= 600 mg/m^3 (Rat)
Octane	–	–	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
Pentane	>2000 mg/kg (Rat)	–	364 g/cu (Rat) 4 h
Petroleum	>4300 mg/kg (Rat)	500 mg (Rabbit) 24 h	–
p-Xylene	= 3910 mg/kg (Rat)	–	4550 ppm (Rat) 4h
Sulfur	–	–	1660 mg/m^3 (Mammal)
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	–
Xylenes	= 3500 mg/kg (Rat)	> 4350 mg/kg (Rabbit) > 1700 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene	• Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in humans. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.
Hydrogen Sulfide Gas (H_2S)	• Toxic by inhalation. Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Xylenes	• Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.
Naphthalene	• Naphthalene has been evaluated in two year inhalation studies in both rats and mice. The US National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has been identified as a carcinogen by IARC and NTP.

Toluene	**Carcinogenicity:** Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC. **Target Organs:** Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances. **Reproductive Toxicity:** Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.
Ethylbenzene	**Carcinogenicity:** Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC. **Target Organs:** In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilio foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	ACGIH SKIN*	IARC	NTP	OSHA
Benzene	A1	X	Group 1	Known	X
Bitumen	A4	–	–	–	–
Ethylbenzene	A3	–	Group 2B	Evidence	X
Fuels, diesel, No. 2	A3	X	–	–	–
Hexane	–	X	–	–	–
Naphthalene	A4	X			
Toluene	A4	–	Group 3	Evidence	–
Xylenes	A4	–	Group 3	Evidence	–

**ACGIH Skin designation refers to the potential significant contribution of overall exposure by cutaneous route, including mucous membranes and eyes, from airborne exposure to gases, vapor, or liquid OR by direct skin contact.*

REPRODUCTIVE TOXICITY	• Suspected of damaging fertility or the unborn child.
STOT—SINGLE EXPOSURE	• May cause drowsiness and dizziness.
STOT—REPEATED EXPOSURE	• Causes damage to organs through prolonged or repeated exposure.
ASPIRATION HAZARD	May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
1,2,4-Trimethylbenzene	–	LC50 96 h: 7.72 mg/L (Pimephales promelas)	EC50 48h: 30 mmol/cu (Daphnia magna)	LC50 24h: 100 mmol/cu Artemia salina (Brine Shrimp)
1-Propanethiol	–	–	LC 48h: 60 ug/L (Daphnia magna)	–
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	–
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Ethanethiol	–	–	EC50 48 h: >90-280 mg/L (Daphnia magna)	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)
Heptane	–	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	–
Hexane	–	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	–
Hydrogen sulfide	–	LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	–
Methanethiol	–	–	–	LC50: 0.55-0.9 mg/L (Salmonides)
Methylcyclohexane	–	LC50 96hr: 72.0 mg/l (Golden Shiner)	–	–
Naphthalene	EC50 24 h: = 33000 ug/L (Chlorella vulgaris)	LC50 96 h: = 1.4 mg/L (Oncorhynchus gorbuscha)	EC50 48 h: 1600 ug/L (Daphnia magna)	–
n-Butanethiol	EC50 96 h: = 1068.3-5478.24 mg/l (Scenedesmus subspicatus)	LC50 96 h: = 1100-3600 mg/L (Ictalurus punctatus)	–	–
Octane	–	–	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
Pentane	–	–	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
p-Xylene	EC50 3h: 430 mmol/cu (Chlamydomonas angulosa)	LC50 96h: 2600 ug/l (Oncorhynchus mykiss)	–	–

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Sulfur	–	LC50 96h: <14000 ug/l (Lepomis macrochirus)	EC50 48 h: = >5000000 ug/L (Daphnia magna)	–
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	-

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG KOW
1,2,4-Trimethylbenzene	3.78
1-Propanethiol	1.81
2-butanethiol	2.18
2-Propanethiol	1.7
Benzene	1.83
Butane	2.89
Cyclohexane	3.44
Ethanethiol	1.27
Ethylbenzene	3.118
Gas oil, blend	3.3-7.06
Heptane	4.66
Hexane	3.90
Methanethiol	0.78
Methylcyclohexane	3.61
Methylcyclopentane	3.37
Naphthalene	3.30
n-Butanethiol	2.28
Octane	5.18
Pentane	3.39
p-Xylene	3.15
Toluene	2.65
Xylene	2.77-3.15

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
1,2,4-Trimethylbenzene	Low
1-Propanethiol	Moderate
2-butanethiol	High
2-Propanethiol	Very High
Benzene	High
Butane	Low
Cyclohexane	Moderate
Ethanethiol	Very High

Ethylbenzene	Low
Gas oil, blend	Low
Heptane	Moderate
Hexane	High
Methanethiol	Very High
Methylcyclopentane	Low
Naphthalene	High to None
n-Butanethiol	Moderate
Octane	Immobile
Pentane	High
p-Xylene	Moderate to Low
Toluene	High to Moderate
Xylene	Very high to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.
- This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP).
- This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s).
- It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging Waste

- Container contents should be completely used and containers should be emptied prior to discard.
- Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations.
- Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner.
- To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1267	Petroleum Crude Oil	3	I	Emergency response guide number: 128
TDG	UN1267	Petroleum Crude Oil	3	I	–
IMO/IMDG	UN1267	Petroleum Crude Oil	3	I	EmS No. F-E, S-E
IATA/ICAO	UN1267	Petroleum Crude Oil	3	I	3L

SPECIAL RECAUTIONS FOR USER

- None

Section 15: Regulatory Information

U.S.—CERCLA/SARA HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Cyclohexane	110-82-7	1000 lb final RQ; 454 kg final RQ
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ
Methanethiol	74-93-1	100 lb final RQ; 45.4 kg final RQ
Naphthalene	91-20-3	100 lb final RQ; 45.4 kg final RQ
p-Xylene	106-42-3	100 lb final RQ; 45.4 kg final RQ
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ

U.S.—CWA (CLEAN WATER ACT)—REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
Benzene	71-43-2	10 lb RQ
Cyclohexane	110-82-7	1000 lb RQ
Ethylbenzene	100-41-4	1000 lb RQ
Hydrogen Sulfide	7783-06-4	100 lb RQ
Methanethiol	74-93-1	100 lb RQ
Naphthalene	91-20-3	100 lb RQ
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—RECOMMENDED WATER QUALITY CRITERIA—CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
HydrogenSulfide	7783-06-4	2.0 µg/L CCC

U.S.—CWA (CLEAN WATER ACT)—HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
1-Propanethiol	107-03-9	Not Listed
2-Butanethiol	513-53-1	Not Listed
2-Propanethiol	75-33-2	Not Listed
Benzene	71-43-2	X
Bitumen	8052-42-4	Not Listed
Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	X
Distillates, petroleum, petroleum residues vacuum	68955-27-1	Not Listed
Ethanethiol	75-08-1	Not Listed
Ethylbenzene	100-41-4	X

Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas oil, blend	64741-44-2	Not Listed
Heavy straight-run (petroluem) naphtha	64741-41-9	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Methanethiol	74-93-1	X
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphthalene	91-20-3	X
Natural gas condensates (petroleum)	64741-47-5	Not Listed
n-Butanethiol	109-79-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
p-Xylene	106-42-3	X
Residues (petroleum), vacuum	64741-56-6	Not Listed
Sulfur	7704-34-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

U.S.—CWA (CLEAN WATER ACT)—PRIORITY POLLUTANTS

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
1-Propanethiol	107-03-9	Not Listed
2-Butanethiol	513-53-1	Not Listed
2-Propanethiol	75-33-2	Not Listed
Benzene	71-43-2	X
Bitumen	8052-42-4	Not Listed

Butane	106-97-8	Not Listed
Cyclohexane	110-82-7	Not Listed
Distillates, petroleum, petroleum residues vacuum	68955-27-1	Not Listed
Ethanethiol	75-08-1	Not Listed
Ethylbenzene	100-41-4	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas oil, blend	64741-44-2	Not Listed
Heavy straight-run (petroluem) naphtha	64741-41-9	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	Not Listed
Methanethiol	74-93-1	Not Listed
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphthalene	91-20-3	X
Natural gas condensates (petroleum)	64741-47-5	Not Listed
n-Butanethiol	109-79-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	Not Listed
Petroleum	8002-05-9	Not Listed
p-Xylene	106-42-3	Not Listed
Residues (petroleum), vacuum	64741-56-6	Not Listed
Sulfur	7704-34-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed

X= The component is listed

COMPONENT	CAS#	CLASSIFICATION
1,2,4-Trimethylbenzene	95-63-6	B3
1-Propanethiol	107-03-9	Not Listed
2-Butanethiol	513-53-1	Not Listed
2-Propanethiol	75-33-2	Not Listed
Benzene	71-43-2	B2, D2A, D2B
Bitumen	8052-42-4	Not Listed
Butane	106-97-8	A, B1
Cyclohexane	110-82-7	B2, D2B
Distillates, petroleum, petroleum residues vacuum	68955-27-1	Not Listed
Ethanethiol	75-08-1	B2
Ethylbenzene	100-41-4	B2, D2A, D2B
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas oil, blend	64741-44-2	Not Listed
Heavy straight-run (petroluem) naphtha	64741-41-9	Not Listed
Heptane	142-82-5	B2, D2B
Hexane	110-54-3	B2, D2A, D2B
Hydrogen Sulfide	7783-06-4	A, B1, D1A, D2B
Methanethiol	74-93-1	A, B1, D1A
Methylcyclohexane	108-87-2	B2
Methylcyclopentane	96-37-7	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphthalene	91-20-3	B4, D2A
Natural gas condensates (petroleum)	64741-47-5	Not Listed
n-Butanethiol	109-79-5	B2, D1B
Octane	111-65-9	B2, D2B
Pentane	109-66-0	B2
Petroleum	8002-05-9	B2

p-Xylene	106-42-3	B2, D2A, D2B
Residues (petroleum), vacuum	64741-56-6	Not Listed
Sulfur	7704-34-9	B4
Toluene	108-88-3	B2, D2A, D2B
Xylene	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Naphthalene	91-20-3	1.1 µg/L
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA—COUNCIL OF MINISTERS OF THE ENVIRONMENT—WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L
Naphthalene	91-20-3	1.4 µg/L

CANADA—ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
1,2,4-Trimethylbenzene	95-63-6	Not Listed
1-Propanethiol	107-03-9	Not Listed
2-Butanethiol	513-53-1	Not Listed
2-Propanethiol	75-33-2	Not Listed
Benzene	71-43-2	X
Bitumen	8052-42-4	Not Listed
Butane	106-97-8	X
Cyclohexane	110-82-7	X
Distillates, petroleum, petroleum residues vacuum	68955-27-1	Not Listed
Ethanethiol	75-08-1	X

Ethylbenzene	100-414	X
Fuels, diesel, No. 2	68476-34-6	Not Listed
Gas oil, blend	64741-44-2	Not Listed
Heavy straight-run (petroluem) naphtha	64741-41-9	Not Listed
Heptane	142-82-5	Not Listed
Hexane	110-54-3	Not Listed
Hydrogen Sulfide	7783-06-4	X
Methanethiol	74-93-1	X
Methylcyclohexane	108-87-2	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Naphtha (petroleum), hydrotreated light	64742-49-0	Not Listed
Naphthalene	91-20-3	X
Natural gas condensates (petroleum)	64741-47-5	Not Listed
n-Butanethiol	109-79-5	Not Listed
Octane	111-65-9	Not Listed
Pentane	109-66-0	X
Petroleum	8002-05-9	Not Listed
p-Xylene	106-42-3	Not Listed
Residues (petroleum), vacuum	64741-56-6	Not Listed
Sulfur	7704-34-9	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X

X= The component is listed

Section 16: Other Information

NFPA				
	Health Hazard: 2	**Flammability:** 3	**Instability:** 1	**Physical and Chemical Hazards:** X
HMIS	**Health Hazard:** 2	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X
ISSUING DATE	4/10/15			
REVISION DATE	4/10/15			

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDSs may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name : **Crude Oil, Sour (=>0.5% S)**
Uses : Refinery Feedstock.

Manufacturer/Supplier : **Shell Canada Limited**
PO Box 100 Station M
400 4th Avenue S.W.
Calgary-AB T2P 2H5
Canada
Telephone : (+1) 800-661-1600

Emergency Telephone Number
: Shell Canada: (+1) 800-661-7378
CANUTEC (24 hr): (+1) 613-996-6666

2. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture Description : Raw petroleum extracted in its natural state from the ground (excluding hydrocarbons from shale) and containing predominantly aliphatic, alicyclic and aromatic hydrocarbons. It may also contain small amounts of nitrogen, oxygen and sulphur compounds. Product is not a mixture according to regulation 1907/2006/EC.
Synonyms : Seal Heavy crude Oil
CAS No. : 8002-05-9

WHMIS Controlled Ingredients

Chemical Identity	CAS No.	Conc. W/W
Petroleum, Crude Oil	8002-05-9	60.00- 100.00 %

Contains Benzene, CAS # 71-43-2.
Contains Ethylbenzene, CAS # 100-41-4.
Contains n-Hexane, CAS # 110-54-3.
Contains Naphthalene, CAS # 91-20-3.
Contains hydrogen sulphide, CAS # 7783-06-4.
Contains Natural Gasoline, CAS # 8006-61-9.
Hydrogen sulphide may be present both in the liquid and the vapour. Composition is complex and varies with the source of the crude oil.

Refer to Chapter 8 for Occupational Exposure Guidelines.

3. HAZARDS IDENTIFICATION



WHMIS Class/Description	:	Class B2 Flammable Liquid Class D2A Other Toxic Effects - Carcinogen/Mutagen Class D2B Other Toxic Effects - Skin Irritant
Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Health Hazards	:	Vapours may cause drowsiness and dizziness. Repeated exposure may cause skin dryness or cracking. Moderately irritating to eyes. Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed. Harmful: may cause lung damage if swallowed. Hydrogen sulphide is highly toxic and may be fatal if inhaled. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and other hazardous vapours may evolve and collect in the headspace of storage tanks, transport vessels and other enclosed containers. A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome). Hydrogen sulphide is highly toxic and may be fatal if inhaled. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and other hazardous vapours may evolve and collect in the headspace of storage tanks, transport vessels and other enclosed containers. May dull the sense of smell, so do not rely on odour as an indication of hazard. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure. Repeated exposure may cause skin dryness or cracking. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome).
Signs and Symptoms	:	Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Eye

		irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.
Safety Hazards	:	Extremely flammable. May ignite on surfaces at temperatures above auto-ignition temperature. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Flammable vapours may be present even at temperatures below the flash point.
Environmental Hazards	:	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Additional Information	:	This product is intended for use in closed systems only.

4. FIRST AID MEASURES

General Information	:	Vaporisation of H2S that has been trapped in clothing can be dangerous to rescuers. Maintain respiratory protection to avoid contamination from the victim to rescuer. Mechanical ventilation should be used to resuscitate if at all possible.
Inhalation	:	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact	:	Flush eyes with water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision, or swelling persist transport to the nearest medical facility for additional treatment.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest

		medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Give nothing by mouth. Do not induce vomiting. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Advice to Physician	:	Hydrogen sulphide (H2S) - CNS asphyxiant. May cause rhinitis, bronchitis and occasionally pulmonary oedema after severe exposure. CONSIDER: Oxygen therapy. Consult a Poison Control Center for guidance. Exposure to hydrogen sulphide at concentrations above the recommended occupational exposure standard may cause headache, dizziness, irritation of the eyes, upper respiratory tract, mouth and digestive tract, convulsions, respiratory paralysis, unconsciousness and even death. Call a doctor or poison control center for guidance. Potential for chemical pneumonitis.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	< 23 °C / 73 °F
Upper / lower Flammability or Explosion limits	:	0.6 - 8 %(V)
Auto ignition temperature	:	> 220 °C / 428 °F
Hazardous Combustion Products and Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Oxides of nitrogen. Oxides of sulphur. Unidentified organic and inorganic compounds. Flammable vapours may be present even at temperatures below the flash point. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Hydrogen sulphide (H2S) and toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.
Protective Equipment for Firefighters	:	Wear full protective clothing and self-contained breathing apparatus.
Additional Advice	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately.

6. ACCIDENTAL RELEASE MEASURES

Protective Measures	:	May ignite on surfaces at temperatures above auto-ignition temperature. Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Clean Up Methods	:	For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.
Additional Advice	:	Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26.

7. HANDLING AND STORAGE

General Precautions	:	Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Prevent spillages. For comprehensive advice on handling, product transfer, storage and tank cleaning refer to the product supplier.
Handling	:	The inherent toxic and olfactory (sense of smell) fatiguing properties of hydrogen sulphide require that air monitoring alarms be used if concentrations are expected to reach harmful levels such as in enclosed spaces, heated transport vessels and spill or leak situations. If the air concentration exceeds 50 ppm, the area should be evacuated unless respiratory protection is in use. Avoid prolonged or repeated contact with skin. When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Earth all equipment.
Storage	:	Drum and small container storage: Drums should be stacked to

		a maximum of 3 high. Use properly labelled and closeable containers. Prevent ingress of water. Keep container in a well-ventilated place equipped with hydrogen sulphide detectors. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition.
Product Transfer	:	Avoid splash filling. Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Keep containers closed when not in use. Do not use compressed air for filling, discharging or handling.
Recommended Materials	:	For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), polyvinyl chloride (PVC), polyvinyl fluoride (PVDF), and fluoroelastomers (FKM), e.g. Viton, which have been specifically tested for compatibility with this product. For container linings, or coatings, use Epoxy (amine-cured), or Epoxy Novolac, or Phenolic Epoxy. For seals and gaskets use: fluoroelastomers (FKM), e.g. Viton A, B, or F, or Neoprene (CR), or nitrile (NBR, HNBR), or graphite, or expanded PTFE (e.g. Gore-Tex).
Unsuitable Materials	:	Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyisobutylene. However, some may be suitable for glove materials.
Container Advice	:	Do not cut, drill, grind, weld or perform similar operations on or near containers. Containers, even those that have been emptied, can contain explosive vapours.
Additional Information	:	Ensure that all local regulations regarding handling and storage facilities are followed. Hydrogen sulphide (H2S) and toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning. Hydrogen sulphide (H2S or Sour Gas) may be present when loading and unloading transport vessels. Stay upwind and away from newly opened hatches and allow to vent thoroughly before handling material. Steam may be used to vent hatches. Keep all sources of ignition away from loading area. Use hydrogen sulphide monitors for detection.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

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Material	Source	Type	ppm	mg/m3	Notation
Benzene	ACGIH	TWA	0.5 ppm		
	ACGIH	STEL	2.5 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SHELL IS	TWA	0.5 ppm	1.6 mg/m3	
	SHELL IS	STEL	2.5 ppm	8 mg/m3	
Hydrogen Sulphide	ACGIH	TWA	1 ppm		
	ACGIH	STEL	5 ppm		
Ethylbenzene	ACGIH	TWA	20 ppm		
n-hexane	ACGIH	TWA	50 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
Naphthalene	ACGIH	TWA	10 ppm		
	ACGIH	STEL	15 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.

Consult local authorities for acceptable exposure limits within their jurisdiction.

Additional Information : SHELL IS is the Shell Internal Standard.

Biological Exposure Index (BEI) - See reference for full details

Material	Determinant	Sampling Time	BEI	Reference
Benzene	S-Phenylmercapturic acid in Creatinine in urine	Sampling time: End of shift.	25 µg/g	ACGIH BEL (2011)

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	t,t-Muconic acid in Creatinine in urine	Sampling time: End of shift.	500 µg/g	ACGIH BEL (2011)
Ethylbenzene	Sum of mandelic acid and phenylglyoxylic acid in Creatinine in urine	Sampling time: End of shift at end of work week.	0.7 g/g	ACGIH BEL (2011)
	Ethyl benzene in End-exhaled air	Sampling time: Not critical.		ACGIH BEL (2011)
n-hexane	2,5-Hexanedion, without hydrolysis in Urine	Sampling time: End of shift at end of work week.	0.4 mg/l	ACGIH BEL (2011)

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use.

Personal Protective Equipment : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory Protection : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. All respiratory protection equipment and use must be in accordance with local regulations. If air-filtering respirators are suitable for conditions of use: Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN14387. Select a filter suitable for acid gases and vapours meeting EN14387.

Hand Protection : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: Longer term protection: Nitrile rubber. Incidental contact/Splash protection: PVC. Neoprene

		rubber. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Breakthrough times for gloves varies depending on, e.g. chemical resistance, material thickness, frequency and duration of contact. Selection should also take into account other usage requirements, e.g. dexterity, heat resistance, other chemical substances handled.
Eye Protection	:	Chemical splash goggles (chemical monogoggles).
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron (where risk of splashing).
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Brown to black. Viscous liquid.
Odour	:	Potential smell of rotten eggs and sulphur..
Odour threshold	:	Data not available
pH	:	Not applicable
Initial Boiling Point and Boiling Range	:	10 - 400 °C / 50 - 752 °F
Freezing Point	:	Data not available
Vapour pressure	:	Typical 10 - 70 kPa
Specific gravity	:	Data not available
Density	:	< 1,010 g/cm3 at 15 °C / 59 °F
Water solubility	:	Insoluble.
n-octanol/water partition coefficient (log Pow)	:	2 - 6
Kinematic viscosity	:	3 - 1,000 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions of use.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly

dependent on conditions. A complex mixture of airborne solids, liquids and gases including carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

Hazardous Polymerisation	:	No, hazardous, exothermic polymerization cannot occur.
Sensitivity to Mechanical Impact	:	Data not available
Sensitivity to Static Discharge	:	Yes

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on product data, a knowledge of the components and the toxicology of similar products.
Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	Low toxicity: LD50 > 5000 mg/kg , Rat.
Acute Dermal Toxicity	:	Low toxicity: LD50 >2000 mg/kg , Rabbit.
Acute Inhalation Toxicity	:	Extremely toxic: LC100 = 600ppm(v) , 30 min , Man. (Hydrogen Sulphide) Low toxicity by inhalation. (Petroleum, Crude Oil)
Skin Irritation	:	Not irritating to skin. Prolonged/repeated contact may cause defatting of the skin which can lead to dermatitis.
Eye Irritation	:	Expected to be moderately irritating to eyes (but insufficient to classify).
Respiratory Irritation	:	Not expected to be a respiratory irritant.
Sensitisation	:	Not expected to be a sensitiser.
Repeated Dose Toxicity	:	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
Mutagenicity	:	Not expected to be mutagenic.
Carcinogenicity	:	Causes cancer in laboratory animals. May cause leukaemia (AML - acute myelogenous leukemia). (Benzene)

Material	:	**Carcinogenicity Classification**
Crude Oil	:	IARC: Not classifiable as to carcinogenicity to humans.
Natural Gasoline	:	IARC: Possibly carcinogenic to humans.
Benzene	:	ACGIH: Confirmed human carcinogen.
Benzene	:	IARC: Carcinogenic to humans.
Naphthalene	:	ACGIH: Not classifiable as a human carcinogen.
Naphthalene	:	IARC: Possibly carcinogenic to humans.
Ethylbenzene	:	ACGIH: Confirmed animal carcinogen with unknown relevance to humans.
Ethylbenzene	:	IARC: Possibly carcinogenic to humans.

Reproductive and Developmental Toxicity	:	Not expected to impair fertility. Not expected to be a developmental toxicant.
Additional Information	:	Can cause liver damage. H2S has a broad range of effects dependent on the airborne

concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.
May cause MDS (Myelodysplastic Syndrome).

12. ECOLOGICAL INFORMATION

Incomplete ecotoxicological data are available for this product. The information given below is based partly on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity : Expected to be harmful:LL/EL/IL50 1-10 mg/l(to aquatic organisms)LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Mobility : Contains volatile constituents. Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. If the product enters soil, one or more constituents will or may be mobile and may contaminate groundwater.

Persistence/degradability : Major constituents are inherently biodegradable, but contains components that may persist in the environment.

Bioaccumulation : Contains constituents with the potential to bioaccumulate.

Other Adverse Effects : Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal : Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.

Container Disposal : Send to drum recoverer or metal reclaimer. Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if

		heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be complied with.

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification

UN/NA Number	UN 1267
Proper shipping name	PETROLEUM CRUDE OIL
Class Division	3
Packing group	II
Shipping Description	PETROLEUM CRUDE OIL, Class 3, UN 1267, PG II

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Class/Description	:	Class B2 Flammable Liquid Class D2A Other Toxic Effects - Carcinogen/Mutagen Class D2B Other Toxic Effects - Skin Irritant

Inventory Status

EINECS	:	All components listed or polymer exempt.
DSL	:	All components listed.
TSCA	:	All components listed.

16. OTHER INFORMATION

MSDS Version Number	:	1.0
MSDS Effective Date	:	09-05-2012
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Prepared By	:	Shell Product Stewardship; 1-800-661-1600
MSDS Distribution	:	The information in this document should be made available to

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all who may handle the product.

Disclaimer : The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

Material Safety Data Sheet

According to the Controlled Product Regulations

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name : **Upgraded Crude**
Uses : Refinery Feedstock.
Product Code : 001B3899, 002D2308, 002D2312, 002D2315, 001B3607, 002D2316, 001D1767, 001D1777, 001B4221

Manufacturer/Supplier : **Shell Canada Products**
400 - 4th Avenue S.W
Calgary AB T2P 0J4
Canada
Telephone : (+1) 8006611600
Fax : (+1) 4033848345

Emergency Telephone Number
: Shell Canada: (+1) 800-661-7378
CANUTEC (24 hr): (+1) 613-996-6666

2. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture Description : Crude oil produced by an upgrading process and containing predominantly aliphatic, alicyclic and aromatic hydrocarbons. It may also contain small amounts of nitrogen, oxygen and sulphur compounds.

Synonyms : CRU Albian Synthetic Blend
CRU Long Lake Premium Synthetic Crude
CRU Premium Newgrade Synthetic
CRU Shell Synthetic Blend
CRU Albian Heavy Synthetic
CRU Albian Premium Synthetic
CRU Shell Premium Synthetic (SPX)
CRU Syncrude
Husky Synthetic

WHMIS Controlled Ingredients

Chemical Identity	CAS No.	Conc. W/W
Distillates (petroleum), hydrotreated middle	64742-46-7	10.00- 30.00 %
Naphtha (petroleum), hydrotreated light	64742-49-0	10.00- 30.00 %
Gas oils (petroleum), hydrotreated vacuum	64742-59-2	10.00- 30.00 %
Gas oils (petroleum), hydrodesulfurized	64742-79-6	1.00- 5.00 %
Gas oil (petroleum), heavy atmospheric	68783-08-4	5.00- 10.00 %
Hydrocracked petroleum residues	64741-75-9	5.00- 10.00 %
Natural Gas Condensate	64741-47-5	10.00- 30.00 %
Naphtha (petroleum), heavy hydrocracked	64741-78-2	5.00- 10.00 %
Distillates (petroleum), straight-run, middle	64741-44-2	10.00- 30.00 %
Naphtha (petroleum), light straight-run	64741-46-4	5.00- 10.00 %

Residues (petroleum), vacuum	64741-56-6	5.00- 10.00 %
Clarified oils (petroleum), catalytic cracked	64741-62-4	1.00- 5.00 %

Contains Benzene, CAS # 71-43-2.
Contains n-Hexane, CAS # 110-54-3.
Contains hydrogen sulphide, CAS # 7783-06-4.
Contains Xylene (Mixed Isomers), CAS # 1330-20-7.
Contains Toluene, CAS # 108-88-3.
Hydrogen sulphide may be present both in the liquid and the vapour. Composition is complex and varies with the source of the crude oil.

Refer to Chapter 8 for Occupational Exposure Guidelines.

3. HAZARDS IDENTIFICATION

WHMIS Class/Description : Class B2 Flammable Liquid
Class D2A Other Toxic Effects - Carcinogen/Mutagen
Class D2A Other Toxic Effects - Reproductive Toxicity
Class D2B Other Toxic Effects - Skin Irritant
Class D2B Other Toxic Effects - Narcotic effects.
Class D2B Other Toxic Effects - Blood, Thymus,Liver.

Routes of Exposure : Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.

Health Hazards : Vapours may cause drowsiness and dizziness. Repeated exposure may cause skin dryness or cracking. Moderately irritating to eyes. Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed. Harmful: may cause lung damage if swallowed. Hydrogen sulphide is highly toxic and may be fatal if inhaled. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and other hazardous vapours may evolve and collect in the headspace of storage tanks, transport vessels and other enclosed containers. A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome). Hydrogen sulphide is highly toxic and may be fatal if inhaled. Hydrogen sulphide (H2S), an extremely flammable and toxic gas, and other hazardous vapours may evolve and collect in the headspace of storage tanks, transport vessels and other enclosed containers. May dull the sense of smell, so do not rely on odour as an indication of hazard. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm

		coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure. Repeated exposure may cause skin dryness or cracking. A component or components of this material may cause cancer. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome).
Signs and Symptoms	:	Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.
Safety Hazards	:	Highly flammable. May ignite on surfaces at temperatures above auto-ignition temperature. Flammable vapours may be present even at temperatures below the flash point. This material is a static accumulator. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.
Environmental Hazards	:	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Additional Information	:	This product is intended for use in closed systems only.

4. FIRST-AID MEASURES

General Information	:	Vaporisation of H2S that has been trapped in clothing can be dangerous to rescuers. Maintain respiratory protection to avoid contamination from the victim to rescuer. Mechanical ventilation should be used to resuscitate if at all possible.
Inhalation	:	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact	:	Flush eyes with water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision, or swelling persist transport to the nearest medical facility for additional treatment.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Give nothing by mouth. Do not induce vomiting. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Advice to Physician	:	Hydrogen sulphide (H2S) - CNS asphyxiant. May cause rhinitis, bronchitis and occasionally pulmonary oedema after severe exposure. CONSIDER: Oxygen therapy. Consult a Poison Control Center for guidance. Exposure to hydrogen sulphide at concentrations above the recommended occupational exposure standard may cause headache, dizziness, irritation of the eyes, upper respiratory tract, mouth and digestive tract, convulsions, respiratory paralysis, unconsciousness and even death. Call a doctor or poison control center for guidance. Potential for chemical pneumonitis.

5. FIRE-FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	< 23 °C / 73 °F
Upper / lower Flammability or Explosion limits	:	0.6 - 8 %(V)
Auto ignition temperature	:	> 220 °C / 428 °F
Hazardous Combustion Products and Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide may be evolved if incomplete combustion occurs. Oxides of sulphur. Unidentified organic and inorganic compounds. Oxides of nitrogen. The vapour is

		heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water. Flammable vapours may be present even at temperatures below the flash point. Hydrogen sulphide (H2S) and toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.
Protective Equipment for Firefighters	:	Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
Additional Advice	:	If the fire cannot be extinguished the only course of action is to evacuate immediately. Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways.

6. ACCIDENTAL RELEASE MEASURES

Protective Measures	:	May ignite on surfaces at temperatures above auto-ignition temperature. Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Clean Up Methods	:	For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.
Additional Advice	:	Notify authorities if any exposure to the general public or the

environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet.

7. HANDLING AND STORAGE

General Precautions : Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Prevent spillages. For comprehensive advice on handling, product transfer, storage and tank cleaning refer to the product supplier.

Handling : When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Never siphon by mouth. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Avoid exposure. Use only non-sparking tools. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Bulk storage tanks should be diked (bunded). Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges. These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements. These activities may lead to static discharge e.g. spark formation. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/s until fill pipe submerged to twice its diameter, then <= 7 m/s). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Storage : Drum and small container storage: Keep containers closed when not in use. Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers. Packaged product must be kept tightly closed and stored in a diked (bunded) well-ventilated area, away from, ignition sources and other sources of heat. Take suitable precautions when opening sealed containers, as pressure can build up during storage. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other

		sources of ignition. Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.
Product Transfer	:	Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Avoid splash filling. Keep containers closed when not in use. Do not use compressed air for filling, discharging or handling. Contamination resulting from product transfer may give rise to light hydrocarbon vapour in the headspace of tanks that have previously contained gasoline. This vapour may explode if there is a source of ignition. Partly filled containers present a greater hazard than those that are full, therefore handling, transfer and sampling activities need special care. Refer to guidance under Handling section.
Recommended Materials	:	For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), polyvinyl chloride (PVC), polyvinyl fluoride (PVDF), and fluoroelastomers (FKM), e.g. Viton, which have been specifically tested for compatibility with this product. For container linings, or coatings, use Epoxy (amine-cured), or Epoxy Novolac, or Phenolic Epoxy. For seals and gaskets use: fluoroelastomers (FKM), e.g. Viton A, B, or F, or Neoprene (CR), or nitrile (NBR, HNBR), or graphite, or expanded PTFE (e.g. Gore-Tex).
Unsuitable Materials	:	Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyisobutylene. However, some may be suitable for glove materials.
Container Advice	:	Do not cut, drill, grind, weld or perform similar operations on or near containers. Containers, even those that have been emptied, can contain explosive vapours.
Additional Information	:	Ensure that all local regulations regarding handling and storage facilities are followed. Hydrogen sulphide (H2S) and toxic sulphur oxides may be given off when this material is heated. Do not depend on sense of smell for warning. Hydrogen sulphide (H2S or Sour Gas) may be present when loading and unloading transport vessels. Stay upwind and away from

newly opened hatches and allow to vent thoroughly before handling material. Steam may be used to vent hatches. Keep all sources of ignition away from loading area.
Use hydrogen sulphide monitors for detection.
See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). CENELEC CLC/TR 50404 (Electrostatics – Code of practice for the avoidance of hazards due to static electricity).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Benzene	ACGIH	TWA	0.5 ppm		
	ACGIH	STEL	2.5 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SHELL IS	TWA	0.5 ppm	1.6 mg/m3	
	SHELL IS	STEL	2.5 ppm	8 mg/m3	
Hydrogen Sulphide	ACGIH	TWA	1 ppm		
	ACGIH	STEL	5 ppm		
Ethylbenzene	ACGIH	TWA	20 ppm		
n-hexane	ACGIH	TWA	50 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
Naphthalene	ACGIH	TWA	10 ppm		
	ACGIH	STEL	15 ppm		

	ACGIH	SKIN_DES			Can be absorbed through the skin.

Consult local authorities for acceptable exposure limits within their jurisdiction.

Additional Information : SHELL IS is the Shell Internal Standard. Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Biological Exposure Index (BEI)

Material	Determinant	Sampling Time	BEI	Reference
Benzene	t,t-Muconic acid in Creatinine in urine	Sampling time: End of shift.	500 µg/g	ACGIH BEL (2011)
	S-Phenylmercapturic acid in Creatinine in urine	Sampling time: End of shift.	25 µg/g	ACGIH BEL (2011)
Ethylbenzene	Sum of mandelic acid and phenylglyoxylic acid in Creatinine in urine	Sampling time: End of shift at end of work week.	0.7 g/g	ACGIH BEL (2011)
	Ethyl benzene in End-exhaled air	Sampling time: Not critical.		ACGIH BEL (2011)
n-hexane	2,5-Hexanedion, without hydrolysis in Urine	Sampling time: End of shift at end of work week.	0.4 mg/l	ACGIH BEL (2011)

Exposure Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits.

		Local exhaust ventilation is recommended. Eye washes and showers for emergency use. Firewater monitors and deluge systems are recommended. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping. Define procedures for safe handling and maintenance of controls. Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. All respiratory protection equipment and use must be in accordance with local regulations. Crude oil is a complex mixture with low and high boiling point components. When using an air-filtering respirator, careful attention to the filter breakthrough time is advised. If air-filtering respirators are suitable for conditions of use: Select a filter suitable for organic gases and vapours [boiling point >65 °C (149 °F)]. In areas where hydrogen sulphide vapours may accumulate, a positive-pressure air-supplied respirator is advised.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC. Longer term protection: Nitrile rubber. Incidental contact/Splash protection: Neoprene rubber. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognise that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time may be acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material.

		Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced.
Eye Protection	:	Chemical splash goggles (chemical monogoggles).
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory. Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/ Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour. Take appropriate measures to fulfil the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Chapter 6. If necessary, prevent undissolved material from being discharged to waste water. Waste water should be treated in a municipal or industrial waste water treatment plant before discharge to surface water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Brown to black. Viscous liquid.
Odour	:	Potential smell of rotten eggs and sulphur..
Odour threshold	:	
pH	:	Not applicable
Initial Boiling Point and Boiling Range	:	Data not available
Freezing Point	:	Data not available
Vapour pressure	:	Data not available
Specific gravity	:	Data not available
Density	:	< 1.010 g/cm3 at 15 °C / 59 °F
Water solubility	:	Insoluble.
n-octanol/water partition coefficient (log Pow)	:	2 - 6
Kinematic viscosity	:	3 - 1,000 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Electrical conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered

nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.

Evaporation rate (nBuAc=1) : Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions of use.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases including carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Hazardous Polymerisation	:	No, hazardous, exothermic polymerization cannot occur.
Sensitivity to Mechanical Impact	:	No, product will not become self-reactive.
Sensitivity to Static Discharge	:	Yes, in certain circumstances product can ignite due to static electricity.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data from components.
Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	May be harmful if swallowed. LD50 > 2000 - <= 5000 mg/kg , Rat.
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit.
Acute Inhalation Toxicity	:	Expected to be of low toxicity if inhaled. (Hydrogen Sulphide)
Skin Irritation	:	Causes skin irritation.
Eye Irritation	:	Expected to be irritating to eyes.
Respiratory Irritation	:	Not expected to be a respiratory irritant.
Sensitisation	:	Not expected to be a sensitiser.
Repeated Dose Toxicity	:	Repeated exposure may cause skin dryness or cracking. May cause damage to organs or organ systems through prolonged or repeated exposure. Bone Marrow (Benzene) Can cause liver damage. Liver: can cause liver damage at chronic exposure to high concentrations.
Mutagenicity	:	May cause heritable genetic damage. (Benzene)
Carcinogenicity	:	Causes cancer in laboratory animals.

Material	:	**Carcinogenicity Classification**
Crude Oil	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Crude Oil	:	GHS / CLP: No carcinogenicity classification

Natural Gasoline	:	IARC 2B: Possibly carcinogenic to humans.
Natural Gasoline	:	GHS / CLP: No carcinogenicity classification
n-hexane	:	GHS / CLP: No carcinogenicity classification
Benzene	:	ACGIH Group A1: Confirmed human carcinogen.
Benzene	:	NTP: Known To Be Human Carcinogen.
Benzene	:	IARC 1: Carcinogenic to humans.
Benzene	:	GHS / CLP: Carcinogenicity Category 1A
Naphthalene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Naphthalene	:	NTP: Reasonably Anticipated to be a Human Carcinogen.
Naphthalene	:	IARC 2B: Possibly carcinogenic to humans.
Naphthalene	:	GHS / CLP: Carcinogenicity Category 2
Ethylbenzene	:	ACGIH Group A3: Confirmed animal carcinogen with unknown relevance to humans.
Ethylbenzene	:	IARC 2B: Possibly carcinogenic to humans.
Ethylbenzene	:	GHS / CLP: No carcinogenicity classification
Sulphur	:	GHS / CLP: No carcinogenicity classification

Reproductive and Developmental Toxicity : Suspected of damaging fertility or the unborn child.

Additional Information : May cause MDS (Myelodysplastic Syndrome).
Can cause liver damage.
H2S has a broad range of effects dependent on the airborne concentration and length of exposure: 0.02 ppm odour threshold, smell of rotten eggs; 10 ppm eye and respiratory tract irritation; 100 ppm coughing, headache, dizziness, nausea, eye irritation, loss of sense of smell in minutes; 200 ppm potential for pulmonary oedema after >20-30 minutes; 500 ppm loss of consciousness after short exposures, potential for respiratory arrest; >1000ppm immediate loss of consciousness, may lead rapidly to death, prompt cardiopulmonary resuscitation may be required. Do not depend on sense of smell for warning. H2S causes rapid olfactory fatigue (deadens sense of smell). There is no evidence that H2S will accumulate in the body tissue after repeated exposure.

12. ECOLOGICAL INFORMATION

Incomplete ecotoxicological data are available for this product. The information given below is based partly on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity : LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Fish : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Aquatic crustacea : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Algae/aquatic plants : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Microorganisms : Expected to be harmful: LL/EL/IL50 >10 <= 100 mg/l

Chronic Toxicity

Fish : Data not available

Aquatic crustacea	:	Data not available
Mobility	:	Floats on water. If product enters soil, one or more of its constituents will be moderately mobile and may contaminate groundwater.
Persistence/degradability	:	Oxidises rapidly by photo-chemical reactions in air. Readily biodegradable.
Bioaccumulation	:	Contains constituents with the potential to bioaccumulate.
Other Adverse Effects	:	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Container Disposal	:	Send to drum recoverer or metal reclaimer. Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be in compliance.

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification

UN/NA Number	UN 1267
Proper shipping name	PETROLEUM CRUDE OIL
Class Division	3
Packing group	II
Shipping Description	PETROLEUM CRUDE OIL, Class 3, UN 1267, PG II
Additional Information	MARPOL Annex 1 rules apply for bulk shipments by sea.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Class/Description : Class B2 Flammable Liquid
Class D2A Other Toxic Effects - Carcinogen/Mutagen
Class D2A Other Toxic Effects - Reproductive Toxicity
Class D2B Other Toxic Effects - Skin Irritant
Class D2B Other Toxic Effects - Narcotic effects.
Class D2B Other Toxic Effects - Blood, Thymus,Liver.

Inventory Status

DSL : All components listed.
:

16. OTHER INFORMATION

SDS Version Number : 2.2

SDS Effective Date : 2013-07-25

SDS Revisions : A vertical bar (|) in the left margin indicates an amendment from the previous version.

SDS Regulation : The content and format of this (M)SDS is in accordance with the Controlled Product Regulations.

SDS Prepared By : Shell Product Stewardship; 1-800-661-1600

Uses and Restrictions : This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier.

SDS Distribution : The information in this document should be made available to all who may handle the product.

Disclaimer : The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

Shell Canada Limited
Material Safety Data Sheet

Effective Date: 2010-02-15
Supersedes: 2007-02-23

Class B2 Flammable Liquid

Class D2B Skin Irritation

Class D2A Embryo/Fetotoxicity
Class D2A Carcinogenicity

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT:	**SHELL SYNTHETIC CRUDE BLEND**
SYNONYMS:	SSX Synthetic crude oil is a mixture of paraffins, naphthenes, aromatics and sulphur compounds
PRODUCT USE:	Base product for Petroleum Refining.
PRODUCT CODE:	**873-100**

SUPPLIER
Shell Canada Limited (SCL)
P.O. Box 100, Station M
400-4th Ave. S.W.
Calgary, AB Conada
T2P 2H5

TELEPHONE NUMBERS	
Shell Emergency Number	1-800-661-7378
CANUTEC 24 HOUR EMERGENCY NUMBER	1-613-996-6666
For general information:	1-800-661-1600
	www.shell.ca

This MSDS was prepared by the Toxicology and Product Stewardship Section of Shell Canada Limited.
*An asterisk in the product name designates a trade-mark of Shell Brands International AG. Used under license.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	CAS Number	% Range	WHMIS Controlled
Hydrocracked Residues	64741-75-9	0 - 100	Yes
Gas Oils (Petroleum), Heavy Atmospheric	68783-08-4	0 - 100	Yes
Distillates (Petroleum), Hydrotreated Middle	64742-46-7	0 - 30	Yes
Naphtha (Petroleum), Hydrotreated Heavy	64742-48-9	0 - 30	Yes
Naphtha (Petroleum), Hydrotreated Light	64742-49-0	0 - 10	Yes
Xylene (Mixed Isomers)	1330-20-7	1 - 2	Yes
n-Hexane	110-54-3	< 1	Yes
Toluene	108-88-3	< 1	Yes
Naphtha (petroleum), heavy straight-run	64741-41-9	0 - 5	Yes

Naphtha, heavy hydrocracked	64741-78-2	0 - 5	Yes
Benzene	71-43-2	< 0.1	Yes
Ethylbenzene	100-41-4	< 0.1	Yes

Note: N-hexane, toluene, xylene, ethylbenzene and benzene are not introduced into the product as intentional additives. These chemicals may be contained in one or more of the blending components that make up the product.

See Section 8 for Occupational Exposure Guidelines.

3. HAZARDS IDENTIFICATION

Physical Description: Viscous Liquid Dark Brown Hydrocarbon Odour

Routes of Exposure: Exposure will most likely occur through skin contact or inhalation.

Hazards:

Flammable Liquid.
Irritating to skin.
May cause cancer.
Contains xylene, which may affect fetal development.
Exposure to vapours may cause irritation of the eyes.
Inhalation of oil mist or vapours from hot oil may cause irritation of the upper respiratory tract.

Handling:

Eliminate all ignition sources.
Wear suitable gloves and eye protection.
Bond and ground transfer containers and equipment to avoid static accumulation.
Empty containers are hazardous, may contain flammable / explosive dusts, liquid residue or vapours. Keep away from sparks and open flames.
Avoid inhalation of vapours.

For further information on health effects, see Section 11.

4. FIRST AID MEASURES

Eyes: Flush eyes with water for at least 15 minutes while holding eyelids open. If irritation occurs and persists, obtain medical attention.

Skin: Wash contaminated skin with mild soap and water for at least 15 minutes. If irritation occurs and persists, obtain medical attention.

Ingestion: Do not induce vomiting; get medical help immediately.

Inhalation: Remove victim from further exposure and restore breathing, if required. Obtain medical attention.

Notes to Physician: Treatment of exposure should be directed at the control of symptoms and the clinical condition.

5. FIRE FIGHTING MEASURES

Extinguishing Media:

Dry Chemical
Carbon Dioxide
Foam
Water Fog

Firefighting Instructions:	Flammable. Clear area of unprotected personnel. Do not use a direct stream of water as it may spread fire. Vapours may travel along ground and flashback along vapour trail may occur. Containers exposed to intense heat from fires should be cooled with water to prevent vapour pressure buildup, which could result in container rupture. Do not enter confined fire space without adequate protective clothing and an approved positive pressure self-contained breathing apparatus. Delayed lung damage can be experienced after exposure to combustion products, sometimes hours after the exposure. Fight fire from maximum distance.
Hazardous Combustion Products:	A complex mixture of airborne solid, liquid, particulates and gases will evolve when this material undergoes pyrolysis or combustion. Carbon monoxide, carbon dioxide, oxides of nitrogen and oxides of sulphur may be formed on combustion.

6. ACCIDENTAL RELEASE MEASURES

Issue warning "Flammable". See Section 8 for advice on personal protective equipment. Eliminate all ignition sources. Isolate hazard area and restrict access. Stop leak only if safe to do so. Notify appropriate environmental agency(ies). Work upwind of spill if it is safe to do so. Dike and contain land spills; contain spills to water by booming. Do not wash spills into sewers or other public water systems. For large spills remove by mechanical means and place in containers. Adsorb residue or small spills with adsorbent material and remove to non-leaking containers for disposal. After area has been cleaned up to the satisfaction of regulatory authorities, flush area with water to remove trace residue. Dispose of recovered material as noted under Disposal Considerations.

7. HANDLING AND STORAGE

Handling:	Flammable. Fixed equipment as well as transfer containers and equipment should be grounded to prevent accumulation of static charge. Avoid breathing vapours and prolonged or repeated contact with skin. Empty containers are hazardous, may contain flammable/explosive dusts, residues or vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers. Launder contaminated clothing prior to reuse. Wash with soap and water prior to eating, drinking, smoking, applying cosmetics or using toilet facilities. Use good personal hygiene.
Storage:	Tank storage should be done according to NFPA Code 30 for crude oils.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

The following information, while appropriate for this product, is general in nature. The selection of personal protective equipment will vary depending on the conditions of use.

OCCUPATIONAL EXPOSURE LIMITS (Current ACGIH TLV/TWA unless otherwise noted):
North American exposure limits have not been established for the product. Consult local and provincial authorities for acceptable values.
Xylene: 100 ppm (STEL: 150 ppm)
Petroleum Distillates (Carbon range C9 to C20): Shell Canada's internal guideline is 100 mg/m3 total hydrocarbon as an OEL (8-hour TWA).
Naphtha (Carbon range C3 to C11): Shell Canada's internal guideline is 900 mg/m3 total hydrocarbon as an OEL (8-hour TWA).

Polycyclic Aromatic Hydrocarbons (PAH): Shell Canada's internal guideline is 0.02 mg/m3 as an OEL (8-hour TWA).

Mechanical Ventilation:	Use explosion-proof ventilation as required to control vapour concentrations. Concentrations in air should be maintained below the occupational exposure limit if unprotected personnel are involved. Make up air should always be supplied to balance air exhausted (either generally or locally). Local ventilation recommended where general ventilation is ineffective in controlling airborne concentrations below the recommended occupational exposure limit. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper confined space entry procedure must be followed including ventilation and testing of tank atmosphere.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection:	Chemical safety goggles and/or full face shield to protect eyes and face, if product is handled such that it could be splashed into eyes.
Skin Protection:	Avoid contact with skin. Impervious gloves should be worn at all times when handling this product. In confined spaces or where the risk of skin exposure is much higher, impervious clothing should be worn. Use protective clothing and gloves manufactured from nitrile.
Respiratory Protection:	Avoid breathing vapour or mists. If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. Depending on airborne concentration, use either a NIOSH-approved chemical cartridge respirator with organic vapour cartridges in combination with a P95 particulate filter or use a NIOSH-approved supplied-air respirator, either self-contained or airline, operated in positive pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous Liquid
Appearance:	Dark Brown
Odour:	Hydrocarbon Odour
Odour Threshold:	Not available
Boiling Point:	-15 - 590 °C
Density:	860 - 900 kg/m3 @ 15 °C
Specific Gravity (Water = 1):	0.86 - 0.9
pH:	Not available
Flash Point:	< 0 °C
Lower Flammable Limit:	Not available
Upper Flammable Limit:	Not available
Autoignition Temperature:	Not available
Viscosity:	16 cSt @ 30 °C
Evaporation Rate (n-BuAc = 1):	Not available
Partition Coefficient (log K_{OW}):	Not available
Water Solubility:	Insoluble
Other Solvents:	Hydrocarbon Solvents

10. STABILITY AND REACTIVITY

Chemically Stable: Yes

Hazardous Polymerization: No
Sensitive to Mechanical Impact: No
Sensitive to Static Discharge: Yes
Hazardous Decomposition Products: When heated to decomposition, may emit toxic and corrosive fumes of sulphur oxides, as well as CO, CO2, uncombusted hydrocarbons and soot.
Incompatible Materials: Avoid strong oxidizing agents.
Conditions of Reactivity: Avoid excessive heat, formation of vapours or mists.

11. TOXICOLOGICAL INFORMATION

Ingredient (or Product if not specified)	Toxicological Data
Hydrocracked Residues	LD50 Oral Rat = 4320 mg/kg LD50 Dermal Rat > 2000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Gas Oils (Petroleum), Heavy Atmospheric	
Distillates (Petroleum), Hydrotreated Middle	LD50 Dermal Rat > 2000 mg/kg LD50 Oral Rat > 5000 mg/kg
Naphtha (Petroleum), Hydrotreated Heavy	LD50 Oral Rat > 5000 mg/kg LD50 Dermal Rabbit > 3160 mg/kg
Naphtha (Petroleum), Hydrotreated Light	LD50 Oral Rat > 5000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Xylene (Mixed Isomers)	LD50 Oral Rat = 4300 mg/kg LC50 Inhalation Rat = 6700 ppm for 4 hours LD50 Dermal Rabbit > 2000 mg/kg
n-Hexane	LD50 Oral Rat > 8 mL/kg LD50 Dermal Rat > 4 mL/kg LC50 Inhalation Rat = 54090 - 57000 ppm for 4 hours
Toluene	LD50 Oral Rat 5580 mg/kg LC50 Inhalation Rat 26700 ppm for 1 hour LD50 Dermal Rabbit 12400 mg/kg
Naphtha (petroleum), heavy straight-run	LC50 Inhalation Rat > 5000 mg/m3 for 4hours
Naphtha, heavy hydrocracked	LC50 Inhalation Rat > 5240 mg/m3 for 4hours LD50 Oral Rat > 5000 mg/kg LD50 Dermal Rabbit > 2000 mg/kg
Benzene	LD50 Oral Rat 690 - 3400 mg/kg LC50 Inhalation Rat 13700 ppm for 4 hours LD50 Dermal Rabbit > 8260 mg/kg
Ethylbenzene	LD50 Oral Rat = 3500 mg/kg LC50 Inhalation Rat = 4000 ppm for 4 hours LD50 Dermal Rabbit = 17.8 mL/kg

Routes of Exposure: Exposure will most likely occur through skin contact or inhalation.
Irritancy: Based on the ingredients, this product is expected to be irritating to skin.
Chronic Effects: Prolonged or repeated contact may cause various forms of dermatitis including folliculitis and oil acne. Prolonged exposure to high vapour concentration can cause headache, dizziness, nausea, blurred vision and central nervous system depression. Long term intensive exposure to oil mist may cause benign lung fibrosis.

Feto/Teratogenicity: High exposures to xylene in some animal studies, often at levels toxic to the mother, have affected embryo/fetal development. Other animal and human studies have not shown this effect.

Pre-existing Conditions: Pre-existing skin disorders may be aggravated by exposure to components of this product.

Carcinogenicity and Mutagenicity: Carcinogenic hazard. This product may contain a variety of polycyclic aromatic hydrocarbons (PAH), some of which are associated with the potential of inducing skin cancer. Increasing amounts of PAH may be released if this product is heated above 200 C.

12. ECOLOGICAL INFORMATION

Environmental Effects: The immediate effect of a release is the physical impairment of the environment from the coating of surfaces, resulting in the disruption of oxygen, water and light to flora and fauna. May cause physical fouling of aquatic and avian organisms. Prolonged exposure may result in the partitioning of light-end hydrocarbon fractions into the water and gas phases of the subsurface soil environment with potential to adversely affect soil and groundwater quality.

Biodegradability: Not readily biodegradable.

13. DISPOSAL CONSIDERATIONS

Waste management priorities (depending on volumes and concentration of waste) are: 1. recycle (reprocess), 2. energy recovery 3. incineration, 4. disposal at a licenced waste disposal facility. Do not attempt to combust waste on-site. Incinerate at a licenced waste disposal site with approval of environmental authority. Landfill adsorbed material in a government approved site.

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification:

UN Number	UN1268
Proper Shipping Name	PETROLEUM DISTILLATES, N.O.S.
Hazard Class	Class 3 Flammable Liquids
Packing Group	PG I
Shipping Description	PETROLEUM DISTILLATES, N.O.S. Class 3 UN1268 PG I

15. REGULATORY INFORMATION

This product has been classified in accordance with the hazard criteria of the *Controlled Products Regulations* (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Class:
Class B2 Flammable Liquid
Class D2B Skin Irritation
Class D2A Embryo/Fetotoxicity
Class D2A Carcinogenicity

DSL/NDSL Status: This product, or all components, are listed on the Domestic Substances List, as required under the Canadian Environmental Protection Act.

Other Regulatory Status: The regulatory information is not intended to be comprehensive. Other regulations may apply to this material. For purposes of TSCA, the product is a mixture of certain blending components, all of which are on the TSCA Inventory. Individual shipments of this product will not necessarily contain all of the blending components listed in Section 2 above.

16. OTHER INFORMATION

LABEL STATEMENTS

Hazard Statement : Flammable Liquid.
Irritating to skin.
May cause cancer.
Contains xylene, which may affect fetal development.

Handling Statement: Eliminate all ignition sources.
Wear suitable gloves and eye protection.
Bond and ground transfer containers and equipment to avoid static accumulation.
Empty containers are hazardous, may contain flammable / explosive dusts, liquid residue or vapours. Keep away from sparks and open flames.
Avoid inhalation of vapours.

First Aid Statement : Wash contaminated skin with soap and water.
Flush eyes with water.
If overcome by vapours remove to fresh air.
Do not induce vomiting.
Obtain medical attention.

Revisions: This MSDS has been reviewed and updated. Changes have been made to: Section 2 Section 15

TURBOFLO® SVX

Safety Data Sheet

According to regulation: (US) paragraph (d) of 1910.1200
Revision date: 25-NOV-2015 Date of issue: 25-NOV-2015

Version: 1 3

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
Product Name : **TURBOFLO® SVX**
Product code : 3451

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Use of the substance/mixture : **TURBOFLO® SVX**, drag reducing additive (DRA) injected in petroleum pipeline systems to reduce frictional pressure.

1.2.2. Uses advised against

No additional information available

1.3.1. Details of the chemcial manufacture:

Flowchem LLC
20333 Blinka Road
Waller, TX 77484
T: (936) 372-5347
http://www.flowchem-dra.com/

1.3.2. Details of party who prepared SDS:

Flowchem LLC
c/o VelocityEHS SDS Authoring Services
350 North Orleans, Suite 950
Chicago, IL 60654 -- h: +1(312) 881-2000
http://www.msdsonline.com/

1.4. Emergency telephone number

Emergency number : 1-800-424-9300 CHEMTREC (FOR U.S. ONLY)
+358(0) 9 412 3055 REACHLaw Ltd (Canada, Eastern Hemisphere)

SECTION 2: Hazards identification

(2.1.a). Classification of the chemical in accordance with paragraph (d) of §1910.1200 : **MAY BE HARMFUL IF SWALLOWED & ENTERS AIRWAYS CATAGORY 2**

For the full text of the H-Statements mentioned in this Section, see Section 16

16 (2.1.b). GHS Pictogram : **NO LABELING APPLICABLE**

(2.1.c). Signal Word : **WARNING**

(2.1.d). Hazard Statement(s) : **MAY BE HARMFUL IF SWALLOWED AND ENTERS AIRWAYS**

(2.1.e). Precautionary Statement(s) : **STORE LOCKED UP. DISPOSE OFCONTENTS/CONTAINER IN ACCORDANCE WITH LOCAL/REGINAL REGULATION. AVOIDE RELEASE TO THE ENVIROMENT. COLLECT SPILLAGE. IF SWALLOWED: IMMEDIATELY CALL A POISON CENTER OR DOCTOR/PHYSICIAN DO NOT INDUCE VOMITING.**

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product Identifier	%	Classification according to Regulation (US) PARAGRAPH (d) OF §1910.1200
Soybean Oil	(CAS No) 8001-22-7		Not Clacssified
Rubber, synthetic.polyolenfin	(CAS No) 308070-26-0		Not Classifed
Calcium Stearate	(CAS No) 1592-23-0-7		Not Classified

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid measures after inhalation	:	When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.
First-aid measures after skin contact	:	Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation develops or persists.
First-aid measures after eye contact	:	Rinse cautiously with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention.
First-aid measures after ingestion	:	Rinse mouth. Do NOT induce vomiting. Obtain medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries	:	Not expected to present a significant hazard under anticipated conditions of normal use.
Symptoms/injuries after inhalation	:	Prolonged exposure may cause irritation.
Symptoms/injuries after skin contact	:	Prolonged exposure may cause skin irritation.
Symptoms/injuries after eye contact	:	May cause slight irritation to eyes.
Symptoms/injuries after ingestion	:	Ingestion may cause adverse effects.

4.3. Indication of any immediate medical attention and special treatment needed

If exposed or concerned, get medical advice and attention. If medical advice is needed, have product container or label at hand.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	:	Water spray, dry chemical, foam, carbon dioxide.
Unsuitable extinguishing media	:	Do not use a heavy water stream. Use of heavy stream of water may spread fire.

5.2. Special hazards arising from the substance or mixture

Fire hazard	:	Not considered flammable but may burn at high temperatures.
Explosion hazard	:	Product is not explosive.
Reactivity	:	Hazardous reactions will not occur under normal conditions.

5.3. Advice for firefighters

Precautionary measures fire	:	Exercise caution when fighting any chemical fire.
Firefighting instructions	:	Use water spray or fog for cooling exposed containers.
Protection during firefighting	:	Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	:	Avoid prolonged contact with eyes, skin and clothing. Avoid breathing dust.

6.1.1. For non-emergency personnel

Protective equipment	:	Use appropriate personal protection equipment (PPE).
Emergency procedures	:	Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment	:	Equip cleanup crew with proper protection.
Emergency procedures	:	Ventilate area. Upon arrival at the scene, a first responder is expected to recognize the presence of dangerous goods, protect oneself and the public, secure the area, and call for the assistance of trained personnel as soon as conditions permit.

6.2. Environmental precautions

Prevent entry to sewers and public waters.

6.3. Methods and material for containment and cleaning up

For containment	:	Contain solid spills with appropriate barriers and prevent migration and entry into sewers or streams.
Methods for cleaning up	:	Clean up spills immediately and dispose of waste safely. Recover the product by vacuuming, shoveling or sweeping. Transfer spilled material to a suitable container for disposal. Contact competent authorities after a spill.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection. See Section 13, Disposal Considerations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Avoid prolonged contact with eyes, skin and clothing. Avoid breathing dust.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety procedures.

7.2. Conditions for safe storage, including any incompatibilities.

Technical Measures:	Comply with applicable regulations.
Storage Conditions:	: Keep container closed when not in use. Store in a dry, cool place. Keep/Store away from direct sunlight, extremely high or low temperatures and incompatible materials.
Incompatible products:	: Strong acids, strong bases, strong oxidizers.
Incompatible materials:	: Sources of ignition. Direct sunlight.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Not Classified		
Not Applicable		

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation, especially in confined areas. Ensure all national/local regulations are observed.

Personal protective equipment : Gloves. Protective clothing. Protective goggles.

Materials for protective clothing : Chemically resistant materials and fabrics.

Hand protection : Wear protective gloves.

Eye protection : Chemical safety goggles.

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : If exposure limits are exceeded or irritation is experienced, approved respiratory protection should be worn. In case of inadequate ventilation, oxygen deficient atmosphere, or where exposure levels are not known wear approved respiratory protection.

Other information : When using, do not eat, drink or smoke.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

a. Physical state	: Liquid Suspension	m. Vapour pressure	: No Data Available
b. Colour	: Pale Yellow	n. Relative vapour density at 20 C	: No Data Available
c. Odour	: Lard / Vegetable Oil	o. Solubility in Water	: Insoluble in Water
d. Odour threshold	: No Data Available	p. Solubility in other	: Miscible in Hydrocarbons
e. pH	: Not Applicable	q. Partition coefficient: n-octanol/	: No Data Available
f. Evaporation rate	: No Data Available	r. water Viscosity	: No Data Available
g. Melting / Freezing point	: 0.1°F (-17.7°C)	s. Explosive properties	: No Data Available
h. Boiling point	: No Data Available	t. Oxidising properties	: No Data Available
i. Flash point	: 210°F (99°C)	u. Secific Gravity	: No Data Available
j. Auto-ignition temperature	: No Data Available	v. Density	: 0.89g/ml
k. Decomposition temperature	: No Data Available	w. Explosive Limits	: No Data Available
l. Flammability (solid, gas)	: No Data Available		

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Hazardous eactions will not occur under normal conditions.

10.2. Chemical stability
Stable under recommended handling and storage conditions (see section 7).

10.3. Possibility of hazardous reactions
Hazardous polymerization will not occur.

10.4. Conditions to avoid
Direct sunlight, extremely high or low temperatures, and incompatible materials.

10.5. Incompatible materials
Strong acids, strong bases, strong oxidizers.

10.6. Hazardous decomposition products
Thermal decomposition generates : Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Oxides of calcium.

SECTION 11: Toxicological information

11.1. Information on toxicological effects
Acute toxicity : Not classified

Calcium Stearate [(CAS No) 1592-23-0 / (EC No) 216-472-8]	
LD50 oral rat	> 10 g/kg

Skin corrosion/irritation : Not classified
Serious eye damage/irritation : Not classified
Respiratory or skin sensitisation : Not classified
Germ cell mutagenicity : Not classified
Carcinogenicity : Not classified
Reproductive toxicity : Not classified
Specific target organ toxicity (single exposure) : Not classified
Specific target organ toxicity (repeated exposure) : Not classified
Aspiration hazard : Not classified
Symptoms/Injuries After Inhalation : Prolonged exposure may cause irritation.
Symptoms/Injuries After Skin Contact : Prolonged exposure may cause skin irritation.
Symptoms/Injuries After Eye Contact : May cause slight irritation to eyes.
Symptoms/Injuries After Ingestion : Ingestion may cause adverse effects.
Potential adverse human health effects & symptoms : Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity
Ecology - general : Not classified.

12.2. Persistence and degradability

TURBOFLO® SVX	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

TURBOFLO® SVX	
Bioaccumulative potential	Not established.

12.4. Mobility in soil
No additional information available

12.5. Results of PBT and vPvB assessment
No additional information available

12.6. Other adverse effects
Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods
Waste disposal recommendations : Dispose of contents/container in accordance with local, regional, national, and international regulations.
Additional information : Container may remain hazardous when empty. Continue to observe all precautions.
Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

ADR	IMDG	IATA	ADN	RID
14.1. UN number				
Not regulated for transport				
14.2. UN proper shipping name				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.5. Environmental hazards				
Dangerous for the environment : No	Dangerous for the environment : No Marine pollutant : No	Dangerous for the environment : No	Dangerous for the environment : No	Dangerous for the environment : No

14.6. Special precautions for user

No additional information available

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

Contains no substances with Annex XVII restrictions
Contains no substance on the REACH candidate list
Contains no REACH Annex XIV substances

Calcium Stearate [(CAS No) 1592-23-0 / (EC No) 216-472-8]
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Soybean Oil [(CAS No) 8001-22-7 / (EC No) 232-274-4]
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.1.2. National regulations

No additional information available

15.2. Chemical safety assessment

No chemical safety assessment has been carried out

SECTION 16: Other information

Revision date : 24-NOV-2015
Data sources : According to regulations
- (US) paragraph (d) of 1910.1200

EU GHS SDS

HMIS - Hazardous Material Information System

HEALTH	1
FLAMMABILTIY	1
REACTIVITY	0
PERSONAL PROTECTION	C

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

ENBRIDGE

Safety Data Sheet

Section 1: Identification

PRODUCT IDENTIFIER	High Sweet Clearbrook	
OTHER MEANS OF IDENTIFICATION	**UN-Number**	UN1267
	Synonyms	Bakken Crude Oil; High Sweet Clearbrook (UHC); Hydrocarbons of Petroleum; North Dakota Sweet (NSW)
RECOMMENDED USE	No information available	
RESTRICTIONS OF USE	No information available	
SUPPLIER INFORMATION	Enbridge Pipelines Inc. 10201 Jasper Avenue Edmonton, Alberta T5J 3N7 Canada TEL: 1-780-420-5210	
EMERGENCY CONTACT INFORMATION	**CHEMTREC**	1-800-424-9300 for US 703-527-3887 outside US
	CANUTEC (Canadian Transportation)	613-996-6666

Section 2: Hazards Identification

CLASSIFICATION	Skin Corrosion/Irritation	Category 2
	Eye Irritation	Category 2
	Germ Cell Mutagenicity	Category 1B
	Carcinogenicity	Category 1A
	Reproductive Toxicity	Category 2
	Specific Target Organ Systemic Toxicity (Single Exposure)	Category 3
	Specific Target Organ Toxicity (Repeated Exposure)	Category 1
	Aspiration Toxicity	Category 1
	Flammable liquids	Category 1
LABEL ELEMENTS	**Signal Word**	Danger
	Hazard Pictograms	

Hazard Statements

- Causes skin irritation.
- Causes serious eye irritation.
- May cause genetic defects.
- May cause cancer.
- Suspected of damaging fertility or the unborn child.
- May cause respiratory irritation.
- Causes damage to organs through prolonged or repeated exposure.
- May be fatal if swallowed and enters airways.
- Extremely flammable liquid and vapor.

PRECAUTIONARY STATEMENTS

Prevention

- Wash face, hands and any exposed skin thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Do not eat, drink or smoke when using this product.
- Keep away from heat/sparks/open flames/hot surfaces.
- No smoking.
- Keep container tightly closed.
- Ground/bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting/equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- In case of inadequate ventilation wear respiratory protection.

Response

- IF exposed or concerned: Get medical advice/attention.
- IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- Get medical advice/attention if you feel unwell.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
- In case of fire: Use CO_2, dry chemical, or foam for extinction.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- Do NOT induce vomiting.

Storage/Disposal

- Store locked up.
- Store in a well-ventilated place. Keep container tightly closed.
- Keep cool.
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

OTHER INFORMATION

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.
- Very toxic to aquatic life with long lasting effects.

Section 3: Composition/Information on Ingredients

COMPONENT NAME	CAS NUMBER	PERCENTAGE (%)*	NOTES
Petroleum Hydrocarbons	68919-39-1	100	
Trans-1, 2-dimethylcyclopentane	28729-52-4	1.8	
2-Methylhexane	591-76-4	1.0	
2-Methylpentane	107-83-5	1.8	
3-Methylhexane	589-34-4	1.6	
3-Methylpentane	96-14-0	1.3	
2-Methylheptane	592-27-8	1.4	
Benzene	71-43-2	0.4	
Cyclohexane	110-82-7	1.0	
i-Pentane	109-66-0	1.8	
MethylCyclohexane	108-87-2	2.3	
Methylcyclopentane	96-37-7	2.2	
n-Butane	106-97-8	1.9	
n-Heptane	142-82-5	3.4	
n-Hexane	110-54-3	3.4	
n-Pentane	109-66-0	3.4	
n-Octane	111-65-9	3.0	
n-Nonane	111-84-2	2.2	
n-Decane	124-18-5	2.0	
n-Undecane	1120-21-4	1.7	
n-Dodecane	112-40-3	1.5	
n-Tridecane	629-50-5	1.3	
Toluene	108-88-3	0.9	
Hydrogen sulfide	7783-06-4	<0.00001	
Ethylbenzene	100-41-4	0.6	
Xylenes	1330-20-7	0-5	

**Values do not reflect absolute minimums and maximums; those values may vary from time to time.*

Section 4: First Aid Measures

DESCRIPTION OF NECESSARY MEASURES

Inhalation	• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If irritation persists: Get medical advice/attention.
Skin	• IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye	• IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	• Do NOT induce vomiting. Call a physician or poison control center. • Aspiration hazard if swallowed - can enter lungs and cause damage.

MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Refer to Section 11 - Toxicological Information

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY

Note to the Physician

- Aspiration hazard. Symptoms may be delayed.
- Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of this material (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for development of cardiac arrhythmias.
- Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

Section 5: Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable Extinguishing Media	• SMALL FIRES: Dry chemical, CO2, water spray or regular foam. • LARGE FIRE: Water spray, fog or regular foam.
Unsuitable Extinguishing Media	• CAUTION: Use of water spray when fighting fire may be inefficient. • Do not use straight streams.

FIREFIGHTING PROCEDURES

- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: If impossible to extinguish, protect surroundings and allow fire to burn itself out.
- Stay upwind.
- Ventilate closed spaces before entering.
- Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
- FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

- FIRE: When a large quantity of this material is involved in a major fire, consider an initial evacuation distance of 300 meters (1000 feet) in all directions.
- Move containers from fire area if you can do it without risk.
- LARGE FIRES: Use water spray or fog; do not use straight streams.
- LARGE FIRES: If insufficient water supply: knock down vapors only. If this is impossible, withdraw from area and let fire burn.
- LARGE FIRES: Flood fire area with large quantities of water, while knocking down vapors with water fog.

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

- Vapors may travel to source of ignition and flash back.
- Air/vapor mixtures may explode when ignited.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Will be easily ignited by heat, sparks or flames.
- Runoff to sewer may create fire or explosion hazard.
- Vapor explosion hazard indoors, outdoors or in sewers.
- MAY EXPLODE AND THROW FRAGMENTS 1600 meters (1 MILE) OR MORE IF FIRE REACHES CARGO.
- May create vapor/air explosion hazard indoors, outdoors or in sewers.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).

EXPLOSION DATA

Hazardous Combustion Products	• Carbon monoxide. Carbon dioxide (CO2). Nitrogen oxides (NOx). Oxides of sulfur. • Aldehydes, aromatic and other hydrocarbons.
Sensitivity to Mechanical Impact	• None.
Sensitivity to Static Discharge	• Yes.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS

- As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
- Water spray is recommended to cool or protect exposed materials or structures. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced firefighters.
- Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.
- Water spray may be useful in minimizing or dispersing vapors.
- Long-duration fires involving diluent stored in tanks may result in a boilover.
- For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear.

Section 6: Accidental Release Measures

PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Personal Precautions

- Evacuate personnel to safe areas.
- Remove all sources of ignition.
- Deny entry to unauthorized and unprotected personnel.
- Use personal protective equipment.
- Avoid contact with skin, eyes and clothing.
- Stop leak if you can do it without risk.
- Keep people away from and upwind of spill/leak.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

- Ventilate enclosed areas.
- Do not walk through spilled material.

Protective Equipment

- Wear appropriate breathing apparatus (if applicable) and protective clothing.

Emergency Procedures

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area) Keep unauthorized personnel away. Evacuate area. Keep out of low areas. Stop leak if you can do it without risk.
- Report spills to local or federal authorities as appropriate or required.

ENVIRONMENTAL PRECAUTIONS

- Avoid run off to waterways and sewers. Do NOT wash away into sewer. Prevent entry into waterways, sewers, basements or confined areas. Runoff from fire control may cause pollution.

METHODS AND MATERIAL FOR CONTAINMENT AND CLEANING UP

Methods for Containment

- Stop leak if you can do it without risk.
- Contain and recover liquid when possible.
- A vapor suppressing foam may be used to reduce vapors.
- Dike far ahead of spill; use dry sand to contain the flow of material; contain water spills by booming.
- Use water spray to reduce vapors or divert vapor cloud drift.
- A fine water spray remotely directed to the edge of the spill pool can be used to direct and maintain a hot flare fire which will burn the spilled material in a controlled manner.

Methods for Cleaning Up

- Clean up spill immediately.
- LARGE SPILLS: DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST.
- SMALL LIQUID SPILLS: Use a non-combustible material like vermiculite or sand to soak up the product and place into a container for later disposal.
- Use appropriate Personal Protective Equipment (PPE).
- Use clean non-sparking tools to collect absorbed material.
- Vacuum spilled material.
- Try to work upwind of spill.
- All equipment used when handling the product must be grounded.
- Recover and return free product to proper containers
- Use suitable absorbent materials such as vermiculite, sands, soil, or clay to clean up residual liquids.
- Do not place spilled materials back in the original container.
- Do not flush to sewer or allow to enter waterways.

Section 7: Handling and Storage

PRECAUTIONS FOR SAFE HANDLING

Handling

- All equipment used when handling the product must be grounded. Avoid contact with heat and ignition sources and oxidizers. Do not breathe (dust, vapor or spray mist). Do not use in areas without adequate ventilation. Do not use sparking tools. Keep away from heat, sparks, and flame. No open flames, no sparks and no smoking. Use only with adequate ventilation. Do not use or store near heat or open flame. Keep away from fire, sparks and heated surfaces.
- The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes).

- The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits.
- Take precautionary measures against static discharges.

Handling

- Do not cut drill, grind or weld on empty containers since they may contain explosive residues.
- Stay upwind and vent open hatches before uploading.
- Avoid contact with skin, eyes and clothing.
- Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water.
- Wear personal protective equipment.
- Remove and wash contaminated clothing before re-use.
- Do not eat, drink or smoke when using this product.
- Do not take internally.
- Wash thoroughly after handling.
- Empty containers pose a potential fire and explosion hazard.

CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES

Storage

- Ventilate enclosed areas.
- Store in a well-ventilated place.
- Keep container tightly closed.
- Store locked up.
- Avoid shock, impact, friction, and rough handling. Do not use sparking tools.
- Store in a cool/low-temperature, well-ventilated place away from heat and ignition sources.
- Keep away from sources of ignition.
- No Smoking.
- Do not enter confined spaces such as tanks or pits without following proper entry procedures.
- Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area.
- Harmful concentrations of hydrogen sulfide (H_2S) gas can accumulate in excavations and low-lying areas as well as the vapor space of storage and bulk transport compartments.
- Keep away from open flames, hot surfaces and sources of ignition.
- Keep product and empty container away from heat and sources of ignition.
- Storage containers should be grounded and bonded.
- Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.
- Store away from incompatible materials.

Incompatible Products

- Strong oxidizers such as nitrates, chlorates, peroxides.

Section 8: Exposure Controls/Personal Protection

CONTROL PARAMETERS: EXPOSURE GUIDELINES

CHEMICAL NAME	ACGIH	OSHA	NIOSH
2-Methylpentane	-	-	TWA 100 ppm TWA 350 mg/m^3 Ceiling 510 ppm Ceiling 1800 mg/m^3

3-Methylpentane			TWA 100 ppm TWO 350 mg/m^3 Ceiling 510 ppm Ceiling 1800 mg/m^3
Benzene	TLV 0.5 ppm TLV 1.6 mg/m^3 STEL 2.5 ppm STEL 8 mg/m^3	PEL 1 ppm STEL 5 ppm	TWA 0.1 ppm STEL 1 ppm IDLH 500 ppm
Cyclohexane	TLV 100 ppm TLV 334 mg/m^3	PEL 300 ppm PEL 1050 mg/m^3	TWA 300 ppm TWA 1050 mg/m^3 IDLH 1300 ppm
i-Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m^3 IDLH 1500 ppm
MethylCyclohexane	TLV 400 ppm TLV 1610 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 400 ppm TWA 1600 mg/m^3 IDLH 1200 ppm
n-Butane	TLV 1000 ppm	-	TWA 800 ppm TWA 1900 mg/m^3
n-Heptane	TLV 400 ppm TLV 1640 mg/m^3 STEL 500 ppm STEL 2000 mg/m^3	PEL 500 ppm PEL 2000 mg/m^3	TWA 85 ppm TWA 350 mg/m^3 Ceiling 440 ppm Ceiling 1800 mg/m^3 IDLH 750 ppm
n-Hexane	TLV 50 ppm TLV 176 mg/m^3	PEL 500 ppm PEL 1800 mg/m^3	TWA 50 ppm TWA 180 mg/m^3 IDLH 1100 ppm
n-Pentane	TLV 600 ppm TLV 1770 mg/m^3	PEL 1000 ppm PEL 2950 mg/m^3	TWA 120 ppm TWA 350 mg/m^3 Ceiling 610 ppm Ceiling 1800 mg/m^3 IDLH 1500 ppm
n-Octane	TLV 300 ppm TLV 1401 mg/m^3	PEL 500 ppm PEL 2350 mg/m^3	TWA 75 ppm TWA 350 mg/m^3 Ceiling 385 ppm Ceiling 1800 mg/m^3 IDLH 1000 ppm
n-Nonane	TLV 200 ppm TLV 1050 mg/m^3	-	TWA 200 ppm TWA 1050 mg/m^3

Toluene	TLV 20 ppm TLV 75 mg/m³	PEL 200 ppm STEL 300 mg/m³	TWA 100 ppm TWA 375 mg/m³ STEL 150 ppm STEL 560 mg/m³ IDLH 500 ppm
Hydrogen sulfide	TLV 1 ppm TLV 1.4 mg/m³ STEL 5 ppm STEL 7 mg/m³	Ceiling 20 ppm	Ceiling 10 ppm Ceiling 15 mg/m³ IDLH 100 ppm
Ethylbenzene	TLV 20 ppm TLV 87 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 125 ppm STEL 545 mg/m³ IDLH 800 ppm
Xylenes	TLV 100 ppm TLV 434 mg/m³ STEL 150 ppm STEL 651 mg/m³	PEL 100 ppm PEL 435 mg/m³	TWA 100 ppm TWA 435 mg/m³ STEL 150 ppm STEL 655 mg/m³ IDLH 900 ppm

APPROPRIATE ENGINEERING CONTROLS

- Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Prevent vapor build up by providing adequate ventilation during and after use. Use only appropriately classified electrical equipment.

INDIVIDUAL PROTECTION MEASURES

Eye and Face	• Wear face shield and eye protection.
Skin and Body	• The use of gloves (nitrile or neoprene) is advised to prevent skin contact and possible irritation. • Wear protective gloves/protective clothing/eye protection/face protection. Wear long sleeves and/or protective coveralls.
Respiratory	• Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.
General Hygiene Measures	• Handle in accordance with good industrial hygiene and safety practice.

Section 9: Physical and Chemical Properties

MATERIAL DESCRIPTION

Physical State	Liquid	**Odor**	Rotten egg, petroleum-like odor
Substance Type	Mixture	**Odor Threshold**	No data available
Appearance	Clear to brown liquid		

PROPERTIES				
	pH	No data available	**Vapor pressure**	72.3 to 101.35 kPa @ 37.8°C (100.4°F)
	Melting Point/ Freezing Point	No data available	**Vapor density**	1.0 to 3.9 Air=1
	Boiling Point/ Boiling Range	82.6 to 1330 °F 28.1 to 721.1 °C	**Relative density**	41.2 to 42.6
	Flash Point	-38 to -36 °F -38.8 to -37.7 °C	**Water Solubility**	Negligible
	Evaporation Rate	(Ethyl Ether =1) >1	**Partition coefficient: n-octanol/water**	No data available
	Flammability (solid, gas)	No data available	**Autoignition temperature**	No data available
	Upper Flammability Limit	No data available	**Decomposition temperature**	No data available
	Lower Flammability Limit	No data available	**Specific Gravity**	0.82
	Viscosity	5.43 mm^2/s		

Section 10: Stability and Reactivity

REACTIVITY	No data available
CHEMICAL STABILITY	Stable at 70 °F, 760 mm Hg pressure
POSSIBILITY OF HAZARDOUS REACTIONS	None under normal processing
CONDITIONS TO AVOID	Excessive heat, sources of ignition, sparks, open flames, and buildup of static electricity
INCOMPATIBLE MATERIALS	Strong oxidizers such as nitrates, chlorates, peroxides
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion produces carbon monoxide, aldehydes, aromatic and other hydrocarbons
HAZARDOUS POLYMERIZATION	Will not occur

Section 11: Toxicological Information

INFORMATION ON THE LIKELY ROUTES OF EXPOSURE	**Inhalation**	• May cause irritation of respiratory tract. May cause drowsiness and dizziness.
	Eye Contact	• Causes serious eye irritation.
	Skin Contact	• Causes skin irritation.

Ingestion

- Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.
- Potential for aspiration if swallowed.
- Aspiration may cause pulmonary edema and pneumonitis.

TOXICOLOGICAL DATA

CHEMICAL NAME	LD50 ORAL	LD50 DERMAL	LC50 INHALATION
Benzene	1800 mg/kg (Rat)	-	13050 - 14380 ppm (Rat) 4 h
Cyclohexane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	= 13.9 mg/L (Rat) 4 h
i-Pentane	>2000 mg/kg (Rat)	-	364 g/cu (Rat) 4 h
MethylCyclohexane	> 3200 mg/kg (Rat)	-	-
n-Butane	-	-	658 mg/L (Rat) 4 h
n-Heptane	-	= 3000 mg/kg (Rabbit)	= 103 g/m^3 (Rat) 4 h
n-Hexane	= 25 g/kg (Rat)	= 3000 mg/kg (Rabbit)	= 48000 ppm (Rat) 4 h
n-Pentane	>2000 mg/kg (Rat)	-	364 g/cu (Rat) 4 h
n-Octane	-	-	= 118 g/m^3 (Rat) 4 h = 25260 ppm (Rat) 4 h
n-Nonane	-	-	= 3200 ppm (Rat) 4 h
n-Decane	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rat)	-
Toluene	2.6 to 7.5 g/kg (Rat)	14.1 ml/kg (Rabbit)	-
Hydrogen sulfide	-	-	= 444 ppm (Rat)
Ethylbenzene	= 3500 mg/kg (Rat)	= 15400 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h
Xylenes	= 3500 mg/kg (Rat)	> 4350 mg/kg (Rabbit) > 1700 mg/kg (Rabbit)	= 29.08 mg/L (Rat) 4 h = 5000 ppm (Rat) 4 h

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS

Benzene

- Repeated or prolonged exposure to benzene at concentrations in excess of the TLV may cause serious injury to blood-forming organs. Significant chronic exposure to benzene vapor has been reported to produce various blood disorders ranging from anemia to certain forms of leukemia (cancer) in man. Benzene produced tumors in rats and mice in lifetime chronic toxicity studies, but the response has not been consistent across species, strain, sex or route of exposure. Animal studies on benzene have demonstrated immune toxicity, chromosomal aberrations, testicular effects and alterations in reproductive cycles and embryo/fetotoxicity, but not teratogenicity.

Hydrogen Sulfide Gas (H_2S)	• Toxicity by inhalation: Prolonged breathing of 50-100 ppm H_2S vapors can produce eye and respiratory tract irritation. Higher concentration (250-600 ppm) for 15-30 minutes can produce headache, dizziness, nervousness, nausea and pulmonary edema or bronchial pneumonia. Concentrations of >1000 ppm will cause immediate unconsciousness and death through respiratory paralysis. Rats and mice exposed to 80 ppm H_2S, 6 hrs/day, 5 days/week for 10 weeks, did not produce any toxicity except for irritation of nasal passages. H_2S did not affect reproduction and development (birth defects or neurotoxicity) in rats exposed to concentrations of 75-80 ppm or 150 ppm H_2S, respectively. Over the years a number of acute cases of H_2S poisoning have been reported. Complete and rapid recovery is the general rule. However, if the exposure was sufficiently intense and sustained causing cerebral hypoxia (lack of oxygen to the brain), neurologic effects such as amnesia, intention tremors or brain damage are possible.
Hexane	• This product may contain hexane at a level of >1.0%. Studies in laboratory animals have produced systemic toxicity in blood, spleen and lungs. Fetotoxicity has been observed at hexane concentrations that produced maternal toxicity. Long term exposure to high concentrations of hexane has been shown to cause testicular effects and nervous system damage.
Xylenes	• Gross overexposure or severe poisoning incidents in humans to xylenes has been reported to cause lung, liver, kidney, heart and brain damage as well as neurologic disturbances. Laboratory animals exposed to high dose of xylenes showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals, Exposure of pregnant rats, mice and rabbits during gestation to significant concentrations of xylenes produced maternal, fetal and developmental toxicity (skeletal retardation, cleft palate, and wavy ribs) generally at maternally toxic doses. These types of fetotoxic effects have been associated with maternal toxicity. Repeated inhalation of high xylene concentrations has shown impairment of performance abilities (behavioral tests) in animals and man. Xylenes produced a mild frequency hearing loss in rats subchronically exposed to high concentrations of xylenes.

DELAYED AND IMMEDIATE EFFECTS AND ALSO CHRONIC EFFECTS FROM SHORT- AND LONG-TERM EXPOSURE

Sensitization	• No information available
Mutagenic Effects	• May cause genetic defects
Carcinogenicity	• May cause cancer

CARCINOGENIC INFORMATION

CHEMICAL NAME	ACGIH	IARC	NTP	OSHA
Benzene	A1	Group 1	Known	X
Toluene	A4	Group 3	Evidence	-
Ethylbenzene	A3	Group 2B	Evidence	X
Xylenes	A4	Group 3	Evidence	-

REPRODUCTIVE TOXICITY

• Suspected of damaging fertility or the unborn child.

STOT - SINGLE EXPOSURE

• No information available.

STOT - REPEATED EXPOSURE

• Causes damage to organs through prolonged or repeated exposure.

ASPIRATION HAZARD

May be fatal if swallowed and enters airways Risk of serious damage to the lungs (by aspiration).

Section 12: Ecological Information

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Benzene	EC50 72 h: = 29 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 10.7 - 14.7 mg/L flow-through (Pimephales promelas) LC50 96 h: = 5.3 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 22.49 mg/L static (Lepomis macrochirus) LC50 96 h: = 28.6 mg/L static (Poecilia reticulata) LC50 96 h: 22330 - 41160 µg/L static (Pimephales promelas) LC50 96 h: 70000 - 142000 µg/L static (Lepomis macrochirus)	EC50 48 h: 8.76 - 15.6 mg/L Static (Daphnia magna) EC50 48 h: = 10 mg/L (Daphnia magna)	-
Cyclohexane	EC50 72 h: > 500 mg/L (Desmodesmus subspicatus)	LC50 96 h: 3.96 - 5.18 mg/L flow-through (Pimephales promelas) LC50 96 h: 23.03 - 42.07 mg/L static (Pimephales promelas) LC50 96 h: 24.99 - 44.69 mg/L static (Lepomis macrochirus) LC50 96 h: 48.87 - 68.76 mg/L static (Poecilia reticulata)	EC50 24 h: > 400 mg/L (Daphnia magna	EC50 = 85.5 mg/L 5 min EC50 = 93 mg/L 10 min (Microorganisms)
Pentane	-	-	EC50 48h: 135 mmol/cu	LC50 24h: 165 mmol/cu Artemia salina (Brine Shrimp)
MethylCyclohexane	-	LC50 96hr: 72.0 mg/l (Golden Shiner)	-	-
n-Heptane	-	LC50 96 h: = 375.0 mg/L (Cichlid fish)	EC50 24 h: > 10 mg/L (Daphnia magna)	-
n-Hexane	-	LC50 96 h: 2.1 - 2.98 mg/L flow-through (Pimephales promelas)	EC50 24 h: > 1000 mg/L (Daphnia magna)	-
n-Octane	-	-	EC50 48 h: = 0.38 mg/L (water flea) EC50 48 h: = 0.02856 mg/L (Daphnia magna)	EC50 = 890 mg/L 30 min (Microorganisms) EC50 <1.67hr: 120 µg/l Mytilus edulis (Common Bay Mussel)
n-Undecane	-	-	-	-
n-Dodecane	-	-	-	-
n-Tridecane	-	-	-	-

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Toluene	EC50: >433 mg/L Pseudokirchneriella subcapitata 96 h EC50: 12.5 mg/L Pseudokirchneriella subcapitata 72 h static	LC50: 15.22 - 19.05 mg/L Pimephales promelas 96 h flow-through LC50: 12.6 mg/L Pimephales promelas 96 h static LC50: 5.89 - 7.81 mg/L Oncorhynchus mykiss 96 h flow-through LC50: 14.1 - 17.16 mg/L Oncorhynchus mykiss 96 h static LC50: 5.8 mg/L Oncorhynchus mykiss 96 h semi-static LC50: 11.0-15.0 mg/L Lepomis macrochirus 96 h static LC50: 54 mg/L Oryzias latipes 96 h static LC50: 28.2 mg/L Poecilia reticulata 96 h semi-static LC50: 50.87-70.34 mg/L Poecilia reticulata 96 h static	EC50 48 h: 5.46 - 9.83 mg/L Static (Daphnia magna) EC50 48 h: = 11.5 mg/L (Daphnia magna)	EC50 = 19.7 mg/L 30 min (Microorganisms)
Hydrogen sulfide		LC50 96h: 49 µg/l Oncorhynchus mykiss (Rainbow Trout) eggs LC50 24h: 1059.7 µg/l Pimephales promelas (Fathead Minnow)	EC50 48h: 62 µg/l Gammarus pseudolimnaeus (Scud)	
Ethylbenzene	EC50 72 h: = 4.6 mg/L (Pseudokirchneriella subcapitata) EC50 96 h: > 438 mg/L (Pseudokirchneriella subcapitata) EC50 72 h: 2.6 - 11.3 mg/L static (Pseudokirchneriella subcapitata) EC50 96 h: 1.7 - 7.6 mg/L static (Pseudokirchneriella subcapitata) EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: 11.0 - 18.0 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 4.2 mg/L semi-static (Oncorhynchus mykiss) LC50 96 h: 7.55 - 11 mg/L flow-through (Pimephales promelas) LC50 96 h: = 32 mg/L static (Lepomis macrochirus) LC50 96 h: 9.1 - 15.6 mg/L static (Pimephales promelas) LC50 96 h: = 9.6 mg/L static (Poecilia reticulata)	EC50 48 h: 1.8 - 2.4 mg/L (Daphnia magna)	EC50 = 9.68 mg/L 30 min EC50 = 96mg/L 24 h (Microorganisms)

ECOTOXICITY

CHEMICAL NAME	TOXICITY TO ALGAE	TOXICITY TO FISH	DAPHNIA MAGNA (WATER FLEA)	OTHER TOXICITY
Xylenes	EC50 72 h: = 11 mg/L (Pseudokirchneriella subcapitata)	LC50 96 h: = 13.4 mg/L flow-through (Pimephales promelas) LC50 96 h: 2.661 - 4.093 mg/L static (Oncorhynchus mykiss) LC50 96 h: 13.5 - 17.3 mg/L (Oncorhynchus mykiss) LC50 96 h: 13.1 - 16.5 mg/L flow-through (Lepomis macrochirus) LC50 96 h: = 19 mg/L (Lepomis macrochirus) LC50 96 h: 7.711 - 9.591 mg/L static (Lepomis macrochirus) LC50 96 h: 23.53 - 29.97 mg/L static (Pimephales promelas) LC50 96 h: = 780 mg/L semi-static (Cyprinus carpio) LC50 96 h: > 780 mg/L (Cyprinus carpio) LC50 96 h: 30.26 - 40.75 mg/L static (Poecilia reticulata)	EC50 48 h: = 3.82 mg/L (water flea) LC50 48 h: = 0.6 mg/L (Gammarus lacustris)	-

PERSISTENCE AND DEGRADABILITY

- No information available

BIOACCUMULATIVE POTENTIAL

CHEMICAL	LOG POW
Benzene	1.83
Cyclohexane	3.44
Butane	2.89
Octane	5.18
Heptane	4.66
Decane	5.1
Xylene, mixed isomers	2.77 - 3.15
Toluene	2.65
Ethylbenzene	3.118

MOBILITY IN SOIL

CHEMICAL	EXPECTED SOIL MOBILITY
2-Methylpentane	Low
3-Methylpentane	Slight
Benzene	High

Cyclohexane	Moderate
Pentane	High
MethylCyclohexane	Low
Butane	Low
Heptane	Moderate
Hexane	High
Octane	Immobile
Nonane	Immobile
Decane	Immobile
Undecane	Immobile
Dodecane	Immobile
Tridecane	Immobile
Toluene	High to Moderate
Ethylbenzene	Low
Xylenes	Very high to Moderate

OTHER ADVERSE EFFECTS

- No information available

Section 13: Disposal Considerations

WASTE TREATMENT METHODS

Product Waste

- This product, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA RCRA (40 CFR 261), Environment Canada, or other State, Provincial, and local regulations. If this product is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.
- This product could also contain benzene at >0.5 ppm and could exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP).
- This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s).
- It is the responsibility of the user to consult federal, state and local waste regulations to determine appropriate disposal options.

Packaging Waste	• Container bottles should be completely used and containers should be emptied prior to discard. • Container could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. • Larger empty containers, such as drums, should be returned to the distributor or to a drum re-conditioner. • To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

Section 14: Transport Information

****CHART NAME****

	UN NUMBER	PROPER SHIPPING NAME	TRANSPORT HAZARD CLASS	PACKING GROUP	ENVIRONMENTAL HAZARD
DOT	UN1267	Petroleum crude oil	3	I	Emergency response guide number: 128
TDG	UN1267	Petroleum crude oil	3	I	-
IMO/IMDG	UN1267	Petroleum crude oil	3	I	EmS No. F-E, S-E
IATA/ICA	UN1267	Petroleum crude oil	3	I	-

SPECIAL RECAUTIONS FOR USER

• None

Section 15: Regulatory Information

U.S. - CERCLA/ SARA - HAZARDOUS SUBSTANCES AND THEIR REPORTABLE QUANTITIES

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	100 lb final RQ; 45.4 kg final RQ
Ethylbenzene	100-41-4	1000 lb final RQ; 454 kg final RQ
Toluene	108-88-3	1000 lb final RQ; 454 kg final RQ
Xylene	1330-20-7	100 lb final RQ; 45.4 kg final RQ
Benzene	71-43-2	10 lb final RQ; 4.54 kg final RQ
Hexane	110-54-3	5000 lb final RQ; 2270 kg final RQ

U.S. - CWA (CLEAN WATER ACT) - REPORTABLE QUANTITIES OF DESIGNATED HAZARDOUS SUBSTANCES

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	100 lb RQ
Ethylbenzene	100-41-4	1000 lb RQ
Toluene	108-88-3	1000 lb RQ
Xylene	1330-20-7	100 lb RQ
Benzene	71-43-2	10 lb RQ

U.S. - CWA (CLEAN WATER ACT) - RECOMMENDED WATER QUALITY CRITERIA - CCC FOR FRESHWATER LIFE

COMPONENT	CAS #	AMOUNT
Hydrogen Sulfide	7783-06-4	2.0 µg/L CCC

U.S. - CWA (CLEAN WATER ACT) - RECOMMENDED WATER QUALITY CRITERIA - CCC FOR SALTWATER LIFE

COMPONENT	CAS #	AMOUNT
HydrogenSulfide	7783-06-4	2.0 µg/L CCC

U.S. - CWA (CLEAN WATER ACT) - HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
Hydrogen Sulfide	7783-06-4	X
MethylCyclohexane	108-87-2	Not Listed
3- Methylhexane	589-34-4	Not Listed
Hexane, 2-methyl-	591-76-4	Not Listed
Dimethylcyclopentane	28729-52-4	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Pentane	109-66-0	Not Listed
Decane	124-18-5	Not Listed
Octane	111-65-9	Not Listed
Dodecane	112-40-3	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X
Benzene	71-43-2	X

Butane	106-97-8	Not Listed
Hexane	110-54-3	Not Listed
2-Methylpentane	107-83-5	Not Listed
3-Methylpentane	96-14-0	Not Listed
Tridecane	629-50-5	Not Listed
Undecane	1120-21-4	Not Listed
2-Methylheptane	592-27-8	Not Listed

X= The component is listed

U.S. - CWA (CLEAN WATER ACT) - HAZARDOUS SUBSTANCES

COMPONENT	CAS #	LISTED
Hydrogen Sulfide	7783-06-4	Not Listed
MethylCyclohexane	108-87-2	Not Listed
3- Methylhexane	589-34-4	Not Listed
Hexane, 2-methyl-	591-76-4	Not Listed
Dimethylcyclopentane	28729-52-4	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Pentane	109-66-0	Not Listed
Pentane	109-66-0	Not Listed
Decane	124-18-5	Not Listed
Octane	111-65-9	Not Listed
Dodecane	112-40-3	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	Not Listed
Benzene	71-43-2	X
Butane	106-97-8	Not Listed
Hexane	110-54-3	Not Listed
2-Methylpentane	107-83-5	Not Listed
3-Methylpentane	96-14-0	Not Listed

Tridecane	629-50-5	Not Listed
Undecane	1120-21-4	Not Listed
2-Methylheptane	592-27-8	Not Listed

X= The component is listed

US-STATE-RIGHT-TO-KNOW

CHEMICAL	NEW JERSEY	MASSACHUSETTS	PENNSYLVANIA	ILLINOIS	RHODE ISLAND
Nonane	X	X	X	-	X
Decane	X	-	X	-	X
Hexane	X	X	X	X	X
MethylCyclohexane	X	X	X	-	X
Octane	X	X	X	-	X
n-Heptane	X	X	X	-	X
Butane	X	X	X	-	X
Ethylbenzene	X	X	X	X	X
Toluene	X	X	X	X	X
Cyclohexane	X	X	X	-	X
Xylene, mixed isomers	X	X	X	X	X
Benzene	X	X	X	X	X

CANADA-WHMIS-CLASSIFICATIONS OF SUBSTANCES

COMPONENT	CAS #	CLASSIFICATION
2-Methylhexane	591-76-4	B2
2-Methylpentane	107-83-5	B2
3-Methylhexane	589-34-4	B2
3-Methylpentane	96-14-0	B2
Benzene	71-43-2	B2, D2A, D2B
MethylCyclohexane	108-87-2	B2
Methylcyclopentane	96-37-7	-
n-Butane	106-97-8	A, B1
n-Heptane	142-82-5	B2, D2B
n-Hexane	110-54-3	B2, D2A, D2B

n-Pentane	109-66-0	B2
n-Octane	111-65-9	B2, D2B
n-Decane	124-18-5	B3, D2B
n-Undecane	1120-21-4	B3, D2B
n-Dodecane	112-40-3	B3
n-Tridecane	629-50-5	B3
Toluene	108-88-3	B2, D2A, D2B
Hydrogen sulfide	7783-06-4	A, B1, D1A, D2B
Ethylbenzene	100-41-4	B2, D2A, D2B
Xylenes	1330-20-7	B2, D2A, D2B

X= The component is listed

CANADA - COUNCIL OF MINISTERS OF THE ENVIRONMENT - WATER QUALITY GUIDELINES FOR FRESHWATER AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	90 µg/L
Toluene	108-88-3	2.0 µg/L
Benzene	71-43-2	370 µg/L

CANADA - COUNCIL OF MINISTERS OF THE ENVIRONMENT - WATER QUALITY GUIDELINES FOR MARINE AQUATIC LIFE

COMPONENT	CAS #	AMOUNT
Ethylbenzene	100-41-4	25 µg/L
Toluene	108-88-3	215 µg/L
Benzene	71-43-2	110 µg/L

CANADA - ENVIRONMENTAL EMERGENCIES

COMPONENT	CAS #	LISTED
Hydrogen sulfide	7783-06-4	X
MethylCyclohexane	108-87-2	Not Listed
3-Methylhexane	589-34-4	Not Listed
Hexane, 2-methyl-	591-76-4	Not Listed
Dimethylcyclopentane	28729-52-4	Not Listed
Methylcyclopentane	96-37-7	Not Listed
Pentane	109-66-0	X
Decane	124-18-5	Not Listed
Octane	111-65-9	Not Listed

Dodecane	112-40-3	Not Listed
Ethylbenzene	100-41-4	X
Heptane	142-82-5	Not Listed
Toluene	108-88-3	X
Xylene	1330-20-7	X
Benzene	71-43-2	X
Butane	106-97-8	X
Hexane	110-54-3	Not Listed
2-Methylpentane	107-83-5	Not Listed
3-Methylpentane	96-14-0	Not Listed
Tridecane	629-50-5	Not Listed
Undecane	1120-21-4	Not Listed
2-Methylheptane	592-27-8	Not Listed
Petroleum Hydrocarbons	68919-39-1	Not Listed

X= The component is listed

Section 16: Other Information

NFPA

Health Hazard: 2	**Flammability:** 3	**Instability:** 1	**Physical and Chemical Hazards:** X

HMIS	**Health Hazard:** 2	**Flammability:** 4	**Instability:** 0	**Personal Protection:** X

ISSUING DATE 3/2/15

REVISION DATE 3/2/15

DISCLAIMER

- The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet (SDS). However, SDS's may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices or from any hazards inherent in the nature of the product.

Section 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name:	Western Canadian Select (WCS)
Synonyms:	Not available.
Product Use:	Chemical feedstock.
Manufacturer/Supplier:	Husky Oil Operations Ltd. PO Box 6525 Station 'D' Calgary, Alberta T2P 3G7
Phone Number:	403-298-6111
Emergency Phone:	403-262-2111
Date of Preparation:	April 15, 2013

Section 2: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

DANGER
EXTREMELY FLAMMABLE LIQUID AND VAPOR - VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. CANCER HAZARD – CAN CAUSE CANCER. IRRITATING TO EYES AND SKIN.

Colour:	Brown to black.
Physical State:	Liquid.
Odour:	Petroleum. Rotten eggs.

WHMIS	Personal Protection Equipment	TDG (Ground)
		

Potential Health Effects: See Section 11 for more information.

Likely Routes of Exposure: Eye contact. Skin contact. Inhalation. Ingestion. Skin absorption.

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. This product contains small amounts of Hydrogen sulphide that may accumulate in confined spaces. Hydrogen sulphide may cause symptoms such as digestive upset and loss of appetite, loss of sense of smell and pulmonary edema. At 500-1000 ppm Hydrogen sulphide may cause respiratory paralysis, collapse and death without rescue.

Eye: Causes eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May be fatal if swallowed and enters airways. May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Medical Conditions Aggravated By Exposure: Not available.

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Liver. Reproductive system. Nervous system.

Potential Environmental Effects: See Section 12 for more information.

This material is considered hazardous by the OSHA Hazard Communication Standard, (29 CFR 1910.1200).

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient(s)	CAS No.	% wt./wt.
Petroleum	8002-05-9	100
Benzene	71-43-2	0.1 - 1
Toluene	108-88-3	0.1 - 1
Xylenes	1330-20-7	0.1 - 1
Hydrogen sulfide (H2S)	7783-06-4	< 0.1 *

* There is a potential for hazardous hydrogen sulphide concentrations where vapours are present and allowed to accumulate.

Section 4: FIRST AID MEASURES

Inhalation: If inhaled: Call a poison center or doctor if you feel unwell. If breathing or the heart stops, trained personnel should immediately begin artificial respiration (AR) or cardiopulmonary resuscitation (CPR) respectively. Get medical attention immediately.

Eye Contact: If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Skin Contact: If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Ingestion: If swallowed: Immediately call a poison center or doctor. If vomiting occurs naturally, have victim lean forward to reduce the risk of aspiration. Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If breathing or the heart stops, trained personnel should immediately begin artificial respiration (AR) or cardiopulmonary resuscitation (CPR) respectively. Get medical attention immediately.

General Advice: In case of accident or if you feel unwell, seek medical advice immediately (show the label or MSDS where possible).

Note to Physicians: Symptoms may not appear immediately. For inhalation of Hydrogen Sulphide, consider oxygen.

Section 5: FIRE FIGHTING MEASURES

Flammability: Flammable liquid by WHMIS criteria. Class IA flammable liquid by OSHA criteria. HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks). Vapor explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard. Containers may explode when heated. Many liquids are lighter than water. When heated, this material may evolve toxic and flammable Hydrogen sulphide.

If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Fire involving Tanks or Car/Trailer Loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Means of Extinction

Suitable Extinguishing Media: Small Fire: Dry chemical, CO_2, water spray or regular foam.

Large Fire: Water spray, fog or regular foam. Move containers from fire area if you can do it without risk.

Unsuitable Extinguishing Media: Do not use straight streams. CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

Products of Combustion: Oxides of carbon. Oxides of sulphur. Aldehydes. Hazardous sulphur dioxide, and related oxides of sulphur may be generated upon combustion.

Protection of Firefighters: Inhalation or contact with material may irritate or burn skin and eyes. Fire may produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or suffocation. Runoff from fire control or dilution water may cause pollution. Hydrogen sulphide is heavier than air and may collect in low lying areas and confined spaces. Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

Explosion Data

Sensitivity to Mechanical Impact: This material is not sensitive to mechanical impact.

Sensitivity to Static Discharge: This material is sensitive to static discharge.

Section 6: ACCIDENTAL RELEASE MEASURES

Emergency Procedures:	As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded.
Personal Precautions:	Do not touch or walk through spilled material. Use personal protection recommended in Section 8. Don full-face, positive pressure, self-contained breathing apparatus.
Environmental Precautions:	Prevent entry into waterways, sewers, basements or confined areas.
Methods for Containment:	Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapors.
Methods for Clean-Up:	Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.
Other Information:	See Section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Handling:
Do not swallow. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat, sparks, open flames, and hot surfaces. – No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Do not breathe mist, vapors, or spray. Wash thoroughly after handling. Harmful concentrations of hydrogen sulfide (H2S) gas can accumulate in excavations and low-lying areas as well as the vapour space of storage and bulk transport compartments. See Section 8 for information on Personal Protective Equipment.

Storage:
Store in a well-ventilated place. Store locked up. Store away from incompatible materials. See Section 10 for information on Incompatible Materials. Keep out of the reach of children. Head spaces in storage containers may contain toxic hydrogen sulphide gas. Structural materials and lighting and ventilation systems should be corrosion resistant.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines
Component

Petroleum [CAS No. 8002-05-9]

ACGIH: A2; Exposure by all routes should be carefully controlled to levels as low as possible (2009); For Mineral oil, excluding metal working fluids; Poorly and mildly refined

OSHA: 500 ppm (TWA), 2000 mg/m³ (TWA);
400 ppm (TWA) [Vacated];

Benzene [CAS No. 71-43-2]

ACGIH: 0.5 ppm (TWA); 2.5 ppm (STEL); Skin; A1; BEI (1996)

OSHA: 1 ppm (TWA); 5 ppm (STEL);

Toluene [CAS No. 108-88-3]

ACGIH: 20 ppm (TWA); A4; BEI (2006)

OSHA: 200 ppm (TWA); 300 ppm (C); 500 ppm (Peak) (Maximum duration: 10 minutes.)
100 ppm (TWA); 150 ppm (STEL) [Vacated];

Xylenes [CAS No. 1330-20-7]

ACGIH: 100 ppm (TWA); 150 ppm (STEL); A4; BEI (1992)

OSHA: 100 ppm (TWA), 435 mg/m³ (TWA);
150 ppm (STEL) [Vacated]; For Xylenes.

Hydrogen sulphide [CAS No. 7783-06-4]

ACGIH: 1 ppm (TWA); 5 ppm (STEL); (2009); For Hydrogen sulfide

OSHA: 20 ppm (C); 50 ppm (Peak) (Maximum duration: 10 mins. once only if no other meas. exp. occurs.)
10 ppm (TWA); 15 ppm (STEL) [Vacated]; For Hydrogen sulfide.

TWA: Time-Weighted Average
STEL: Short-Term Exposure Limit
C: Ceiling

Engineering Controls: Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapour, gas, etc.) below recommended exposure limits. Use explosion-proof electrical, ventilating, and lighting equipment.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Eye/Face Protection: Wear safety glasses. Ensure that eyewash stations are close to the workstation location. Use equipment for eye protection that meets the standards referenced by OSHA regulations in 29 CFR 1910.133 for Personal Protective Equipment.

Hand Protection: Wear protective gloves. Consult manufacturer specifications for further information.

Skin and Body Protection: Wear protective clothing. Flame resistant clothing that meets the NFPA 2112 and CAN/CGSB 155.20 standards is recommended in areas where material is stored or handled.

Respiratory Protection:	If engineering controls and ventilation are not sufficient to control exposure to below the allowable limits then an appropriate NIOSH/MSHA approved air-purifying respirator with organic vapor cartridge, or self-contained breathing apparatus must be used. Supplied air breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.
General Hygiene Considerations:	Handle according to established industrial hygiene and safety practices.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Opaque.
Colour:	Brown to black.
Odour:	Petroleum. Rotten eggs.
Odour Threshold:	0.00047 ppm, (H_2S)
Physical State:	Liquid.
pH:	Not available.
Viscosity:	Not available.
Melting Point:	Not available.
Boiling Point:	10 to > 1100 °C (50 to > 2012 °F)
Flash Point:	-40 °C (-40 °F) (PMCC)
Evaporation Rate:	Not available.
Lower Flammability Limit:	Not available.
Upper Flammability Limit:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	Not available.
Specific Gravity:	Not available.
Density:	Not available.
Solubility in Water:	Insoluble.
Coefficient of Water/Oil Distribution:	Not available.
Auto-ignition Temperature:	Not available.
Percent Volatile, wt. %:	100
VOC content, wt. %:	Not available.

Section 10: STABILITY AND REACTIVITY

Stability: Stable under normal storage conditions.

Conditions of Reactivity: Contact with incompatible materials. Exposure to heat.

Incompatible Materials: Strong acids. Strong oxidizers. Chlorine.

Hazardous Decomposition Products: Hazardous sulphur dioxide, and related oxides of sulphur may be generated upon combustion.

Possibility of Hazardous Reactions: None known.

Section 11: TOXICOLOGICAL INFORMATION

EFFECTS OF ACUTE EXPOSURE

Component Toxicity

Component	CAS No.	LD_{50} oral	LD_{50} dermal	LC_{50}
Petroleum	8002-05-9	4300 mg/kg (rat)	Not available.	Not available.
Benzene	71-43-2	930 mg/kg (rat)	> 9400 µl/kg (rabbit)	10000 ppm (rat); 7H
Toluene	108-88-3	600 mg/kg (rat)	14.1 mL/kg (rabbit)	49000 mg/m³ (rat); 4H
Xylenes	1330-20-7	> 1700 mg/kg (rat)	4300 mg/kg (rabbit)	5000 ppm (rat); 4H
Hydrogen sulfide (H2S)	7783-06-4	Not available.	Not available.	444 ppm (rat); 4H

Inhalation: May cause respiratory irritation. Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Excessive inhalation may cause headache, dizziness, confusion, loss of appetite and/or loss of consciousness. This product contains small amounts of Hydrogen sulphide that may accumulate in confined spaces. Hydrogen sulphide may cause symptoms such as digestive upset and loss of appetite, loss of sense of smell and pulmonary edema. At 500-1000 ppm Hydrogen sulphide may cause respiratory paralysis, collapse and death without rescue.

Eye: Causes eye irritation. Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin: Causes skin irritation. Signs/symptoms may include localized redness, swelling, and itching.

Ingestion: May be fatal if swallowed and enters airways. May cause gastrointestinal irritation. Signs/symptoms may include abdominal pain, stomach upset, nausea, vomiting and diarrhea.

Skin Sensitization: Not available.

Respiratory Sensitization: Not available.

EFFECTS OF CHRONIC EXPOSURE

Target Organs: Skin. Eyes. Gastrointestinal tract. Respiratory system. Lungs. Blood. Cardiovascular system. Bone marrow. Liver. Kidneys. Reproductive system. Nervous system.

Chronic Effects: Prolonged or repeated contact may dry skin and cause irritation. Repeated dermal application of crude oils in rats produced systemic toxicity in blood, liver, thymus and bone marrow. Reports of chronic poisoning with Benzene, Toluene or Xylenes describe anemia, decreased blood cell count and bone marrow hypoplasia. Liver and kidney damage may occur. Repeated exposure of the eyes to high concentrations of Xylenes vapour may cause reversible eye damage. Chronic inhalation exposure to xylene causes mid-frequency hearing loss in laboratory animals. Xylene reacts synergistically with n-hexane to enhance hearing loss. Hydrogen sulphide may reduce lung function; cause neurological effects such as headaches, nausea, depression and personality changes; eye and mucous membrane irritation: damage to cardiovascular system.

Carcinogenicity: May cause cancer. Lifetime skin painting studies in animals with whole crude oils and crude oil fractions have produced tumours in animals following prolonged and repeated skin contact. Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumour composed of cells of the type normally found in the bone marrow).

Component Carcinogenicity

Component	ACGIH	IARC	NTP	OSHA	Prop 65
Petroleum	A2	Group 3	List 1	OSHA Carcinogen.	Listed.
Benzene	A1	Group 1	List 1	OSHA Carcinogen.	Listed.
Toluene	A4	Group 3	Not listed.	Not listed.	Not listed.
Xylenes	A4	Group 3	Not listed.	Not listed.	Not listed.

Mutagenicity: May cause heritable genetic damage.

Reproductive Effects: Studies exist which report a link to crude oil and reproductive effects including menstrual disorders.

Developmental Effects

Teratogenicity: Not available.

Embryotoxicity: Possible risk of harm to the unborn child. Repeated dermal application of crude oils to pregnant rats produced maternal toxicity and fetal developmental toxicity and fetal tumours. Benzene and Xylenes have caused adverse fetal effects in laboratory animals. Exposure to Toluene may affect the developing fetus.

Toxicologically Synergistic Materials: Xylene reacts synergistically with n-hexane to enhance hearing loss.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Petroleum: 21 and 41 mg/l, 96 hr., Rainbow trout;
Petroleum: 2.7 and 4.1 mg/l, 96 hr., Mysid;
Petroleum: 122 and 528 ml/kg, 96 hr., Algae.

Persistence / Degradability: Not available.

Bioaccumulation / Accumulation: Not available.

Mobility in Environment: Not available.

Section 13: DISPOSAL CONSIDERATIONS

Disposal Instructions: Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

Section 14: TRANSPORT INFORMATION

U.S. Department of Transportation (DOT)

Proper Shipping Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

Class: 3

UN Number: UN1267

Packing Group: I

Label Code:

Canada Transportation of Dangerous Goods (TDG)

Proper Shipping Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

Class: 3

UN Number: UN1267

Packing Group: I

Label Code:

Section 15: REGULATORY INFORMATION

Chemical Inventories

US (TSCA)
The components of this product are in compliance with the chemical notification requirements of TSCA.

Canada (DSL)
The components of this product are in compliance with the chemical notification requirements of the NSN Regulations under CEPA, 1999.

Federal Regulations

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

WHMIS Classification:

Class B2 - Flammable Liquids.
Class D2A - Carcinogenicity.
Class D2A - Embryotoxicity.
Class D2A - Mutagenicity.
Class D2B - Skin irritant.
Class D2B - Eye irritant.

Hazard Symbols:

United States

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SARA Title III

Component	Section 302 (EHS) TPQ (lbs.)	Section 304 EHS RQ (lbs.)	CERCLA RQ (lbs.)	Section 313	RCRA CODE	CAA 112(r) TQ (lbs.)
Benzene	Not listed.	Not listed.	10	313	U019	Not listed.
Toluene	Not listed.	Not listed.	1000	313	U220	Not listed.
Xylenes	Not listed.	Not listed.	100	313	U239	Not listed.
Hydrogen sulphide	500	100	100	313s	U135	10000

State Regulations

Massachusetts

US Massachusetts Commonwealth's Right-to-Know Law (Appendix A to 105 Code of Massachusetts Regulations Section 670.000)

Component	CAS No.	RTK List
Petroleum	8002-05-9	Listed.
Benzene	71-43-2	Listed.
Toluene	108-88-3	E
Xylenes	1330-20-7	Listed.
Hydrogen sulphide	7783-06-4	Listed.

Note: E = Extraordinarily Hazardous Substance

New Jersey

US New Jersey Worker and Community Right-to-Know Act (New Jersey Statute Annotated Section 34:5A-5)

Component	CAS No.	RTK List
Petroleum	8002-05-9	SHHS
Benzene	71-43-2	SHHS
Toluene	108-88-3	SHHS
Xylenes	1330-20-7	SHHS
Hydrogen sulphide	7783-06-4	SHHS

Note: SHHS = Special Health Hazard Substance

Pennsylvania

US Pennsylvania Worker and Community Right-to-Know Law (34 Pa. Code Chap. 301-323)

Component	CAS No.	RTK List
Petroleum	8002-05-9	Listed.
Benzene	71-43-2	ES
Toluene	108-88-3	E
Xylenes	1330-20-7	E
Hydrogen sulphide	7783-06-4	E

Note: E = Environmental Hazard; S = Special Hazardous Substance

California

California Prop 65: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Component	Type of Toxicity
Petroleum	cancer
Benzene	cancer; developmental, male
Toluene	female; developmental
Ethylbenzene	cancer

Section 16: OTHER INFORMATION

Disclaimer: The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user's responsibility to satisfy oneself as to the suitability and completeness of this information for their own particular use.

MSDS Expiry Date (Canada): April 14, 2016

Version: 1.0

MSDS Prepared by: **Deerfoot Consulting Inc.**

Phone: (403) 720-3700

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Annex 2 – Table of Contents Page

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2.0 Notifications Overview

Immediate actions are required at the onset of an emergency response to limit the extent of a release, minimize the potential hazard to human health and the environment, and implement an effective response. It is also important to act decisively to create a professional working atmosphere among Company personnel and stakeholders. This section is intended to provide guidance for determining the appropriate initial response and notification actions that should be carried out in the event of a release or other emergency incident.

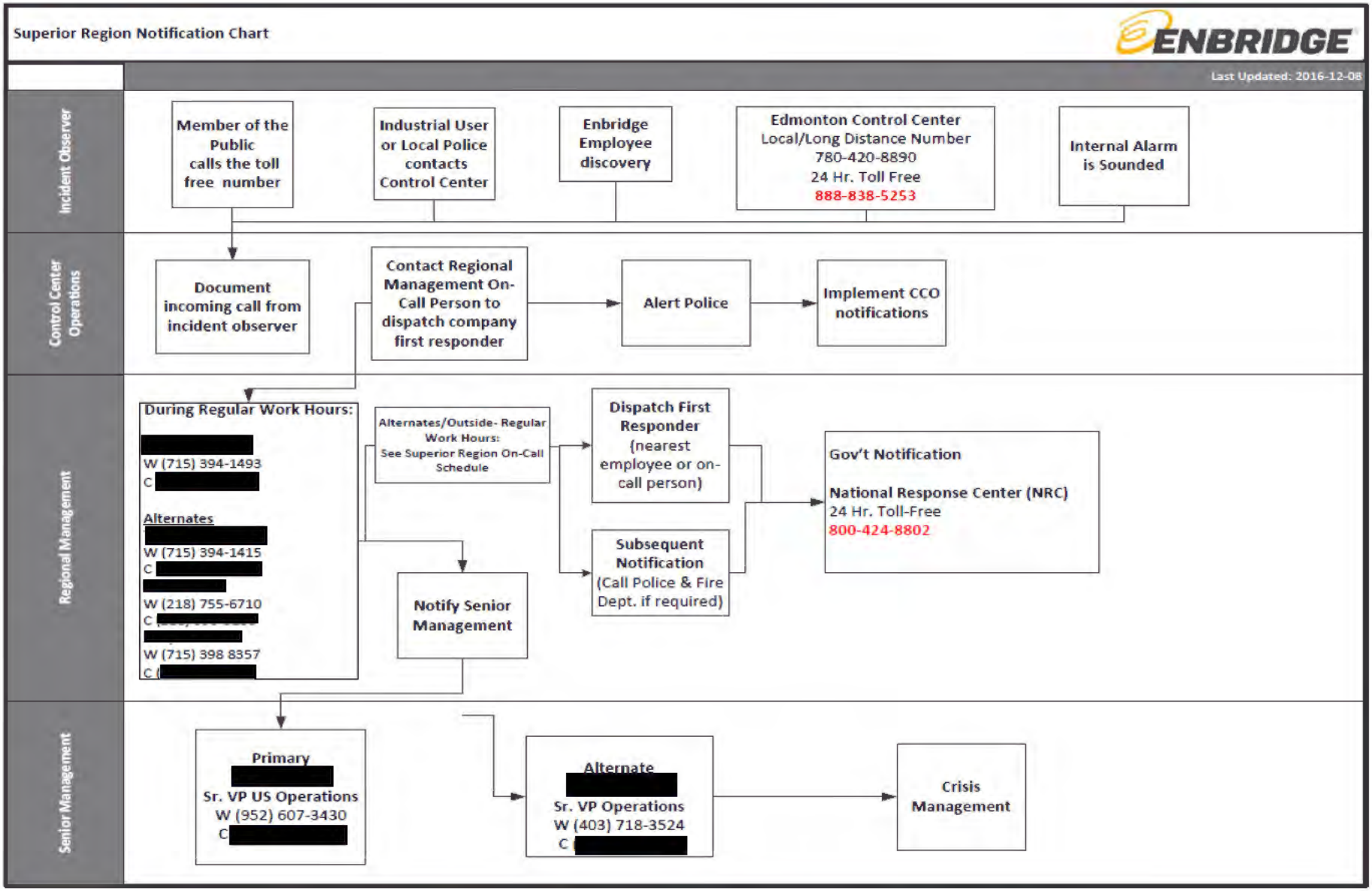
This section outlines general guidelines on the procedures and sequence for making the various internal and external notifications following discovery of a pipeline release or other emergency incident.

The internal notification procedures are essentially the same for all emergency incidents although the external notifications will vary depending on the type of incident, type and quantity of material released, and the consequences (injuries, deaths and property damage).

Company personnel have the authority and obligation to terminate any operation in response to an abnormal, threatening or hazardous situation.

2.0.1 Emergency Notification / Activation

The chart on the following page is an overview of roles personnel or groups fill upon initial discovery, from reporting the emergency to activating Emergency Response Teams to manage an emergency.


Superior Region Notification Chart
ENBRIDGE
Last Updated: 2016-12-08
Incident Observer
Member of the Public calls the toll free number
Industrial User or Local Police contacts Control Center
Enbridge Employee discovery
Edmonton Control Center
Local/Long Distance Number
780-420-8890
24 Hr. Toll Free
888-838-5253
Internal Alarm is Sounded
Control Center Operations
Document incoming call from incident observer
Contact Regional Management On-Call Person to dispatch company first responder
Alert Police
Implement CCO notifications
Regional Management
During Regular Work Hours:
[redacted]
W (715) 394-1493
C [redacted]
Alternates
[redacted]
W (715) 394-1415
C [redacted]
[redacted]
W (218) 755-6710
C [redacted]
[redacted]
W (715) 398 8357
C [redacted]
Alternates/Outside- Regular Work Hours:
See Superior Region On-Call Schedule
Dispatch First Responder (nearest employee or on-call person)
Subsequent Notification (Call Police & Fire Dept. if required)
Gov't Notification
National Response Center (NRC)
24 Hr. Toll-Free
800-424-8802
Notify Senior Management
Senior Management
Primary
[redacted]
Sr. VP US Operations
W (952) 607-3430
C [redacted]
Alternate
[redacted]
Sr. VP Operations
W (403) 718-3524
C [redacted]
Crisis Management

2.1 Emergency Responsibilities

All Personnel	
The most important thing is individual personal safety!	
✓	Always think before responding.
✓	Never rush into the scene of an incident.
✓	Always assess the situation first and know the hazards.
✓	Never perform any actions that may put your safety at risk.

Initial Response Checklist	
The first employee who responds to the scene of an emergency should take the following actions:	
✓	For emergencies reported or observed, contact the Control Center and area supervisor
✓	Upon initial discovery, employees should notify local emergency services as needed. If anyone is seriously injured, or the emergency is beyond the Response Zone's abilities, dial 911 or local emergency responder immediately. Be sure to give your name, phone number, nature of emergency, exact location, and the number of injuries
✓	If safe, take prompt action to eliminate any dangers
✓	If necessary, evacuate everyone from the danger area to a safe location
✓	Contact a spill response contractor if product has been released or discharged
✓	Promptly decide whether or not the emergency situation can be readily brought under control and if immediate action can be taken. (Always use the correct PPE)
✓	If there is a spill, deploy necessary local equipment and absorbent material and begin mitigation procedures
✓	Direct the initial phase of control, containment, and response until a supervisor arrives
✓	Regional Management (or designee) notifies the following: • Initial Company response personnel • Response resources (if not already done) • Applicable regulatory agencies.

2.2 Incident Reporting

Utilize the General Incident Report Form, in *Section 4* - Forms of the ICP Core Plan, to log all pertinent information relative to the Superior Response Zone incident response. When filling out this form, try to complete as much information as possible. Additional incident reporting guidance is located in the General Compliance Reference Manual located on the Company website.

A list of emergency contact information detailing required internal notifications and external agency contacts is located in this section. The following summarizes who should be contacted in an emergency.

2.2.1 Required Notifications

- The Enbridge Control Center
- Regional Management
- Regulatory Agencies.

2.2.2 Incident Management Team

The Region has designated personnel that will be activated based on the needs of the incident response to fill command and general staff roles in the Incident Command System.

2.2.3 External Agencies and Support Resources

After the initial situational assessment and regulatory reporting are completed, call external agencies for support. Refer to Emergency Contact List in this Annex.

2.2.3a Emergency Contact Information

EDMONTON CONTROL CENTER			
24-Hour Toll Free	800-858-5253		
Local / Long Distance	780-420-5221		
ENBRIDGE MEDIA HOTLINE			
United States	877-496-8142		
Canada	888-992-0997		
ENBRIDGE QUALIFIED INDIVIDUALS			
Director, Superior Region Ops Svcs (QI)	[redacted]	715-394-1493	[redacted]
Manager, Regional Services	[redacted]	715-394-1415	[redacted]
Manager, Bemidji Operations	[redacted]	218-755-6711	[redacted]
Manger, Superior Area Ops	[redacted]	715-398-8357	[redacted]
OIL SPILL RESPONSE ORGANIZATIONS (OSRO)			
OSRO of Record			
Marine Pollution Control Corp. (MPC) - (Superior)		24 Hr. 313-849-2333	
T & T Marine Salvage, Inc. (Superior-Great Lakes)		24 Hr. 713-534-0700	
Additional OSROs			
1. Clean Harbors (Great Lakes/Superior)		24 Hr. 800-645-8265	
2. Clean Harbors (North Dakota)		24 Hr. 800-645-8265	
3. Future Environmental (MidContinent)		24 Hr. 866-579-6900	
4. HazMat Response, Inc. (MidContinent)		24 Hr. 800-229-5252	
5. ACME Environmental (MidContinent)		24 Hr. 855-563-2666	
6. Environmental Restoration, LLC (MidContinent)		24 Hr. 888-814-7477	

2.2.3b Incident Management Team

ICS Position	Normal Job Title	Name	Office Number	Alt. Number
Command Staff				
Incident Commander (IC)	Director Superior Region	[redacted]	715-394-1493	[redacted]
Alternate IC	Manager Regional Services		715-394-1415	
Alternate IC	Manager, Bemidji Area Operations		218-755-6710	
Liaison Officer (LOFR)	Compliance Advisor		715-398-4779	
Alternate LOFR	Project Coordinator		715-394-1585	
Alternate LOFR	Supervisor, Superior Terminal		715-398-8327	
Public Information Officer (PIO)	Sr. Community Engagement Advisor		218-464-5722	
Alternate PIO	Community Engagement Advisor		715-394-1825	
***On call Crisis Management Team**				
Safety Officer (SOFR)	Regional Safety Advisor	[redacted]	715-398-8368	[redacted]
Alternate SOFR	Regional Safety Advisor		608-756-0071	
Alternate SOFR	Sr. Safety Advisor		715-395-3604	
ICS Technical Specialist	ER & Security Coordinator		715-394-0727	
Operations Section				
Operations Section Chief (OSC)	Manager, PLM	[redacted]	218-755-6723	[redacted]
Alternate OSC	Supervisor, Clearbrook		218-776-6101	
Alternate OSC	Supervisor, Pipeline Services		715-398-8348	
Staging Area Manager (STAM)	Supervisor, Pipeline Services		218-755-6729	
Alternate STAM	PLM Coordinator		218-681-7195	
Alternate STAM	Technical Services Coordinator		715-398-5326	
Planning Section				
Planning Section Chief	Engineering Specialist	[redacted]	715-398-4737	[redacted]
Alternate PSC	Sr. Region Engineer		715-398-4703	
Alternate PSC	Technical Supervisor		715-718-5310	
Situation Unit Leader (SITL)	Operations Project Coordinator		715-398-4744	
Alternate SITL	Technical Supervisor		715-398-8363	
Alternate SITL	Outage Coordinator		715-394-0706	
Environmental Unit	Environmental Analyst		715-398-4795	
Alternate ENVL	Environmental Advisor		715-394-0709	
Alternate ENVL	Supervisor, Regional Support		715-398-4751	
Documentation Unit Leader (DOCL)	Admin Assistant III		715-398-4630	
Alternate DOCL	Admin Assistant		715-394-1548	
Alternate DOCL	Admin Assistant		715-718-5319	

Resource Unit Leader	PLM Coordinator	[redacted]	715-398-8344	[redacted]
Alternate RESL	PLM Coordinator		715-398-8377	
Alternate RESL	PLM Project Coordinator		218-755-6715	
Logistics Section				
Logistics Section Chief (LSC)	Terminal Coordinator Gauger	[redacted]	715-398-8364	[redacted]
Alternate LSC	Technical Supervisor		218-681-1817	
Alternate LSC	Supervisor, Technical Services		218-623-7621	
Finance Section				
Finance Section Chief	Regional Accountant	[redacted]	952-607-3444	[redacted]
Alternate FSC	Business System Coordinator	[redacted]	715-398-8326	
On Call Supply Chain Management Team				

2.2.3c Emergency Services

EMERGENCY SERVICES							
County/City/ Station	Sheriff Call 911	Police Call 911	Fire Call 911	DEM	Ambulance Call 911	Hospital Call 911	Highway Patrol/ State Police
NORTH DAKOTA							
THIEF RIVER FALLS AREA - L1-4 & 67 MP773.72 to 896.0							
Gretna, Manitoba, CA		204-945-5555	204-945-5555	204-945-5555	204-945-5555	204-945-5555	*
Pembina- Neche	701-265-4122		Neche 701-886-7422 Pembina 701-825-6625		701-265-8259		
Pembina- Cavalier, Joliette Station	701-265-4122		Cavalier 701-265-4342 Drayton 701-454-3599	701-265-4849	701-265-8259	Neche 701-265-8461 Grand Forks 701-780-5000	701-795-3832
MINNESOTA							
Kittson- Hallock, Joliette Station	218-843-3535		Hallock 218-843-3535 Kennedy 218-674-4485	218-843-2113	218-843-3535	218-843-3612	218-681-0943
Marshall- Warren, Viking Station	218-745-5411		Argyle 218-478-3314 Warren 218-745-5411 Newfolden 218-874-7135	218-745-5841	218-478-3314	Warren 218-745-4211 Thief River Falls 218-681-4240	218-681-0943
Pennington- Thief River Falls,	218-681-	218-681-6161	218-681-3943	218-681-6161	218-681-4084	218-681-4240	218-681-0943
Pennington- St. Hilaire			218-964-5280				218-681-0943
Polk- Crookston	218-281-			218-281-0437			
Red Lake- Plummer, Plummer Station	218-253-2996		Plummer 218-465-4231 Red Lake Falls 218-253-2105 Oklee 218-796-5788	218-253-2996	Red Lake Falls 218-253-2996 Thief River Falls 218-681-4240	218-681-4240	218-681-0943
Clearwater- Clearbrook, Clearbrook Terminal	218-694-6226	218-776-3490	Clearbrook 218-776-3335 Shevlin 218-785-2101 Bagley 218-694-2686 Gonvick 218-487-5770	218-694-6226	218-694-6226	218-694-6501	218-681-0943

County/City/ Station	Sheriff Call 911	Police Call 911	Fire Call 911	DEM	Ambulance Call 911	Hospital Call 911	Highway Patrol/ State Police
MINNESOTA cont.							
Beltrami- Bemidji, Wilton Station, Bemidji PLM	218-333-9111	218-333-9111	Bemidji 218-751-8001 Shevlin 218-243-2175 Solway 218-467-3350	218-333-8320	218-444-3328	218-751-5430	218-681-0943
Hubbard- Park Rapids	218-732-3331			218-732-2588			218-828-2230
BEMIDJI AREA – L1-4 & 67 MP 896.0 to 1032							
Cass- Cass Lake, N. & S. Cass Lake Stations	218-547-1424	218-335-2351 Tribal 218-335-8277 888-622-9225	218-335-6195	218-547-1424	218-335-6363	218-751-5430	218-828-2230
Itasca- Deer River, Deer River Station	218-326-3477	218-246-2525	Grand Rapids 218-326-7639 Deer River 218-246-8261 Cohasset 218-328-5723	218-327-4496	218-326-3477	Deer River 218-246-2900 Grand Rapids 218-326-3401	218-749-7720
Itasca- Grand Rapids, Blackberry Station	218-326-3477		Grand Rapids 218-326-7639 Warba 218-492-1445 Goodland 218-492-1420	218-327-4496	218-326-3477	218-326-3401	218-749-7720
Aitkin- Jacobson	218-927-7435		218-752-6631	218-927-7435			218-749-7720
SUPERIOR AREA - L1-4 & 67 MP 1032 to 1096.95							
Itasca- Warba	218-326-3477		218-492-1445	218-327-4496	218-326-3477	218-326-3401	218-749-7720
Aitkin- Aitkin	218-927-7435			218-927-7435			218-749-7720
SUPERIOR AREA - L1-4 & 67 MP 1032 to 1096.95							
St. Louis- Floodwood, Floodwood Station	218-726-2340	218-476-2239	218-476-2238	218-625-3960	218-476-2238	Grand Rapids 218-326-3401 Duluth 218-786-4020	218-723-4885
St. Louis- Floodwood, Gowan Station	218-726-2340	218-476-2239	218-476-2238	218-625-3960	218-476-2238	218-786-4020	218-723-4885
St. Louis- Brookston			218-879-6916				
St. Louis- Duluth	218-726-2340	218-730-5400 USCG 218-720-5286	218-730-4390	218-625-3960	218-722-0807	218-786-4020 218-249-5555	218-723-4885

County/City/ Station	Sheriff Call 911	Police Call 911	Fire Call 911	DEM	Ambulance Call 911	Hospital Call 911	Highway Patrol/ State Police
SUPERIOR AREA - L1-4 & 67 MP 1032 to 1096.95 cont.							
Carlton- Cloquet	218-384-3236	218-879-1247	Cloquet 218-879-6514 Culver Twp 218-879-5053	218-384-9141	218-384-4158	218-879-4641	218-723-4885
Carlton- Carlton	218-384-3236		218-384-4158	218-384-9141	218-384-4158	218-879-4641	218-723-4885
Carlton- Wrenshall	218-384-3236		218-384-4670	218-384-9141	218-384-4158	218-879-4641	218-723-4885
WISCONSIN							
Douglas- Superior, Terminal & PLM	715-395-1371	715-395-7234	715-394-0227	715-395-1391	715-722-0807	715-817-7000	715-635-2141
SUPERIOR AREA - L-5 MP 0 to 1137.3							
Bayfield	715-373-6120		Maple 715-363-2520 Iron River 715-372-4394	715-373-6113	715-372-4394	715-685-5500	715-635-2141
SUPERIOR AREA - SUPERIOR TERMINAL L-6A & L-14 MP 0 to MP 97.23							
Douglas- Superior, Superior Terminal & PLM	715-395-1371	715-395-7234	715-394-0227	715-395-1391	715-394-4432	715-817-7000	715-635-2141
Douglas- Solon Springs, Hawthorne Station	715-395-1371		715-378-4111	715-395-1391	Gordon,WI 715-394-4432 Superior,WI 715-376-2640	715-817-7000	715-635-2141
Washburn- Minong, Minong Station	715-468-4720	715-466-2266	Minong 715-466-2324 Gordon 715-376-2221	715-468-4730	Minong 715-466-2324 Spooner 715-635-6179	Hayward 715-934-4321 Spooner 715-635-2111	715-635-2141
SUPERIOR AREA - L-6A & L-14 & I-61 MP 0 to MP 112.5							
Sawyer- Stone Lake, Stone Lake Station	715-634-4858		Stone Lake 715-865-2616 Hayward 715-634-1311 LCO 715-634-9800	715-634-5213	715-634-4322	715-934-4321	715-635-2141
Sawyer- Stone Lake, Edgewater Station	715-634-4858		Stone Lake 715-865-2616 Hayward 715-634-1311 LCO 715-634-9800	715-634-5213	715-634-4322	715-934-4321	715-635-2141

County/City/ Station	Sheriff Call 911	Police Call 911	Fire Call 911	DEM	Ambulance Call 911	Hospital Call 911	Highway Patrol/ State Police
WISCONSIN cont.							
SUPERIOR AREA - L-6A & L-14 & I-61 MP 0 to MP 112.5 cont.							
Rusk- Ladysmith	715-532-2189	715-532-2186	715-532-2186	715-532-2121	715-532-2121	715-532-5561	715-635-2141
L-6A & L-14 & I-61 MP 112.5 to MP 115							
Chippewa- Chippewa Falls	715-726-7701	715-723-4424	715-723-5710	715-723-1811	715-726-7728	715-723-5710	715-839-3800
L-6A & L-14 & I-61 MP 115 to MP 135							
Taylor-Medford	715-748-2200	715-748-1447	715-748-4321	715-748-8100	715-748-2200	715-748-1447	715-845-1143
Taylor-Gilman	715-748-2200	715-447-5700	715-447-8775	715-644-5571	715-748-2200	715-447-5700	715-839-3800
Taylor-Lublin/Gilman	715-748-2200	715-447-5700	715-669-7150	715-644-5571	715-748-2200	715-447-5700	715-839-3800
L-6A & L-14 & I-61 MP 135 to MP 162							
Clark-Nellsville	715-743-3157	715-743-3122	715-743-2651	715-743-3101	715-743-5100	715-743-3122	715-839-3800
Clark-Owen	715-743-3157	715-229-2161	715-229-2652	715-743-3101	715-743-5100	715-229-2161	715-839-3800
L-6A & L-14 & I-61 MP 162 to MP 167							
Marathon-Wausau	715-261-1200	715-261-7800	715-261-7900	715-847-2121	715-261-1222	715-261-7800	715-845-1143
Marathon-Spencer	715-261-1200	715-659-5453	715-659-4030	715-387-1713	715-261-1222	715-659-5453	715-845-1143
Marathon- Marshfield	715-421-8700	715-387-4394	715-486-2094	715-421-8500	715-387-4394	715-387-7113	715-845-1143
L-6A & L-14 & I-61 MP 167 to MP 205							
Wood-Vesper/Pittsville	715-421-8700	715-884-2100	715-569-4600	715-421-8500	715-886-7892	715-423-6060	715-845-1143
Wood-Wisconsin Rapids	715-421-8700	715-423-4444	715-423-6860	715-421-8500	715-423-4444	715-423-6060	715-845-1143
Wood-Port Edwards	715-421-8700	715-887-3030	715-886-7893	715-421-8500	715-887-3030	715-423-6060	715-845-1143
Wood-Nekoosa/Port Edwards	715-421-8700	715-887-3030	715-886-7893	715-421-8500	715-887-3030	715-423-6060	715-845-1143
L-6A & L-14 & I-61 MP 205 to MP 236							
Adams-Friendship/ Adams/ Grand Marsh	608-339-3304	608-339-6839	Friendship 608-564-7754 Adams 608-339-3011 Grand Marsh 608-339-6100	608-339-4248	715-886-7892	608-339-3331	715-845-1143
L-6A & L-14 & I-61 MP 236 to MP 252							
Marquette-Montellow	608-297-2115	608-297-2345	608-297-9237	608-297-3022	608-429-9089	608-339-3331	715-845-1143
Marquette- Westfield	608-297-2115	608-296-2883	608-296-2883	608-297-3022	608-296-4210	608-339-3331	715-845-1143
Marquette-Oxford/ Endeavor	608-297-2115	608-587-2486	Oxford 608-586-5882 Endeavor 608-587-2790	608-297-3022	Oxford 608-296-4210 Endeavor 608-429-9089	608-742-4131	715-845-1143
L-6A & L-14 & I-61 MP 252 to MP 283							
Columbia- Portage/ Wycocena	608-742-4166	608-742-2174	Portage 608-742-2172 Wycocena 608-429-3393	608-742-4166	608-429-9089	608-742-4131	608-846-8500

County/City/ Station	Sheriff Call 911	Police Call 911	Fire Call 911	DEM	Ambulance Call 911	Hospital Call 911	Highway Patrol/ State Police
L-6A & L-14 & I-61 MP 252 to MP 283 cont.							
Columbia- Rio	608-742-4166	920-992-3546	920-992-5655	608-742-4166	920-992-5605	608-742-4131	608-846-8500
Columbia- Pardeeville	608-742-4166	608-429-2188	608-429-2282	608-742-4166	608-429-9089	608-742-4131	608-846-8500
Columbia-Columbus	608-742-4166	920-623-5919	920-623-5914	608-742-4166	920-623-5919	920-623-2200	608-846-8500
L-6A & L-14 & I-61 MP 283 to MP 295							
Dane- Marshall	608-284-6800	608-655-3533	608-655-3322	608-266-4330	920-623-2200	920-623-2200	608-846-8500
Dane- Madison	608-284-6800	608-255-2345	608-266-4420	608-266-4330	608-255-2345	608-251-6100 608-263-6400	608-846-8500
Dane- Cambridge	608-284-6800	608-423-4328	608-423-3511	608-266-4330	608-423-4328	920-568-5000	608-846-8500
Jefferson- Waterloo	920-674-7344 800-675-7310	920-478-2343	920-478-2535	920-674-7450	920-350-0190	920-623-2200	608-846-8500
Jefferson- Lake Mills	920-674-7344 800-675-7310	920-648-2354	920-648-5117	920-674-7450	920-261-3610	920-648-4518	608-846-8500
Jefferson- Fort Atkinson	920-674-7344 800-675-7310	920-563-7777	920-563-7795	920-674-7450	920-691-0060	920-568-5000	608-846-8500
L-6A & L-14 & I-61 MP 295 to MP 348							
Rock - Janesville	608-757-8000	608-755-3088	608-755-3050	608-758-8440	608-563-4336	608-756-6868	608-846-8500
Rock - Beloit	608-757-8000	608-364-6800	608-364-2900	608-758-8440		608-364-5011	608-846-8500
IRONWOOD AREA - L-5 MP 1137.3 to 1318.54							
Bayfield- Iron River, Ino Station	715-373-6120		715-373-6120	715-373-6113	715-373-6120	715-685-5500	715-635-2141 or 715-635-7725 (ER)
Ashland- Ashland	715-685-7640	715-682-7062	715-682-7052	715-685-7640 X456	715-682-7052	715-685-5500	715-635-2141 or 715-635-7725 (ER)
Ashland- Odanah		715-682-7023	715-682-7155	715-682-7111	715-682-7052	715-685-5500	715-635-2141 or 715-635-7725 (ER)
Iron- Saxon, Saxon Station	715-561-3800		715-561-2121	715-561-3266	715-561-4444	715-685-5500	715-635-2141 or 715-635-7725 (ER)

2.2.3d Government Notifications

ENBRIDGE ENERGY

GOVERNMENT CONTACTS		
See Annex 6.5.5 Notification Tab for reporting criteria.		
NATIONAL WEATHER SERVICE-	www.weather.gov	
(Duluth,MN)	**(24 hr)**	218-729-6697
FEDERAL		
NATIONAL RESPONSE CENTER (NRC)	**(24 hr)**	**800-424-8802**
(in Washington DC)		202-267-2675
Army Corps of Engineers		"
Environmental Protection Agency – Region 5-Chicago Branch		800-621-8431
Transportation Security Administration (TSA)		866-289-9673
U. S. Department of Homeland Security (U.S Coast Guard)		410-576-2525
U.S. Fish & Wildlife		800-344-9459
U.S. Forest Service		800-832-1355
NOAA-National Oceanic & Atmospheric Admin		206-526-6317
PHMSA- Central Region (ND/MN) - [redacted]	Office:	816-214-3027
	Cell:	[redacted]
PHMSA- Central Region (ND/MN) - [redacted]	Office:	816-329-3827
	Cell:	[redacted]
OSHA - 877-470-6742		
OSHA (Federal) Eau Claire,WI		715-832-9019
OSHA (Federal) Milwaukee,WI		414-297-3315
OSHA – Chicago, IL- Regional Administrator - [redacted]		312-353-2220
OSHA – Madison, WI		608-441-5388
OSHA – Appleton,WI		920-734-4521
OSHA – (Federal) Lansing, MI		517-487-4996
MIOSHA Hotline (in case of fatality or catastrophic injuries)		800-858-0397
OSHA - St. Paul, MN		651-284-5050
OSHA – Madison, WI		608-441-5388
UNITED STATES COAST GUARD		
USCG –Milwaukee, WI Sector Command		414-747-7182
USCG – Great Lakes- 9th District (MN, IL, IN, MI, NY)		800-321-4400
USCG – Duluth, MN		218-720-5286
STATES		
Minnesota		
State Duty Officer – Division of Emergency Management	(24 hr)	800-422-0798
State Duty Officer (out of state)		651-649-5451
MN Department of Health, Northwest Region, Public Health Preparedness Consultant	(24 hr)	218-308-2146
MN Department of Health, Northeast Region, Public Health Preparedness Consultant	(24 hr)	218-340-0543
Duluth Port Captain – Lake Superior - Press 1 after hrs.		218-720-5286
Minnesota Pollution Control Agency (MPCA)		800-657-3864
Switchboard		651-296-6300
Spills Unit St. Paul		651-649-5451
Duluth Branch		218-723-4660
Detroit Lakes Office		218-847-1519

Brainerd Office		218-828-2492
Carlton County Public Health		218-879-4511 or 888-818-4511
St. Louis County Public Health		218-726-2450
North Dakota		
North Dakota Dep.t of Health – Div. of ER Mgmt. Section Chief	(Out of State)	701-328-2270
State-Wide Sheriff Depts.	(In State-24 hr)	800-472-2121
U.S. EPA Region VIII Office (Denver)		800-227-8917 or 303-312-6312
U.S. EPA Region V Office (Chicago)		800-621-8431 or 312-353-2000
Upper Souris Nat'l. Wildlife Refuge		701-468-5467
Grand Forks Public Works		701-738-8746
North Dakota Industrial Commission- NDIC-Oil & Gas Div.		701-328-8020
Division of Environmental Engineering (burn permits)		701-328-5188
Army Corps of Engineers		701-255-0015
Wisconsin		
Wisconsin Division of Emergency Management-Madison		608-242-3232
Wisconsin DNR- Emergency Spill Hotline	(24 hr)	800-943-0003
	Office:	608-267-7454
NATIONAL FORESTS		
Chequamegon-Rhinelander, WI	Daytime:	715-362-1300
After Hrs.: Dispatcher	Dispatch :	715-358-6863
	Cell:	[redacted]
Chippewa-Cass Lake, MN	Daytime:	218-335-8600
After Hours: Same (answering machine)		
ONE-CALL NOTIFICATION AGENCIES		
Nationwide One-Call Number - 811		
Minnesota	(In State)	800-252-1166
"Gopher State One-Call"		651-454-0002
North Dakota		800-795-0555
"One Call"		701-610-1057
Wisconsin		800-242-8511
"Diggers Hotline"		262-785-5300

2.2.3e State and Local Planning Committee Contacts

SERC	Address	City	State	Zip Code	Name	Phone	Verified
STATE EMERGENCY RESPONSE COMMISSION (SERC)							
Minnesota-Minnesota Homeland Security & Emergency Management	445 Minnesota St. Ste. 223	St. Paul	MN	55101-6223	[redacted]	651-201-7408	7/15/2016
North Dakota-Haz-Chem Program-ND Dept. of Emergency Services	Fraine Barracks Lane Bld. 35 PO Box 5511	Bismarck	ND	58504		701-328-8100 701-328-8112	7/15/2016
North Dakota-Haz-Chem Program for ND Dept. of Emergency Services	Fraine Barracks Lane Bld. 35 PO Box 5511	Bismarck	ND	58504		701-328-8216 701-328-9921	7/15/2016
Wisconsin-Wisconsin Emergency Management	2400 Wright St., Rm 213 PO Box 7865	Madison	WI	53704		608-242-3210	7/15/2016
LOCAL EMERGENCY PLANNING COMMITTEES							
WISCONSIN LEPC							
Adams	400 Main St. PO Box 144	Friendship	WI	43934	[redacted] (EM/LEPC)	608-339-4248	8/16/2016
Chippewa	PO Box 67	Chippewa Falls	WI	54729	[redacted], Chairman (LEPC)	715-723-3085	8/16/2016
Chippewa	32 East Spruce St	Chippewa Falls	WI	54729	[redacted] (EM/LEPC)	715-726-7728	8/16/2016
Clark	517 Court St. Courthouse Rm 306	Neillsville	WI	54456	[redacted] Director (EM)	715-743-5100 715-429-0669	8/16/2016
Columbia	711 E.Cook St.	Portage	WI	53901	[redacted] Dep. Director (EM/LEPC)	608-742-4166 X1308	8/16/2016
					[redacted], Director (EM/LEPC)	608-742-4166 X1309	8/16/2016
Dane	115 W. Doty St. Rm 2107	Madison	WI	53703	[redacted], Coordinator (EM/LEPC)	608-267-1591	8/16/2016
Jefferson	411 S. Center Ave.	Jefferson	WI	53549	[redacted] (EM/LEPC)	920-674-7450	8/16/2016
Marathon	500 Forest	Wausau	WI	54403	[redacted] (EM)	715-261-1229	8/16/2016
Marquette	PO Box 129	Montello	WI	53949	[redacted] (EM/LEPC)	608-297-3022	8/16/2016
Rock	3530 N. Cty Trk F PO Box 920	Janesville	WI	53547	[redacted] (EM/LEPC)	608-758-8440	8/16/2016
Rusk	311 Miner Ave. E.	Ladysmith	WI	54848	[redacted], EMS	715-532-2121	7/16/2016
Taylor	224 S. Second St.	Medford	WI	54451	[redacted] (EM/LEPC)	715-748-3503 715-748-3813	8/16/2016
Walworth	1770 Cnty Rd. NN PO Box 1004	Elkhorn	WI	53121	[redacted] (EM/LEPC)	262-741-4616	8/16/2016
Wood	400 Market St. PO Box 8095	Wisconsin Rapids	WI	54495	[redacted] (EM/LEPC)	715-421-8500	8/16/2016
Iron	300 Taconite St.	Hurley	WI	54534	[redacted], EMS	715-561-3266	7/16/2016

SERC	Address	City	State	Zip Code	Name	Phone	Verified
WISCONSIN LEPC cont.							
Douglas	1316 N. 14th St. Ste. 10	Superior	WI	54880-1674	[redacted]	715-395-1391	7/16/2016
Bayfield	117 E Sixth St. PO Box 423	Washburn	WI	54891		715-373-6113	7/16/2016
Ashland	220 6th St. E.	Ashland	WI	54806		715-685-7640 X456	7/16/2016
Sawyer	10610 Main St. Ste 89	Hayward	WI	54843	[redacted], Director EMS	715-634-2004	7/16/2016
Washburn	PO Box 429 421 Hwy. 63	Shell Lake	WI	54871	[redacted]	715-468-4730	7/16/2016
MINNESOTA LEPC							
Region 2 LEPC	402 SE 11th St.	Grand Rapids	MN	55744	[redacted] Coordinator	218-259-2221	7/16/2016
St. Louis	2030 N Arlington Ave N	Duluth	MN	55803	[redacted] Coordinator	218-625-3960 218-336-4341	7/16/2016
					[redacted] Director	218-336-4340	7/16/2016
St. Louis	100 N 5th Ave W Room 103	Duluth	MN	55802	[redacted] Sheriff	218-625-2341	7/16/2016
Carlton	317 Walnut Ave PO Box 530	Carlton	MN	55718	[redacted]	218-384-9518	7/16/2016
Itasca	440 First Ave NE	Grand Rapids	MN	55744	[redacted] Coordinator	218-326-3477	7/16/2016
Aitkin	217 Second St NW Ste. 185	Aitkin	MN	56431	[redacted]	218-927-7420	7/16/2016
					[redacted]	218-927-7436	7/16/2016
Cass	300 Minnesota Ave PO Box 1119	Walker	MN	56484	[redacted]	218-547-7437	7/16/2016
Region 3 LEPC	12337 152nd St.	Park Rapids	MN	56470	[redacted]	[redacted] (cell)	7/16/2016
Region 3 RRC		Warren	MN		[redacted] Chair	218-201-0098 218-745-4211	7/16/2016
Kittson	410 South 5th, Suite 104 PO Box 504	Hallock	MN	56728	[redacted]	218-843-2113	7/16/2016
Marshall	208 E. Colvin, Courthouse Ste. 5	Warren	MN	56762	[redacted] Director	218-745-5841	7/16/2016
Pennington	101 Main Ave N	Thief River Falls	MN	56701	[redacted]	218-683-7087	7/16/2016
Red Lake	124 Main Ave N PO Box 306	Red Lake Falls	MN	56750	[redacted]	218-253-2996	7/16/2016
Polk	600 Bruce St PO Box 416	Crookston	MN	56716	[redacted] Director	218-470-8263	7/16/2016
Clearwater	213 Main Ave N Dept. 102	Bagley	MN	56621	[redacted]	218-694-6226	7/16/2016
Beltrami	613 Minnesota Ave NW	Bemidji	MN	56601	[redacted]	218-333-8386	7/16/2016
Hubbard	301 Court Ave	Park Rapids	MN	56470	[redacted]	218-732-2588 218-732-2502	7/16/2016
NORTH DAKOTA LEPC							
Pembina	301 Dakota St. W. #8	Cavalier	ND	58220	[redacted]	701-265-4849	7/16/2016

2.2.3f Enbridge (U.S.) – Required Leak Notifications

In the event of a release on our pipeline system or at our facilities, the following shall serve as a guide for initial notification/reporting required within the first 24-hours, or sooner where noted. ***As Federal, State and internal criteria all differ, each box must be independently reviewed to ensure all notifications are made.***

EMERGENCY NOTIFICATION RESPONSIBILITIES

PERSONNEL	FUNCTION	INFORMATION SOURCE	RESPONSIBILITIES
ENBRIDGE EMPLOYEE	Communicates possible emergency.	Public notification or observed incident.	- **RECORDS** information on the Receiving Emergency Information Form. - **GIVES** caller precautions and instructions (found after the Receiving Emergency Information Form), as required. - **ALERTS** pipeline control centre - **TAKES** appropriate field action.
REGIONAL MANAGEMENT	Co-ordinates verification, Management Communication, and field response activities.	Control Center Operations	- **RECORDS** information on log. - **ENSURES** First Responder has been dispatched to verify report. Stresses safety precautions. - **ENSURES** Emergency Response (Police) have been notified. Provides same with updated information and confirms whether assistance is needed. - **CONFIRMS** whether Enbridge or Public personnel require evacuation. - **ENSURES** that the appropriate Supervisor, PLM Services/Crew have been alerted. - **PROCEEDS** to Regional Office or command post. - **CALLS** Vice-President, Operations or designate. - **MAINTAINS** contact with verifier and Control Centre. - **MAKES** a decision when it is safe to consider the emergency in control and authorize action (re-start line, re-call verifiers, etc.) - **COORDINATES** additional verification efforts as necessary. - **INVOKES** the Emergency Response Plan. - **ALERTS** other pipeline companies if/when required. - **NOTIFIES** appropriate Government agencies (including the TSB/DOT), as required. - **COMPLETES** Release Alert.

INTERNAL COMPANY NOTIFICATIONS

INITIATE THE NOTIFICATION PROCESS

Procedure: If an Enbridge employee outside of the control center is the first person to discover or receive the initial call on a release, they need make only one call that serves to secure a line shutdown, initiate a response and initiate proper internal notification.

CONDITION	WHO TO NOTIFY
1. A release of any quantity requiring an operating change/shutdown, or 2. An outside caller reports a suspected or confirmed leak	Contact: Edmonton Control Center immediately Liquids (U.S.) 800-858-5253 Alternate Number: 780-420-5221 Contact: Notify Regional On-Call Manager Regional On-Call Manager will notify Qualified Individual
1. A leak or spill of crude oil or hazardous substance occurs that does not require an operating change/shutdown but meets one of the following criteria: - Any NGL/natural gas leak - Any release/spill/contamination meeting state or federal notification requirement (see DOT-REGULATEDPIPELINE RELATED SPILLS: EXTERNAL NOTIFICATIONS section)	Contact: Notify Regional On-Call Manager Regional On-Call Manager will notify Qualified Individual

CONTROL CENTER ACTION AND NOTIFICATIONS

Procedure: If Control Center receives notification or observe operating conditions where a leak is suspected, line operation is terminated and the Control Center initiates and/or continues the notification process by alerting the Qualified Individual or on-call designee. In addition, local law enforcement is notified and assistance requested, if necessary.

CONDITION	WHO TO NOTIFY
1. An Enbridge or outside caller reports a suspected or confirmed release, or 2. An alarm condition necessitates a line shutdown, or 3. The line is shutdown under the 10 minute rule as a result of abnormal operating conditions.	Complete: Receiving Emergency Information Form Contact: Qualified Individual; Local Law Enforcement; Other Control Centers; Field verifier if authorized by Qualified Individual; and Consider contacting fire/other public officials (emergency management).

QUALIFIED INDIVIDUAL (OR DESIGNEE) - CRITERIA FOR INTERNAL NOTIFICATIONS/REPORTING

Procedure: Upon receiving notification of a suspected or confirmed release, the Qualified Individual is responsible for verifying and/or initiating a response. Depending upon the specifics of a confirmed release or spill, further internal notifications must be made including a Release Alert. Required external notifications and criteria must also be viewed (see DOT-REGULATEDPIPELINE RELATED SPILLS: EXTERNAL NOTIFICATIONS section) and reported accordingly.

CONDITION	WHO TO NOTIFY
1. Report of a suspected release or spill, or 2. Control Center reports an alarm condition and line shutdown, or 3. The line is shutdown under the 10 minute rule as a result of abnormal operating conditions	Contact: Nearest verifier Alert: Crews for possible mobilization Consider contacting fire/other public officials (emergency management)
1. A release of any quantity requiring an operating change or shutdown	Mobilize: Crews and contractors as necessary Ensure: Line is shutdown and prior communications are complete Alert: Enbridge Management Complete: Release Alert
1. A release or spill of crude oil or hazardous substance occurs that does not require an operating change/shutdown but meets one of the following criteria: Any NGL/natural gas leak Any leak/spill/contamination meeting state or federal notification requirement (see DOT-REGULATEDPIPELINE RELATED SPILLS: EXTERNAL NOTIFICATIONS section).	Initiate: Appropriate clean-up activity Complete: Release Alert

Enbridge (U.S.) - Required Leak Notifications (con't)
DOT-REGULATED PIPELINE-RELATED SPILLS: EXTERNAL NOTIFICATIONS

QUALIFIED INDIVIDUAL (OR DESIGNATES)- CRITERIA FOR EXTERNAL NOTIFICATIONS: FEDERAL
Procedure: Upon verification of a release, Qualified Individuals must make an initial assessment of the situation to determine whether or not the incident requires Federal Notification based on the criteria described below.

CONDITION	WHO TO NOTIFY
If a failure in the pipeline system in which there is a release of hazardous liquid or gas from its primary containment (pipe or pipe system) including a release captured in a secondary containment results in: 1.* Death of any person or hospitalization of any person OR 2. Unintentional explosion or fire OR 3.* Estimated property damage exceeding $50,000 (including repair, cleanup and cost of product) OR 4. Pollution of a water body (rivers/streams/wetland/reservoir) OR 5.* Any other event that the Qualified Individual deems significant for other reasons.	**Then (WITHIN 1 HOUR)** Contact: National Response Center (NRC) **(800) 424-8802** Be ready to provide the following: - Name and address of Enbridge; - Your name and telephone number; - Location of the failure with Legal Description (Coordinates); - Time of the failure; - Fatalities and personal injuries, if any; - Initial estimate of amount of product released; and - All other significant facts known at that time If not asked by the Operator, clarify appropriate pipeline safety regulator (e.g. OPS, Oklahoma Corporation Commission, etc.)
SIGNIFICANT CHANGES Increase or decrease in the number of previously reported injuries or fatalities OR Revised estimate of the product release amount that is at least 10X greater than the amount initially reported OR Revised estimate of the property damage that is at least 10X greater than amount initially reported.	Submit a verbal supplement to the NRC during the emergency response phase **within 48 hours of initial report.** Contact: **NATIONAL RESPONSE CENTER** **(800) 424-8802**
If a failure in the pipeline system in which there is a release of hazardous liquid or gas from its primary containment (pipe or pipe system) including a release captured in a secondary containment results in: 1. Any of the above; or 2. Loss of 5 gallons or more of liquid with an exception for spills under 5 barrels resulting from pipeline maintenance activities that did not result in water pollution, spill is cleaned up promptly, and spill is confined to company property or ROW; or 3. Escape of more than 5 gallons of NGL to atmosphere.	**Then (WITHIN 30 DAYS)** The U.S Pipeline Compliance Department in Superior, WI, will file a written Accident Report on PHMSA Form 7000-1 (liquids for all reportable releases. These reports are due 30 days from the date of the incident. If an internal "Release Alert" is not drafted immediately after the leak, please contact the Compliance Department as soon as poss ble to initiate the process.

Qualified Individuals (Or Designee)- Criteria for External Notifications: State (Crude Oil & NGL*)
Procedure: Upon verification of a release, Qualified Individual or designee must make an initial assessment of the situation to determine whether or not the incident requires state notification based on the criteria described below.

State	Water	Release Reporting Criteria- Soil	Notification Period	24-Hour Reporting Hotline
Minnesota	Visible sheen or emulsion	**>=5 gal.** Any spill that threatens surface water or groundwater	Immediately upon discovery	800-422-0798 (within Minnesota) 651-649-5451 (outside Minnesota)
North Dakota	Visible sheen or emulsion	**No minimum**. All spills are reportable that may harm human health or harm the environment.	Immediately upon discovery	800-472-2121 (within North Dakota) 701-328-8100 (outside North Dakota)
Wisconsin	Visible sheen or emulsion	**>=5 gal. of crude or 1 gal of diluent,** any amount that threatens or contacts surface water or groundwater. Any amount that causes fire or explosion hazard or other safety hazard. Not reportable if immediately contained and cleaned up, and spilled on competent asphalt or cement (an impervious surface)	Immediately upon discovery	800-943-0003

The state reporting requirements noted in this table were developed by U.S. LP Environment.

NOTE:
- Releases should be reported if any one of the reporting criteria are triggered.
- Environment staff in the Superior Office should be contacted for releases reported to regulatory agencies.
- Local reporting requirements (police, fire department, EMS, Coast Guard, etc.) may also apply.
- For releases impacting drinking water HCAs, identify water intakes, wellhead protection areas or other identified HCA DW sources, and notify the local Public Utilities Department (or equivalent) if potential threats exist.

All uncontrolled or accidental NGL releases are subject to immediate notification to the state agencies listed above.
*Vector Natural Gas reportable incidents.
** Contact the Enbridge U.S. Pipeline Compliance Department in Superior, WI (715) 395-3620 to have a DOT form 7000-1 submitted (within 30 days) to the Federal OPS & Pipeline Safety Department, OCC Jim Thorpe Building, OKC, OK 73105.

Non-Pipeline Related Spill - - External Notification

Non-pipeline related releases of oil/petroleum products or hazardous materials may also require external notification. Example non-pipeline releases could include the following:

- Leak, failure or spill from a drum or other container of oil, solvent or hazardous material.
- Hydraulic hose or equipment failure.
- Vacuum truck hose or fittings.
- Aboveground or equipment-related fuel storage tanks and containers.

The following reporting guidelines apply:

Petroleum related compounds (oils, gasoline, diesel, used oil, mineral spirits, etc.)	Reporting requirements are the same as provided in the previous tables, except for gasoline in: **Oklahoma** (>25 gallons) **Wisconsin** (>1 gallon if on pervious surface)
Non-petroleum hazardous substances (antifreeze (ethylene glycol), toluene, xylene, methanol, battery acid, etc.)	Reporting requirements vary depending on the material, spill and applicable regulations - **Contact Environment Department**

2.2.3g Husky Tanks at Superior Terminal (Tank 28 & 29)

A. Notification

Enbridge shall immediately notify T.J. Pounder (Husky) when it becomes aware that an incident has occurred or exists. Notice shall be provided to Husky in the following call protocol order:

Main Contact: 419-226-2555 – Lima Refinery's 24-Hour Emergency Number (RSS) Lima, Ohio

If there is no answer at the Main Contact listed above, Enbridge should contact Husky using the Secondary Contact provided below:

Secondary Contact: 1-877-262-2111 – Husky Corporate 24-Hour Emergency Number and request to be connected with the On-Call Deputy Director (Calgary, Alberta)

If there is no answer at the Secondary Contact listed above, Enbridge should contact Husky using the Tertiary Contact provided below:

Tertiary Contact: 403-801-8592 – Husky On-Call Deputy Director (Calgary, Alberta) Deputy.Director@huskyenergy.com

B. Response

1. In the event of an incident, Enbridge shall promptly use its personnel and equipment to respond to the incident as directed by the *Enbridge Integrated Contingency Plan (ICP)*.
2. Enbridge's response to an incident will be dependent on the incident's nature and severity as defined in *Figure 1 Classification of the Incident* in Core *Section 2* in the ICP.

C. Coordination

Enbridge shall direct, as well as implement, any response to an incident, but only until a representative of T.J. Pounder (Husky) arrives on-site and assumes the role of Qualified Individual or Incident Commander. From that point on, Enbridge shall continue to implement the response, but under the direction of, and in coordination (Unified Command) with, the representative from T.J. Pounder (Husky).

D. Corporate Communications Contacts

In the event of an incident, a representative from Corporate Communications at Enbridge shall promptly notify Husky Corporate Communications at the contact number below.

Main Contact: 403-370-0488 – Husky On-Call Corporate Communications

In order to ensure timely and effective communication with various stakeholders, Enbridge and Husky agree to coordinate, where possible, on the development and delivery of external communications.

It is understood that stakeholders may contact Enbridge directly regarding Husky-owned Tanks 28 and 29 and that Enbridge will make a reasonable effort to ensure Husky is notified and has an opportunity to review messages. However in the event of a life safety matter, Enbridge will initiate communications to ensure timely messages are released and Husky will be made aware as soon as possible.

2.3 Oil Spill Response Organization

2.3.1 Marine Pollution Control Corp. (MPC) Agreement

Marine Pollution Control Corp.
8631 West Jefferson Ave., Detroit, MI 48209-2691
Phone: 1-313-849-2333 ■ Fax: 1-313-849-1623
Web: www.marinepollutioncontrol.com ■ E-mail: info@marinepollutioncontrol.com

OSRO MEMBERSHIP PROGRAM AND CONTRACTOR DESIGNATION AGREEMENT

THIS OSRO MEMBERSHIP PROGRAM AND CONTRACTOR DESIGNATION AGREEMENT ("Agreement") is made effective this 19th day of January, 20 12, by and between Enbridge Energy Company, Inc., a Delaware Corporation, including subsidiaries and affiliates thereof, with its principal offices located at 1320 Grand Avenue, Superior WI 54880 (collectively "Owner"), and Marine Pollution Control Corporation, a Michigan Corporation, with its principal business offices located at 8631 W. Jefferson, Detroit, Michigan 48209 ("MPC").

RECITALS

A. Owner is required to file either a vessel response plan or a facility response plan with the United States Coast Guard and to designate therein a Response Contractor, and to also comply with various other requirements mandated by OPA 90 and applicable regulations thereto.

For Pipelines: A pipeline means all parts of an onshore "pipeline facility" through which oil, fuel or other product moves including, but not limited to, line pipe, valves, and other appurtenances connected to line pipe, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks. A "pipeline facility" will be handled as a single "facility" for each state for which the Owner/Operator is required to file a facility response plan.

B. By becoming a member of MPC's OSRO Membership Program, the Owner will be authorized to designate MPC as a Response Contractor in the Owner's Vessel Response Plan or the Facility Response Plan to be filed with the United States Coast Guard and MPC will provide additional types of response preparedness services outlined below to assist the Owner in complying with OPA 90.

C. Owner wishes to enroll in MPC's OSRO Membership Program on the terms and conditions hereinafter set forth.

NOW, THEREFORE, in consideration of the mutual covenants herein contained, and for good and valuable consideration, the receipt hereof is hereby acknowledged, Owner and MPC agree as follows:

1. Enrollment in OSRO Program and Membership Benefits: Owner hereby enrolls in the OSRO Membership Program as set forth below. As a member of this program, MPC agrees to provide to the Owner the following membership benefits within the applicable geographic area for the term of this agreement:

1

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a. Response Equipment Inventory: MPC, together with its subcontractor network, maintains an inventory of dedicated response equipment, including recovery and storage devices, and containment boom and is supported by an integrated maintenance and logistics program. Membership includes documentation of equipment capabilities and capacities, updates to inventory and annual maintenance performance.

b. OSRO Documentation: MPC will maintain a comprehensive record of all pertinent aspects of your Membership. This will insure that your compliance officer has easy access to your OSRO compliance data. All relevant information (exercise reports, etc.) from previous OPA 90 compliance projects conducted to date between MPC and the Plan Holder will be included in this file.

c. Annual Table-Top Exercise (TTX) Participation: As a Member, MPC will provide an experienced person to participate or facilitate your annual Vessel/Facility Table-Top Exercise on the date mutually agreed upon by the parties. MPC will furnish a documented report upon completion of the TTX. TTX design and facilitation available upon request.

d. Subcontract Network: MPC maintains a subcontractor support network in connection with its OSRO Membership Program.

e. Regional Annual OSRO Equipment Deployment Exercise (EDX): Regional Annual OSRO Equipment Deployment Exercises will be handled for Vessels and Facilities, respectively, as follows:

For Vessel Owners/Operators: MPC will perform a Regional OSRO Equipment Deployment Exercise (EDX), in accordance with the PREP Guidelines and to test response plan strategies. Vessel Owners wishing to participate in the exercise may attend an exercise at no cost. Vessel owners wishing to participate in the drill should contact MPC at their earliest convenience to be included in the annual drill schedule. MPC will provide all vessel owners signed up for the membership program with documentation that MPC has conducted the necessary exercises.

For Facility Owners/Operators: For Facility Owner(s) whose locations are within a fifty (50) mile radius of MPC's base of operations in Detroit, Michigan, MPC will perform a PREP OSRO Equipment Deployment Exercise (EDX), in accordance with the PREP Guidelines and to test response plan strategies. MPC will furnish a documented report upon completion of the OSRO Equipment Deployment Exercise.

For Pipeline Owners/Operators: For Pipeline Facility Owner(s) MPC will perform a PREP OSRO Equipment Deployment Exercise (EDX) within a fifty (50) mile radius of MPC's base of operations in Detroit, Michigan, in accordance with the PREP Guidelines and to test response plan strategies. MPC will furnish a documented report upon completion of the OSRO Equipment Deployment Exercise.

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f. Designation of MPC as OSRO in Owner's Reponses Plan. So long as Owner is current in payment of the membership fee, Owner may designate MPC as the response contractor in its Vessel Response Plan or Facility Response Plan for vessels/facilities listed in Schedule "A " hereto.

g. Scheduling: In reference to the TTX, Equipment Deployment and other events, MPC reserves the right to schedule "the date" for these activities in collaboration with the Owner.

PLEASE NOTE THAT THIS AGREEMENT IS NOT INTENDED, AND DOES NOT COVER, RESPONSE SERVICE FOR ACTUAL EMERGENCY SPILLS. SEE PARAGRAPH 4 BELOW AS TO THE APPLICABLE AGREEMENT THAT WILL GOVERN ACTUAL EMERGENCY RESPONSES ACTIVITIES BETWEEN THE PARTIES.

2. Term and Membership Fee: The term ("Term") of this Agreement shall commence on the date set forth above and shall continue for a period of one (1) year. ***Upon expiration of the initial term of this Agreement or any subsequent renewal, this Agreement shall be automatically renewed annually for an additional one (1) year unless terminated by either party by giving written notice to the other at least thirty (30) days prior to the end of the initial term or each subsequent renewal ("evergreen").*** In consideration of MPC providing the services described in paragraph 1 above during the Term of this Agreement for the vessels/facility(s) listed in the attached Schedule 'A", Owner will pay MPC an annual enrollment fee of $4,250/facility (or "pipeline facility") and/or $1,000/covered vessel (up to a maximum $7,500 for vessels) for three (3) facilities ~~to be paid with the execution of this agreement and/or~~ ***is waived for the first year (calendar year 2012) of this agreement. NOTE: if an Equipment Deployment Exercise (EDX) is requested during the first year of this agreement, the exercise will be billed on a non-emergency, time and materials basis. Following the first year of coverage, the annual enrollment fee shall apply for*** each subsequent renewal term, for each vessel/facility (or "pipeline facility") covered. MPC Reserves the right to adjust the membership fees stated herein on an annual basis, by providing Owner thirty (30) days written notice. **OWNER SHALL NOT NAME MPC AS THE DESIGNATED OSRO CONTRACTOR IN ITS VESSEL/FACILITY RESPONSE PLAN IF OWNER FAILS TO PAY MPC THE ENTIRE ANNUAL ENROLLMENT FEE PURSUANT TO THE PAYMENT TERMS SET FORTH HEREIN.**

3. Qualified Individual. Within thirty (30) days of enrollment under this Agreement, Owner shall furnish to MPC the name, address, telephone and facsimile number of Owner's qualified individual with respect to the vessel(s)/facility(s) listed in Schedule "A." The foregoing information shall be kept current and updated throughout the Term of this Agreement.

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4. Actual Emergency Response Services to be provided under Separate Agreement. The parties agree that no actual emergency response services for spill(s) or discharge(s) from the Owner's vessel(s)/facility(s) enrolled under this program will be provided under this Agreement. Concurrently with the execution of this Agreement, the Owner and MPC have entered into a separate contract entitled MASTER ENVIRONMENTAL SERVICES AGREEMENT which is applicable to actual emergency response activities to be performed by MPC for spills and discharges that may occur from the vessel(s)/facility listed in Schedule "A" hereto,

5. Limitation of Liability: MPC shall not be liable for any of Owner's losses or damages caused by non-performance by MPC of its obligations under this Agreement, except to the extent that any such losses or damages arise out of MPC's gross negligence or willful misconduct.

6. Governing Law. This Agreement shall be subject to and governed by the laws of the State of Michigan, and all questions concerning its validity, construction, and administration shall be determined under such laws.

7. Notices. Any notice required or permitted by this Agreement shall be in writing and shall be sent by party by either certified mail or by facsimile transmission to the principal place of business of the other party (as herein below set forth) or to such other address as the other party hereinafter may specify in writing. Any notice shall be deemed given when received by the other party.

8. Entire Agreement. This Agreement and the Emergency Response Service Agreement referred to in paragraph 4 above (as applicable) constitutes the entire agreement between the parties hereto pertaining to the subject matter hereof, and the final, complete and exclusive expression of the terms and conditions thereof. All prior agreements, negotiations and understandings of the parties hereto, oral or written, express or implied, are hereby superseded and merged herein. No addition to or modification of any provision contained in this Agreement shall be effective unless fully set furth in writing and signed by both the Owner and MPC

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[redacted]

IN WITNESS WHEREOF, the parties have executed this Agreement effective as of the date first above written.

"OWNER": Enbridge Energy Company, Inc.

STREET ADDRESS: 1320 Grand Avenue

CITY, PROVINCE, ZIP: Superior WI 54880

TELEPHONE #: _____ FACSIMILE #: _____

e-Mail: [redacted]

SIGNATURE: _____

PRINTED NAME: _____

The person signing this document on behalf of the Client acknowledges that he/she has the authority to contractually bind said Client in accordance with this agreement and the General Terms and Conditions thereof.

MPC ENVIRONMENTAL
MARINE POLLUTION CONTROL CORP.

[redacted] Its: [redacted]

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Schedule A

Owner's vessels/facilities to be covered under this Agreement are as follows:

1. "Pipeline facilities" in Michigan
2. "Pipeline facilities" in Wisconsin
3. "Pipeline facilities" in Minnesota (to also include 28 miles of pipeline into North Dakota
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

MASTER ENVIRONMENTAL SERVICES AGREEMENT

This Master Environmental Service Agreement ("the "Agreement") entered into & effective this 19th day of January, 20 12, by and between Marine Pollution Control Corporation d/b/a MPC Environmental, a Michigan corporation ("MPC"), and Enbridge Energy Company, Inc., a Delaware corporation, including its subsidiaries and affiliates thereof (collectively "Client").

GENERAL SCOPE OF SERVICES

MPC agrees to provide Client, on an emergency basis, with services at Client's terminals, pipelines, service stations and other related facilities (all hereinafter "Facilities") as may be required by Client to mitigate, remediate, cleanup or remove the conditions caused by a release, spill or discharge into the environment of crude oil, petroleum products, chemicals and other materials.

MPC agrees, when called upon by Client, that MPC will respond with its best efforts using the appropriate personnel, equipment and supplies identified in the "rate sheet" to this Agreement. MPC further agrees, when called upon by Client, that MPC will utilize its best efforts to provide Spill Response Resources within response times stipulated by the Client and/or applicable Federal and state laws, rules and regulations where such Spill Response Resources have not already been committed to a previous response. MPC agrees to notify Client promptly and in writing within seven (7) days, of any additions to or deletions from the list of Spill Response Resources identified in the "rate sheet" to this Agreement, attached hereto and made a part hereof. MPC also agrees to immediately notify Client in writing in the event MPC's response capability is reduced by 20% or more.

MPC agrees that Client may identify MPC as a spill responder in any spill response plans required by or filed with applicable Federal and state governmental agencies including but not limited to the U.S. Coast Guard, provided Client provides the MPC the name, location, type of products and estimated worst case discharge.

That for and in consideration of the mutual promises and covenants hereinafter contained, MPC and Client agree as follows:

1. AUTHORIZATION TO COMMENCE WORK. Client may request commencement of Work by MPC, by giving notice by telephone 24 hours per day, seven (7) days per week, by calling MPC at either 800-521-8232 or 313-849-2333. At such time the Client's representative making the call shall furnish MPC the name and title of the caller, the location of the facility or site needing Work or Response Services, the hazardous materials involved when applicable, and if known, and other relevant facts relating to the situation then known to the caller, and to the best of the caller's ability, and any additional information as MPC deems reasonably necessary. If necessary personnel and equipment are available to respond, MPC shall inform the Client's representative making the call that it is available to respond and it accepts the request for services. The parties recognize that at the commencement of Work or Response Services hereunder, the scope of the Work thereof may not be well defined. The parties agree that at the commencement of Work involving emergency response service that their respective representatives shall consult with each other to better define the scope of

Work to be performed and outline strategies and approaches to such Work. Client shall promptly confirm all telephone requests for Work, after consulting with MPC, by issuing to MPC a written authorization (i.e. purchase order, work order, authorization to proceed) describing the Work to be performed and designate the Client's representative authorized to act on behalf of the Client in connection with that particular project. Notwithstanding the above, in non-emergency response situations, the Client shall issue to MPC a written authorization describing the Work to be performed prior to commencement of services by MPC. For the purposes of this agreement, non-emergency response services shall be defined as services which do not require either (i) an immediate response by MPC (less than 24 hours and/or before the next business day) or (ii) the continuous, ongoing presence by MPC for an extended time at the on-site release area. In the event of a conflict between the terms of such purchase order and the terms of this Agreement, the terms of this Agreement shall prevail. Due to the emergency situation that MPC may be requested to respond to, the Client further authorizes MPC to use whatever procedure it deems advisable, and in conjunction therewith, to utilize whatever number of employees and types of equipment and supplies that it feels is necessary in handling the work. Client hereby authorizes MPC to promptly mobilize the necessary personnel and equipment and commence performance of the Work upon MPC's acceptance of telephone request for Work by Client.

2. IDENTIFICATION OF CLIENT'S FACILITIES AND DESCRIPTION OF WORK TO BE PERFORMED BY MPC. The particular facilities owned by Client that are covered by this Agreement, the contact information applicable for each such facility and the description of response services to be rendered by MPC at one of Client's identified facilities upon Client's request are as follows (please check):

X Any facility or location "as needed" based on emergent conditions.

OR

☐ A specific facility (facilities) as identified below

Facility Name: _____

Facility Address: _____

Facility Contact Person: _____

Contact's Telephone No: _____

Description of Work to be Performed: MPC is to provide emergency spill response and non-emergency services on an "as needed" basis for the facilities listed above (hereinafter referred to either as the "Work or "Response Services").

Additional divisions and subsidiaries affiliated with Client and other facilities not identified above that are also covered by this Agreement are indicated on Exhibit B attached hereto.

3. EXCLUDED OSRO RELATED SERVICES: PLEASE NOTE THAT NOTWITHSTANDING ANYTHING TO THE CONTRARY HEREIN, MPC'S SCOPE OF SERVICES UNDER THIS AGREEMENT EXPRESSLY EXCLUDES OSRO RELATED SERVICES MANDATED BY THE OIL POLLUTION ACT OF 1990 AND APPLICABLE REGULATIONS THERETO (OSRO RELATED SERVICES INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING: DESIGNATING MPC AS A RESPONSE CONTRACTOR IN OWNER'S RESPONSE PLAN; IDENTIFYING MPC'S RESPONSE RESOURCES AS AVAILABLE IN CASE OF DISCHARGE; MPC'S ASSISTANCE IN ANNUAL TABLE-TOP EXERCISE AND IN PERFORMING DEPLOYMENT EXERCISE; AVAILABILITY OF SUBCONTRACT NETWORK ESTABLISHED BY MPC TO RESPOND TO A DISCHARGE, ETC). IF CLIENT IS INTERSTED IN ENROLLING IN MPC'S OSRO PROGRAM SO THAT IT IS ELIGIBLE TO NAME MPC AS CLIENT'S DESIGNATED RESPONSE CONTRACTOR IN ITS OWNER'S RESPONSE PLAN, AND RECEIVE ADDITIONAL BENEFITS UNDER THAT PROGRAM, PLEASE CONTACT MPC FOR INFORMATION (YOU WILL BE REQUIRED TO SIGN A SEPARATE WRITTEN ORSO MEMBERSHIP AGREEMENT WITH MPC AND REMAIN CURRENT IN PAYMENT OF THE ANNUAL ENROLLMENT FEE FOR THIS PROGRAM). IF YOU ARE ALREADY ENROLLED IN MPC'S OSRO MEMBERSHIP PROGRAM AND ARE CURRENT IN PAYMENT OF YOUR ANNUAL ENROLLMENT FEE, PLEASE DISREGARD THIS PARGARGH BECAUSE IT DOES NOT APPLY TO YOU.

4. PAYMENT FOR SERVICES AND TERMS OF PAYMENT.

(a) Client agrees to pay MPC for Work on a time and materials basis in accordance with the Schedule of fees and charges set forth in Exhibit A attached hereto, which lists the applicable rates for personnel, equipment, transportation, materials and disposal costs. Charges commence upon notification to proceed and terminate at conclusion of operation. Charges will include, but are not limited to, time required for transport of personnel, materials, and equipment to and from the work site; labor, materials, and equipment necessary for clean-up; labor, equipment and materials necessary to transport wastes to a treatment, storage, or disposal facility and off-load the wastes; and decontamination of equipment upon completion of the work. Minimum call out time for emergency services is six (6) hours and for non-emergency services is four (4) hours per person and equipment.

(b) Client agrees to pay each one of MPC's invoices within thirty (30) days after the date of each respective invoice. Should Client become delinquent in payment of any sum due MPC, MPC reserves the right to immediately discontinue performance of any remaining work that needs to be completed hereunder. Notwithstanding any such discontinuance of services, Client shall pay MPC for all services rendered by MPC to date of discontinue of service. Further, a service charge of two percent (2%) per month shall be charged on all balances not paid within thirty (30) days from the date of each invoice.

(c) If MPC retains an attorney to collect any delinquent invoices, Client also agrees to pay MPC all of its costs and expenses, including reasonable attorney fees, incurred in collecting amounts due from Client.

(d) The parties agree that this Contract incorporates a debt incurred in the ordinary course of business or financial affairs of the purchaser; that all payments made on this Contract will be made in

the ordinary course of business and financial affairs of each other; that all payments will be made according to the ordinary business terms of each other and in the industry.

5. DAILY WORK SHEETS. MPC shall furnish, at the end of each working day, a Daily Work Sheet which sets forth the number of MPC's personnel working that day and the number of hours each one worked, as well as equipment and materials utilized that day. Once the Daily Work Sheet(s) have been presented, Client shall sign and return the Daily Work Sheet(s) to MPC's on-site representative. Client shall note on each Work Sheet any errors or dispute as to any entry that it may identify and the parties will promptly endeavor to resolve any such dispute. Notwithstanding anything to the contrary, whether a Daily Work Sheet is signed or not signed by the Client, the Daily Work Sheet will be used by MPC to prepare its' invoices for the Client.

6. GENERATOR NUMBER. If the materials that are being removed or cleaned up are identified by the federal government and/or any applicable state or local governmental authority as "hazardous" or "liquid industrial waste", then, as a condition precedent to the performance by MPC of this agreement, Client shall provide MPC with the generator number that is provided by applicable governmental authority of which is otherwise required by law. Until such time as Client has obtained a generator's number, MPC shall be allowed to either store the materials on Client's property where the materials were removed or at such other location at Client's cost.

7. CLIENT REPRESENTATION/SELECTION OF DISPOSAL FACILITY. Client represents to MPC that it will provide a true and correct description of the materials to be handled by MPC hereunder and further advise MPC of all known or suspected hazard and risk incidental to the handling, transportation and disposal of said materials. In the event the scope of work includes the transportation of hazardous substances, then Client shall also select the disposal or treatment facilities to which said hazardous substances are to be taken. MPC SHALL NOT SELECT THE DISPOSAL OR TREATMENT FACILITIES.

8. MPC'S COMPLIANCE WITH LAWS AND REGULATIONS: MPC represents that it will comply with all applicable governmental laws, regulations and ordinances in performance of the work described under the scope of work.

9. REGULATORY REPORTING. Client acknowledges that it may be required to report regulated conditions at the Site to the appropriate public authorities, including the Environmental Protection Agency and/or other State or Federal Agencies, in accordance with applicable law. Client indemnifies and holds MPC harmless from any requirement to report such condition.

10. TERM. The term of this Agreement shall commence on the date set forth above and shall continue for a period of one (1) year. Upon expiration of the initial term of this Agreement or any subsequent renewal, this Agreement shall be automatically renewed for an additional one (1) year unless terminated by either party by giving written notice to the other at least thirty (30) days prior to the end of the initial term or each subsequent renewal. Notwithstanding anything to the contrary contained herein, either party, for any reason, may terminate this agreement by giving the other party thirty (30) days written notice of the termination.

11. MPC's WARRANTIES. MPC represents and warrants to Client that MPC is qualified to perform the services hereunder and will do so in a safe and workmanlike manner and in compliance with all governmental laws, regulations, and orders.

12. CLIENT'S WARRANTIES. Client represents and warrants to MPC that (i) it will provide a true and accurate description of all known hazardous substances to be handled by MPC and further advise MPC of all known or suspected hazards or risks incidental to the handling, transportation, and disposal of said substances; (ii) it shall select the disposal or treatment facilities that said hazardous substances are to be taken; and (iii) it will, if deemed necessary by MPC, secure all necessary approvals, judicial and/or administrative orders necessary to ensure MPC's legal access to the site to perform the work.

13. INDEMNIFICATION.

(a) **MPC's INDEMNIFICATION.** MPC agrees to indemnify, save harmless and defend Client, and its respective officers and employees from and against any and all losses, liabilities, claims, penalties, suits and the costs and expenses incident thereto which any or all of them may hereunder incur, become responsible for or pay out as a result of damage to any property, contamination of or adverse effects on the environment, or any violation of governmental laws, regulations or orders, caused by or arising out of, in whole or in part: (i) MPC's breach of any term, provision, or warranty contained in this Agreement; (ii) any negligent act or omission of MPC, its employees, agents or subcontractors in the performance of this Agreement; or (iii) any violation by MPC of any governmental laws, regulations or ordinances relating to the performance of services hereunder. MPC and Client shall, in the event of liability arising out of their joint negligence or willful acts, be liable to the other and any damaged third party in proportion to their relative degree of fault.

(b) **CLIENT'S INDEMNIFICATION.** Client agrees to indemnify, save harmless and defend MPC, its officers and employees from and against any and all losses, liabilities, claims, penalties, suits and the costs and expenses incident thereto which any or all of them may hereunder incur, become responsible for or pay out as a result of damage to any property, contamination of or adverse effects on the environment, or any violation of governmental laws, regulations or orders, caused by or arising out of, in whole or in part: (i) Client's breach of any term, provision, or warranty contained in this Agreement; (ii) any negligent act or omission of Client, its employees, agents or subcontractors in the performance of this Agreement; or (iii) any violation by Client of any governmental laws, regulations or ordinances relating to the performance of services hereunder. Client and MPC shall, in the event of liability arising out of their joint negligence or willful acts, be liable to the other and any damaged third party in proportion to their relative degree of fault.

14. LIMITATION OF LIABILITY In no event shall MPC be liable to Client for incidental, exemplary, special or consequential damages (including loss of profits), even if MPC has been advised of the possibility of such damages. Client acknowledges that the fees charged by MPC for services herein are based, in part, on this limitation of liability.

15. EXTREME HAZARDOUS CONDITIONS. The services contemplated by this Agreement may require MPC's personnel and equipment to be exposed to extreme hazardous conditions, substances, and/or wastes. As a result of this exposure, MPC's equipment may be damaged or destroyed during the course of its employment in the services being rendered. Client agrees to pay for the repair and/or replacement of equipment that is damaged or destroyed after being exposed to extreme hazardous conditions, substances, and/or wastes at Cost + 20%.

16. DISCLAIMER OF WARRANTY. EXCEPT AS OTHERWISE PROVIDED HEREIN, MPC MAKES NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

17. NO THIRD PARTY BENEFICARY: The services provided under this contract are solely for the benefit of the Client and neither this contract nor any services rendered hereunder shall give rise to, or shall be deemed or construed so as to confer any rights upon any other party as a third party beneficiary or otherwise, and Client agrees to indemnify MPC against any claims by such third parties.

18. CONFIDENTIALITY. Except as required by law, MPC agrees that it will maintain in confidence and not disclose to others information acquired in performance of the work under this Agreement without the prior written consent of the Client.

19. NON-EXCLUSIVITY. This Agreement shall not be construed as granting to MPC the exclusive right to respond to environmental problems experienced by Client; Client reserves the right to contract with other parties for such services as it deems necessary. Furthermore, Client understands that MPC has entered into similar emergency response service agreements with other parties, and as a result of those agreements it is possible that MPC may not be available to respond to Client's request for services. MPC does, however, intend to respond to the requests for services by Client if its personnel and equipment are available.

20. PRIMARY RESPONSE FACILITY. Although MPC maintains a worldwide subcontractor network, Client acknowledges that MPC's primary facility is located in Detroit, Michigan, and upon request by Client for emergency spill response services, MPC shall promptly mobilize reasonably necessary personnel and equipment and proceed to the site where services are to be rendered as quickly as reasonably possible.

21. FORCE MAJEURE. MPC shall not be deemed in default of this Agreement or any duty hereunder to the extent that any delay or failure in the performance of its obligations results, without its fault or negligence, from any cause beyond its reasonable control, including, but without limitation, acts of God, acts of any governmental body, acts or delays of other subcontractors or suppliers, fire, flood or labor disturbances and severe weather.

22. INDEPENDENT CONTRACTOR. In performing services under this Agreement, MPC shall be deemed to be acting as an independent contractor, and is not the agent, servant, employee or representative of Client.

23. NOTICE. Except as otherwise provided for herein, all notices shall be in writing and sent to the address by certified mail or facsimile number as set forth under the signature of Client and MPC. Either party may change the contact information by providing notice to the other as provided herein.

24. ASSIGNMENT. Neither this Agreement, nor any claim or performance obligations arising in connection with performance of this Agreement, may be assigned or subcontracted by either party without the prior written consent of the other party. Any such assignment or delegation shall not relieve the assigning or delegating party of its obligations hereunder.

25. CAPTIONS. The captions used herein are for convenience only and are not a part of this agreement and do not in any way limit or amplify the terms and provisions hereof.

26. GOVERNING LAW. This agreement shall be governed by and construed in accordance with the laws of the State of Michigan. All litigation between the parties arising out of this Agreement shall be tried in federal and/or state courts located in County of Wayne, State of Michigan. The parties further agree that before such litigation is filed authorized representatives of the parties shall meet to try to resolve such dispute.

27. INSURANCE. Without in any way limiting the liability of MPC under the Agreement, MPC shall carry the following insurance with limits not less than shown on the respective items:

(a) Commercial or Comprehensive General Liability Insurance covering damages resulting from bodily injury (including death) or property damage (including loss of use or occupancy) in the sum of not less than Two Million Dollars ($2,000,000.00) (US) for each accident or occurrence. This policy shall include coverage for contractual liability, protective liability, employer's liability, cross liability or severability of interest clause, broad form property damage and non-owned automobile liability. MPC shall add the Client as an additional insured to this policy.

(b) Worker's Compensation Insurance to the limit required by the laws of the state in which the work is being done.

(c) Automobile Liability Insurance covering all motor vehicles owned or leased and licensed in the name of MPC or any of its affiliates. Limits of liability shall not be less than Two Million Dollars ($2,000,000.00) (US) (inclusive limit) for the accidental injury to or death of one or more persons or damage to or destruction of property as a result of any single accident.

(d) Pollution Liability insurance in the amount of not less than Five Million Dollars ($5,000,000.00).

(e) MPC shall maintain insurance or self-insure all MPC's equipment, whether owned or leased. No insurance will be provided by the Client. MPC shall waive its rights of any recovery or subrogation against the Client and will have its insurers waive their rights of

subrogation against the Client in the event of loss or damage to the equipment owned by, leased by or rented to such MPC.

(f) MPC will add the Client as an additional insured on all policies obtained by MPC for this contract.

(g) Other Insurance – MPC is required to provide, at its own cost, any additional insurance which is required by law or which MPC considers necessary.

27.1 General Provisions Applicable to the Foregoing Insurance Provisions:

A certificate of insurance, completed by MPC's authorized representative or official of MPC's insurance Client, shall be forwarded prior to the commencement of work evidencing the placement of insurance. The certificate of insurance is to certify that all insurance policies and required endorsements have been issued by MPC's insurer. Each and every policy shall state that the policy cannot be cancelled, lapsed or materially altered without at least thirty (30) days prior written notice by MPC's insurer to the Client. All policies required herein by MPC shall also provide for subrogation to be waived against the Client, its affiliates, employees, directors, officers and agents, but only in respect of operations performed by MPC under this Agreement.

27.2 All policies of insurance carried by MPC shall contain endorsements stating that MPC's insurance coverage is primary to any coverage that the Client may elect for its own account or for MPCs.

27.3 Failure to Meet Insurance Requirements - If MPC fails to furnish to the Client a Certificate of Insurance for each policy required to be obtained hereunder, then in every such case the Client may obtain and maintain such insurance in the name of MPC. The cost thereof plus a 10% administration fee shall be payable by MPC to the Client on demand and the Client may deduct these costs from any monies which are or may become payable to MPC.

27.4 MPC shall immediately advise the Client of any claim against any policy that will erode the policy aggregate limit. Following receipt of such correspondence, the Client will determine if MPC's policy limit is materially eroded. If the Client determines the policy limit to be materially eroded then MPC shall, at its own expense, immediately obtain such additional insurance to comply with the policy limit required under insurance.

27.5 Subcontractors - MPC shall ensure that all of its subcontractors procure the insurance required by this clause.

27.6 Any and all deductibles specified in the above-described insurance policies or self-retained by MPC shall be assumed by, for the account of, and at the sole risk of MPC.

27.7 Client acknowledges that the use of additional excess umbrella coverage is an acceptable substitute where actual individual coverage is lower than requested.

28. ENTIRE AGREEMENT. This agreement represents the entire understanding and agreement between the parties hereto, and supersedes any prior oral or written agreements or representation. This Agreement cannot be modified except by written instrument signed by both of the parties hereto.

IN WITNESS WHEREOF, this Agreement has been duly executed on the date and year above written.

CLIENT: Enbridge Energy Company, Inc.

STREET ADDRESS: 1320 Grand Avenue

CITY, PROVINCE, ZIP: Superior WI 54880

TELEPHONE #: 715-394-1410

FACSIMILE #: 715-394-1405

e-Mail ADDRESS: [redacted]

SIGNATURE: [redacted]

PRINTED NAME:

The person signing this document on behalf of the Client acknowledges that he/she has the authority to contractually bind said Client in accordance with this Agreement and the General Terms and Conditions thereof.

MARINE POLLUTION CONTROL CORP.
d/b/a MPC ENVIRONMENTAL

STREET ADDRESS: 8631 West Jefferson Avenue

CITY, STATE, ZIP: Detroit, Michigan 48209

TELEPHONE #: (313) 849-2333

FACSIMILE #: (313) 849-1623

e-Mail ADDRESS: [redacted]

SIGNATURE:

PRINTED NAME:

The person signing this document on behalf of the MPC acknowledges that he/she has the authority to contractually bind said Client in accordance with this Agreement and the General Terms and Conditions thereof.

EXHIBIT A
RATE SCHEDULES

Emergency Response Rate Schedule
Non-Emergency Response Rate Schedule

GENERAL TERMS

1. **CHARGES** commence upon notification to proceed and terminate at conclusion of operation. Includes time required for transport of personnel and equipment to and from origin and necessary time for clean-up and decontamination of equipment. Minimum call out time for emergency services is six (6) hours and for non-emergency services is four (4) hours per person and equipment. For all projects beyond fifty (50) miles from the MPC base of operations, the minimum daily billing for personnel will be twelve (12) hours (this includes weather days, standby days, etc).

2. **STRAIGHT TIME (ST)** rate will apply for hours the first 8 hours worked between 7:00 a.m. and 5:00 p.m., Monday through Friday. The OVERTIME (OT) rate will apply for all other hours worked except for work done on Sunday and federal holidays, which will be compensable at the DOUBLE TIME (DT) rate.

3. **TRAVEL TIME** for all personnel classifications will be compensable at regular straight time man hour rates (out of town) commencing from the time Marine Pollution Control's personnel are mobilized until their arrival at the job site, and for the return from the job site to the MPC base of operations. Actual travel hours will be used when calculating the amount due, and will not exceed ten (10) hours per day. Travel time costs will be incurred for all projects more than fifty (50) miles from the MPC base of operations.

4. **The STANDBY RATE FOR EQUIPMENT** will be charged at the above listed operational rates less 15%. Standby rates will apply only during the transportation of equipment, and for hours spent in standing by due to inclement weather, mechanical breakdown, or for the time spent waiting parts delivery. Standby rates will not apply during work stoppage requested by Client.

5. **CLEANING OF EQUIPMENT** after a job will be specified on the worksheets. Charges for tanker cleaning or other services relating to the job will be billed at cost plus 20%.

6. **AIR MASK PREMIUM** pay per person is $38.00 per day/job.

7. **SURCHARGES.** A variable Fuel Surcharge and a 1.5% Insurance Surcharge is applied to the total invoice. Fuel Surcharges are calculated based on fuel prices published by the US Motor Gasoline and On-Highway Diesel Fuel prices for the Midwest Region.

8. **REIMBURSABLE COSTS** shall consist of only those items listed below which are incurred and paid subsequent to the date of contract and which are incurred by contractor for accomplishing services under this contract. Reimbursable costs shall be invoiced to Client at actual costs incurred and paid by Marine Pollution Control Corporation, plus the mark up shown below. Marine Pollution Control Corporation will be reimbursed for the following in U.S. dollars:

Any repair or replacement of equipment caused by loss or damage (other than normal "wear and tear") will be charged to the Client at:

A. Cost of replacement or repair plus 20%.
B. Labor charges for replacement or repair plus 20%.
C. Cost of shipping and handling plus 20%.

8.2 The actual costs plus 20% of air freight bills incurred for equipment shipments to and from the job site, except as provided otherwise by Client.

8.3. PER DIEM ON ALL JOBS MORE THAN 50 MILES FROM MPC BASE

A. Per Diem allowance varies based on the federal per diem rates as published by the us general services administration (http://www.gsa.gov).
B. Lodging will be reimbursed at the actual cost incurred plus 20%.

8.4. Airfare to and from the job site will be reimbursed at the actual cost plus 20%.

8.5. Subcontractors, if required for performance of work, will be charged at actual cost plus 20%.

8.6. Materials and supplies required for the performance of work will be billed at actual cost plus 20%.

EXHIBIT B
AUTHORIZED DIVISIONS AND SUBIDIARIES

Client hereby authorizes MPC, upon the terms and conditions provided for in the attached Environmental Services Agreement, to perform environmental services on behalf of any of the affiliates or subsidiaries of the Client listed below and to bill the Client directly for services rendered to said affiliates and subsidiaries:

Company Name: Enbridge Energy, Limited Partnership

Address: 1320 Grand Avenue

City/State/Zip: Superior, WI 54880

Contact Person: [redacted]

Contact's Telephone #: 715-394-1410

Company Name: Enbridge Pipelines (Southern Lights), LLC

Address: 1320 Grand Avenue

City/State/Zip: Superior, WI 54880

Contact Person: [redacted]

Contact's Telephone #: 715-394-1410

Company Name: _____

Address: _____

City/State/Zip: _____

Contact Person: _____

Contact's Telephone #: _____

2.3.2 Marine Pollution Control Corp. (MPC) Facilities and Equipment

Updated July 17, 2012

MPC EQUIPMENT AND MATERIALS LIST

Vacuum Tankers & Vacuum Trucks

VT-452	4,500 gal 1988 Huber Diesel, mild steel, hoist body, dump door, coded DOT MC 307, 312
VT-453	5,500 gal mild steel, coded DOT 307, 312
VT-455	5,000 gal 1999 Cusco, carbon steel, hoist body, dump door, coded DOT 412
VT-458	6,000 gal 1993 Brenner Diesel, stainless steel, coded DOT 407, 412
#2	2,000 gal International Vacuum truck, coded DOT 306, 307, 312
#15	2,000 gal International Vacuum truck, coded DOT 306, 307, 312
#17	3,500 gal 1992 Ford/Cusco Turbo-Vacuum unit
#20	3,300 gal 1989 Ford Vacuum truck, coded DOT 306, 307, 312
#26	3,000 gal 2002 Sterling Vacuum, coded 312
#29	3,500 gal 1995 Ford/Cusco Turbo-Vacuum unit
#45	2,000 gal 1999 Sterling/Cusco Stainless Steel Vacuum Truck, coded DOT
#48	2,000 gal 1990 Ford Vacuum truck, coded DOT 306, 307, 312
#60	3,000 gal 2008 Peterbuilt Turbo Vacuum Unit

Tanker Trailers

T-454	7,000 gal stainless steel, coded DOT 307, 312
T-459	6,800 gal stainless steel, coded DOT 307

Trucks/Trailers

1	Oil Spill Response Trailer – normally 2,300' boom (see boom update below - 40' van with inventory of sorbents, booms, recovery barrels, command center)
1	Oil Spill Response Trailer – normally 1,000' boom (see boom update below – 18" with johnboat, skimmer head, sorbents, etc.)
1	Spill Response Trailer – 18" enclosed – Absorbents, tools, PPE, etc.
3	Stake Trucks (#30, #31, & #32)
20	Operations Vehicles (Pickups, etc.)
1	46' Drop-deck-Side board kit & tarp (T-11)
1	42' Drop-deck-Side board kit & tarp (T-14)
1	43' Drop-deck w/pump gear (T-15)
1	43' Drop-deck, with steel containment (T-17)
1	48' Hyundai, 48' Box Van Trailer with 4000# lift gate (T-18)
1	48' Trail King Double Drop-Deck Extended (T-30)
2	Roll off Trailers
2	All-terrain vehicles
2	Flatbeds with tarp covers
3	Tractors (3 equipped with wet systems PTO)

1

14	20-yard roll-off boxes
1	20 yard vacuum box
1	Bobcat (sweeper, blade, bucket, backhoe attachments)

Skimmers

Drum skimmer – Abasco – Hydraulic - 50-gpm (2)
Drum Skimmer – Crucial – Pneumatic - 10-gpm (1)
Brush Skimmer – Lamor - 40-gpm (1)
Oleophilic rope – Oil Rope - 11 GPM (1)
Weir Skimmer Head - ACME Model VSV-39T - gpm varies based on pump (1)
Weir Skimmer Head – Slickbar Slurp – gpm varies based on pump (1)
KMA Pump Skimmer Flotation Collars – 150+ gpm based on pump (3)
Pump Skimming Plates - 6" (10) and 4" (3) – gpm varies based on pump

BUDA I Work Barge

36' x 12'
Twin 175 HP outboards
Debris catcher
12' x 20' Debris or boom hauling space
Marine radio
Enclosed Pilot Cabin

BUDA II Vacuum Barge

40' x 10', Diesel self-propelled
Twin 150 HP outboards
1000 CFM Blower/Vacuum
500 gallon storage capacity
Two Man Platforms
10' x 8' debris hauling space and debris catcher
Marine radio
Enclosed Cabin

Outboard Utility Boats

27' Command Ship *Red Anchor II*, equipped with marine radio (1)
24' Aluminum Rapid-Response Boat, 180HP
20' Aluminum work boat, 140 hp
17' Boom boat with Marine radios and outboard motors (1)
13' Boom boat with Marine radios and outboard motors (1)
20' Pontoon Work Boats, 90 HP (2)

MPC

High Capacity Pumping Systems

Six Complete Systems located in Detroit, Michigan. These high capacity submersible pump systems are effective for use in emergency transfers, dewatering, in addition to sewer and water system bypasses. They can be used with all liquid petroleum products, including low flash and highly viscous materials.

Special pumps are also available for caustics and acids. Each system contains:

Air or Water Cooled Diesel Power Pack

Cargo Hose
Hydraulic Hose
Fittings and Rigging
PPE
Submersible Hydraulic Pump

Submersible Hydraulically Powered Pumps (7 types)

Type 1 - KMA 333 stainless steel, chemical/viscous material
Type 2 - 3,000 GPM at 80' head (TK-6)
Type 3 - NiAl Bronze, Chemical/viscous material, 2250 GPM at 140' head, Butterworth access (CGN-150)
Type 4 - Auger type for viscous material (latex, molasses, etc.) 660 GPM at 165' head (Marflex)
Type 5 - Stainless Steel 600 GPM at 80' head (TK-4)
Type 6 - Stainless Steel 1,200 GPM at 100' head (TK-5)
Type 7 - 6" Submersible, 1,000 GPM at 65' head (Bryon Jackson)
Type 8 - 6" Submersible, double stage, 1050 GPM at 65' head

Fire fighting monitors at many locations - portable (2 or 3) gun monitor – Foam capable, can be powered by submersible pumps - spray and straight stream

A total of nineteen (19) additional systems are located in the following cities (map attached):

Boston, MA (1)	Baltimore, MD (1)	Long Beach, CA (1)
Houston, TX (1)	New Orleans, LA (1)	San Francisco, CA (1)
Seattle, WA (1)	Hong Kong (1)	Ashford, Kent, U.K. (1)
South Point, OH (1)	Savannah, GA (1)	Nikiski (Anchorage), AK (1)
New York Harbor (1)	Tampa, Florida (1)	Honolulu, HI (1)
San Juan, Puerto Rico (1)	Ketchikan, Alaska (1)	Singapore (1)

All pump systems are ready for immediate deployment to any point in the world.

MPC has stationed additional spill response equipment at most of the locations listed above. The spill response equipment that has been added to each location includes pneumatic marine fenders (5' x 10') and dual nozzle fire monitors.

MPC maintains one portable hydraulically driven "Hot-Tap" unit capable of making safe penetrations on steel plate and pipe. The "Hot-Tap" unit is deliverable with necessary valves and cutting tools to make 3", 4" or 6" taps while installing valves over access point.

3

MPC

Communications Equipment

Telephone (313) 849-2333 and (800) 521-8232
Facsimile (313) 849-1623
Digital 2-way communications devices
Portable 2-way radios (intrinsically safe available)
Marine radios and Mobile Marine radios

Boom

ACME 18" "O.K. Corral" containment boom (or equivalent)

Detroit, MI	11,400 feet
Bay City, MI	1,000 feet
Ferrysburg, MI	1,000 feet
Toledo, OH	1,000 feet
St. Ignace, MI	1,000 feet
Marysville, MI	1,000 feet
Munising, MI	300 feet
Hammond, IN	500 feet
Duluth, MN	1,000 feet

Absorbent Supplies:

Type	Quantity in stock (typical)
8" Boom	50 bales (8,000')
5" Boom	50 bales
Rolls	30 rolls
Pads	50 bales
Pillows	20 bales
Sweeps	20 bales

Note: All equipment availabilities subject to change.

4

2.3.3 T & T Marine Salvage Inc. Agreement

AN ENBRIDGE APPROVED SAFETY EXEMPTION/MITIGATION PLAN WILL BE REQUIRED PRIOR TO THE START OF FIELD WORK.

EMERGENCY RESPONSE SERVICES CONTRACT

THIS CONTRACT is entered into as of the 1st day of August, 2016 by and between **Enbridge (U.S.) Inc.**, a Delaware corporation with an address of 1100 Louisiana, Suite 3300, Houston, Texas 77002 (hereinafter "COMPANY") and **T & T Marine Salvage, Inc.**, a Texas corporation having an address of 9723 Teichman Road, Galveston, Texas 77554 (hereinafter "CONTRACTOR"). For this Contract, the term "COMPANY" includes any Affiliates of COMPANY and the term "CONTRACTOR" includes any Affiliates of CONTRACTOR. The term, "Affiliates" (including, the corollary terms "Affiliated companies" and "Affiliated entities") when used in this Contract with respect to a specified company or other legal entity, means another company or other legal entity that directly or indirectly through one of more intermediaries, controls or is controlled by or is under common control with the specified company or other legal entity. For the definition of Affiliates, the term "controls" (including, the corollary terms "controlling", "controlled by" and "under common control with") as used with respect to another company or other legal entity means, the possession, directly or indirectly, of the power to direct or cause the direction of the management or policies of another company or legal entity, whether through the ownership of: (i) voting stock or securities, (ii) partnership or membership interest, (iii) by contract, or (iv) otherwise. Employees of the COMPANY shall be deemed Affiliates of the COMPANY; employees of the CONTRACTOR shall be deemed Affiliates of the CONTRACTOR.

WITNESSETH:

THAT for and in consideration of the covenants, contract, terms, provisions and conditions hereinafter set forth, the parties do hereby mutually agree, each with the other, as follows:

ARTICLE 1 - SCOPE OF SERVICES

1.1 CONTRACTOR agrees to provide COMPANY, on an emergency basis, with services at Company's terminals, pipelines, stations, facilities, and any and all other assets of COMPANY (all hereinafter "Facilities") as may be required by COMPANY to mitigate, remediate, cleanup or remove the conditions caused by a release, spill or discharge into the environment of crude oil, petroleum products, chemicals and any and all other materials that COMPANY possesses, stores, handles, or transports (hereinafter "Spill Response Services"). CONTRACTOR will use due diligence to achieve the objectives agreed upon with COMPANY for that project, but cannot guarantee whether a particular result can or will be achieved or achieved in any particular time.

1.2 CONTRACTOR agrees, when called upon by COMPANY, that CONTRACTOR will respond with its best efforts using the necessary and appropriate personnel, equipment and supplies to provide Spill Response Services. Availability of all equipment and personnel of CONTRACTOR is subject to prior commitments. CONTRACTOR further agrees, when called upon by COMPANY, that CONTRACTOR will utilize its best efforts to provide Spill Response Services within response times stipulated by the COMPANY and/or applicable Federal and state laws, rules and regulations where such Spill Response Services have not already been committed to a previous response. CONTRACTOR also agrees to immediately notify COMPANY in writing in the event CONTRACTOR's response capability in the vicinity of the Great Lakes is reduced by 20% or more.

1.3 CONTRACTOR agrees that COMPANY may identify CONTRACTOR as a spill responder in any spill response plans required by or filed with applicable Federal and state governmental agencies including but not limited to the U.S. Coast Guard, provided COMPANY provides the CONTRACTOR the name, location, type of products and estimated worst case discharge.

1.4 In order to provide COMPANY with Spill Response Services capabilities, CONTRACTOR will:

a. maintain or subcontract individuals on 24 hour call trained in current release control and clean-up technology in accordance with OSHA HAZWOPER regulations 29CFR§1910.120 (including between 24 and 80 hours of training depending on the individual duties) and applicable regulations of the

[illegible]

Department of Transportation and its subordinate agencies. All personnel must have attended an accredited training course, if so required by law, and be capable of administering the Spill Response Services required in this Contract;

b. maintain or subcontract for fully equipped emergency release control units adequate to provide coverage in the states and locations listed in Exhibit B, Facilities and States for Coverage of Spill Response Services, attached hereto and made a part hereof; and

c. upon receipt of an initiation of a request for Spill Response Services ("Initiation") as provided in this Article 1 below and subject to availability, promptly dispatch resources to arrive on the scene of the release within the time frame specified in Exhibit B, attached hereto and made a part hereof.

1.5 COMPANY may initiate a Spill Response Service by a direct telephone call to CONTRACTOR at the number identified in Article 24 Notices. Upon initiating Spill Response Services, COMPANY shall provide to CONTRACTOR the following information:

Names and contact information for COMPANY's authorized representative(s) for the project;

Location of the project and any staging areas;

For spill response, the chemical and trade names of all substances involved and Material Safety Data Sheets (MSDSs) for the same;

Any information within COMPANY's knowledge relating to site safety or risks to the safety or health of CONTRACTOR's employees responding to the project, including, without limitation, information concerning toxic or hazardous material exposure threats and personal protective equipment requirements;

The nature of the goods and services requested; and

Any additional information requested by CONTRACTOR to effectuate the work to be performed.

CONTRACTOR shall, subject to availability, mobilize and dispatch initial CONTRACTOR personnel and resources within one and one-half (1 ½) hours after an Initiation. COMPANY shall, within a reasonable time thereafter, confirm all Initiations for Spill Response Services, notices of mobilization, standby and final authorizations to CONTRACTOR in writing, by issuance of a Work Order.

1.6 CONTRACTOR shall, upon receiving a call requesting Spill Response Services, obtain and document the name of the calling party, on-site contact, essential telephone numbers, substances involved, brief description of incident and incident site. CONTRACTOR's on-call person for the appropriate region or division will then be contacted with this information. CONTRACTOR's on-call person will immediately notify their supervisor or designate, and other personnel required (equipment operators, truck drivers, engineers, chemists, etc.) for the response. A certified hazardous materials manager or an industrial hygienist will be dispatched on all chemical spills. CONTRACTOR's on-call person and intended supervisor will call COMPANY to obtain any additional information needed and notify COMPANY of anticipated resources to be mobilized and estimated time of arrival (ETA) at the COMPANY Work Site. CONTRACTOR will then carry on with coordination of personnel and equipment to be sent to the COMPANY Work Site; make final preparation for departure to the COMPANY Work Site with initial resources; and mobilize and dispatch follow-up personnel and equipment as necessary. COMPANY and CONTRACTOR shall confer to decide, based on the magnitude of the incident, as to whether additional resources should be mobilized to the COMPANY Work Site. CONTRACTOR's on-call person will contact COMPANY on a periodic basis until CONTRACTOR's initial Spill Response Service crew arrives to inform COMPANY of response progress, a more definite ETA of CONTRACTOR resources and of all pertinent numbers. Records of all communication with COMPANY shall be maintained throughout the process. Upon arrival on-site and after initial assessment, CONTRACTOR's site supervisor, or designate, will establish communications with COMPANY immediately, and update it on the situation, the status of CONTRACTOR personnel and equipment that have arrived on COMPANY Work Site, and what other resources are on the way and ETA. Further communications with COMPANY will take place directly with CONTRACTOR's on-site supervisor, project manager, or designate.

1.7 COMPANY may limit its initiation to a notice of "mobilization-standby". If COMPANY so limits its initiation, CONTRACTOR will not dispatch equipment or personnel to the scene of the spill until COMPANY instructs CONTRACTOR to respond to the release. Upon receipt of such instruction, CONTRACTOR will respond to the release in the manner provided in Article 1.6 above. Upon CONTRACTOR's arrival at the release scene, COMPANY's Incident Commander or his/her designee will give CONTRACTOR final authorization to proceed with the Spill Response Services.

1.8 After an Initiation, the Spill Response Services shall automatically be downgraded to a "post emergency response" or "non-emergency/remedial effort" once the immediate threat of a release has been stabilized or eliminated and clean-up of the COMPANY Work Site has begun (as specified in OSHA 29CFR§1910.120). Downgrading of Spill Response Services to a post emergency response or non-emergency/remedial effort shall be determined solely by Company, unless a governmental agency controls such decision.

1.9 CONTRACTOR will provide the Spill Response Services set forth in this Contract to COMPANY within the geographical areas and for those COMPANY facilities set forth in Exhibit B to this Contract. CONTRACTOR shall make reasonable efforts to promptly notify COMPANY of any additions to or deletions of Facilities from Exhibit B to this Contract and shall give COMPANY written notice thereof within 30 days of the date of such change.

1.10 This Contract does not obligate COMPANY to order Spill Response Services from CONTRACTOR, but shall control and govern all Spill Response Services ordered by COMPANY from CONTRACTOR hereunder and shall define the rights and obligations of COMPANY and CONTRACTOR with regard to the matters covered hereby.

1.11 CONTRACTOR shall carry out the Spill Response Services under this Contract and shall furnish experienced personnel, supervision, small tools, transportation, licenses, insurance, permits, services and all other things necessary or required in and for the safe, proper and timely performance of the Spill Response Services. Further, CONTRACTOR shall furnish all materials and equipment as specified in the Job Order pursuant to the rates specified in CONTRACTOR's rate sheet.

1.12 CONTRACTOR understands and accepts that there may be known and unknown hazards and risks presented to human beings, property and the environment during the performance of Spill Response Services.

1.13 CONTRACTOR shall report to COMPANY in writing, any incident resulting in injury to any CONTRACTOR or subcontractor employee, COMPANY employee, or third party, within twenty-four (24) hours of occurrence or of CONTRACTOR having knowledge of such incident.

1.14 Notwithstanding anything to the contrary in this Contract, in the event that information developed during performance of the Spill Response Service gives rise to a reporting obligation to governmental authorities under Applicable Laws, CONTRACTOR shall immediately report this information to COMPANY, and COMPANY shall make the required reports to said governmental authorities.

1.15 COMPANY recognizes that CONTRACTOR is not required to accept any waste transportation or disposal services, in connection with Spill Response Services, provided by CONTRACTOR nor is CONTRACTOR obligated to offer such waste transportation and disposal services. Any such services will be provided as agreed by the parties.

1.16 CONTRACTOR shall serve as "Importer of Record" (as defined by Applicable Law) for all United States imports under this Contract. CONTRACTOR shall take no action to import or export any items intended to be part of the Work, into or out of a country other than the USA, without first notifying COMPANY and obtaining written approval from COMPANY for such import or export.

ARTICLE 2 – NON-EMERGENCY RESPONSE SERVICES

2.1 In connection with providing Spill Response Services, CONTRACTOR may be requested by COMPANY to provide limited environmental services, including, but not limited to additional cleanup outside the scope of Spill Response Services, remediation or studies.

2.2 CONTRACTOR at COMPANY's request will develop jointly with COMPANY, an emergency response

contingency plan. Such a contingency plan will be designed to be an extension to COMPANY's operation and would be directed by COMPANY personnel. It shall incorporate geographic response times, service type requirements, resource requirements, subcontractor recommendations and risk assessment information specifically for the locations specified at Exhibit D. CONTRACTOR will provide training, as necessary, to ensure that the subcontractors and COMPANY personnel understand the procedures set forth in Article 1 above. All costs for the preparation of the emergency response contingency plan and training as referenced herein shall be for the account of COMPANY.

2.3 CONTRACTOR shall, at the request of COMPANY and at COMPANY's expense, participate with COMPANY and any governmental agency designated by COMPANY in tests, inspections and drills to verify the availability and condition of the Spill Response Resources identified in Exhibit C to this Contract. CONTRACTOR shall fulfill the requirements to maintain its "OSRO" status at no charge to COMPANY and shall provide COMPANY with a copy of its certification by January 31 of each year.

2.4 CONTRACTOR shall immediately notify COMPANY of any safety related incident, including, but not limited to personal injury that occurs in connection with any Spill Response Services provided hereunder.

ARTICLE 3 – TERM

3.1 This Contract shall have a term of five (5) years commencing on August 1, 2016 and ending on July 31, 2021.

The term of this Contract shall be extended until completion of any outstanding Spill Response Services.

ARTICLE 4 – COMPANY WORK SITE

4.1 COMPANY Work Site shall mean a location owned, leased or controlled by COMPANY where Work will be performed.

ARTICLE 5 - COMPENSATION

5.1 Spill Response Services to be furnished during the term of this Contract shall be furnished at the rates agreed to in writing by the parties (the "Rate Sheet") as identified on Exhibit E "Compensation" attached hereto and made a part hereof unless otherwise provided in the applicable Job Order.

5.2 CONTRACTOR must give thirty (30) days advance written notice of proposed rate changes to the Rate Sheet. Such change will not apply to any Spill Response Services in progress at time of notice without COMPANY's written consent.

5.3 CONTRACTOR shall comply with the requirements and procedures regarding compensation as outlined in Exhibit E attached hereto.

ARTICLE 6 - PAYMENT

6.1 If required by COMPANY, each invoice must list each piece of equipment separately, with the description taken verbatim from the Rate Sheet submitted with the Contract. Material and/or third party equipment rentals shall include third party invoices as support.

6.2 COMPANY shall pay CONTRACTOR's invoice within thirty (30) days of receipt of such invoice by COMPANY's Accounts Payable Department. If undisputed sums are not paid when due, interest will be payable on any unpaid balance at the rate of 1.5% per month, commencing as of the date of the invoice. COMPANY's obligation to pay for goods and services provided hereunder is not conditioned upon COMPANY's recovery from any third party or underwriter, nor will CONTRACTOR look directly to any third party or underwriter for payment in the absence of a written agreement to do so signed by an officer of CONTRACTOR.

6.3 COMPANY may withhold payment for a disputed invoice or part thereof, without interest, including the right of set-off against any amount due CONTRACTOR until such dispute is resolved. If such disputed amount is resolved in favor of CONTRACTOR, COMPANY shall owe interest as refereoced in Section 6.2 above on the unpaid disputed amount.

6.4 Sums due CONTRACTOR shall be adjusted by deducting any amounts paid by COMPANY to prevent or remove liens, claims, debts and encumbrances which are the responsibility of CONTRACTOR, or its subcontractors, or to satisfy other obligations of CONTRACTOR or its subcontractors hereunder.

6.5 No payment made under this Contract shall constitute a waiver by COMPANY of the performance by CONTRACTOR of any of CONTRACTOR's obligations hereunder and any payment withheld shall be without prejudice to any other rights and remedies available to COMPANY. COMPANY shall be under no legal or contractual obligation to pay any invoices of CONTRACTOR, its subcontractors or vendors, physically received by COMPANY more than One Hundred Eighty (180) days after completion or termination of the Work under the applicable Job Order.

ARTICLE 7 - CHANGES IN THE SPILL RESPONSE SERVICES

7.1 All changes in the Work shall be approved by means of a written Change Order to the Work Order. No extra Work or claim for additional compensation or time to complete the Work shall be made without a written Change Order, signed on behalf of COMPANY by its Incident Commander or his/her designee and delivered to CONTRACTOR.

ARTICLE 8 – WARRANTY

8.1 CONTRACTOR warrants that it is experienced in the Spill Response Services to be undertaken on behalf of COMPANY, possesses the skills and resources to complete the Spill Response Services and has the authority to fulfill its obligations under this Contract. The Spill Response Services shall be performed in a good and workmanlike manner by qualified, careful and efficient workers in accordance with the Contract, in strict conformity with the best standard practices and in a manner protective of its employees, the public and the environment and in accordance with Applicable Laws, including the National and Area Contingency Plans. CONTRACTOR agrees that all Spill Response Services requiring specific licensing, certification, or training shall be performed by individuals possessing the requisite licenses, certifications, or training. Upon request, CONTRACTOR shall provide the COMPANY with true and accurate copies of such licenses, certifications, or training records.

8.2 CONTRACTOR warrants that all of CONTRACTOR's response personnel, including any and all subcontracted personnel, will be trained in spill and emergency response procedures. CONTRACTOR training will include personnel training necessary to meet applicable OSHA standards and any other standards imposed by law. CONTRACTOR will maintain records of personnel training and such records will be available for inspection by COMPANY and any and all requesting governmental agencies. CONTRACTOR agrees to take all necessary precautions, for the safety of its personnel and any and all subcontracted personnel.

8.3 CONTRACTOR represents and warrants to COMPANY that it is certified with the U.S. Coast Guard as an oil spill removal organization ("OSRO"). CONTRACTOR further represents and warrants to COMPANY that it has the resources required to provide Spill Response Services, as contemplated by the Oil Pollution Act of 1990 as may be amended from time to time or any similar state law. CONTRACTOR further warrants that it has available the Spill Response Resources identified in Exhibit C and will comply with the conditions identified in Article 8.1 above.

8.4 COMPANY may be contracting for Spill Response Services and the benefits derived therefrom as agent for its Affiliates. All of CONTRACTOR's warranties under this Contract, and any warranties made by manufacturers, suppliers, subcontractors or others acting in the interest of the parties to this Contract, shall inure to the benefit of such Affiliates, as well as to COMPANY. CONTRACTOR shall make certain that all warranties not previously issued to such Affiliates, where the Spill Response Services are performed for such Affiliates, are assigned to such Affiliates, upon completion of the Service.

8.5 CONTRACTOR warrants that it has neither created, nor contributed to the creation or the existence of, any Hazardous Wastes (as defined in Article 16) or any other type of hazardous or toxic waste, material, chemical, compounds, or any other type of environmental hazard or pollution, whether latent or patent, existing at the COMPANY Work Site before the date CONTRACTOR commences the Spill Response Services.

8.6 CONTRACTOR warrants that it shall conduct appropriate investigations to determine, with reasonable certainty, the location of utility lines (whether underground or overhead), underground storage systems, and

other any other subsurface or overhead structures of any kind before commencement of any drilling, excavation, or other Spill Response Services that has the potential to disturb these structures. CONTRACTOR further warrants that it shall conduct independent field investigations to confirm the location of subsurface or overhead structures before commencement of subsurface or overhead work and shall not rely exclusively on plot plans or other drawings provided by COMPANY in conducting these investigations. Such investigations to be invoiced to COMPANY pursuant to the rates outlined in CONTRACTOR'S rate sheet.

ARTICLE 9 - INDEMNITY

9.1 **CONTRACTOR AGREES TO PROTECT, DEFEND, INDEMNIFY AND HOLD HARMLESS COMPANY, ITS PARENTS, SUBSIDIARIES AND AFFILIATES, EACH OF THEIR OFFICERS, DIRECTORS, AGENTS, INSURERS, EMPLOYEES, INVITEES, AND EACH OF THEIR CONTRACTORS AND SUBCONTRACTORS AT ANY TIER, EACH OF THEIR VESSELS EMPLOYED IN CONNECTION WITH OR AS THE OBJECT OF THE SERVICES BEING CARRIED OUT UNDER THIS AGREEMENT, (THE FOREGOING SHALL COLLECTIVELY BE REFERRED TO AS THE "COMPANY GROUP," WHICH SHALL EXCLUDE ALL MEMBERS OF CONTRACTOR GROUP) FROM AND AGAINST ALL CLAIMS, DEMANDS, CAUSES OF ACTION OF ANY KIND AND CHARACTER WITHOUT LIMIT AND WITHOUT REGARD TO THE CAUSE OR CAUSES THEREOF OR THE NEGLIGENCE OR FAULT (ACTIVE OR PASSIVE) OF ANY PERSON OR ENTITY (INCLUDING THE SOLE, JOINT OR CONCURRING NEGLIGENCE OR FAULT OF ANY COMPANY GROUP MEMBER ON ANY THEORY), AND ANY THEORY OF STRICT LIABILITY AND ANY DEFECT OF PREMISES OR UNSEAWORTHINESS OF ANY VESSEL (WHETHER OR NOT PRE-EXISTING THE DATE OF THIS AGREEMENT) MADE, BROUGHT BY OR ON BEHALF OF ANY CONTRACTOR GROUP MEMBER (AS DEFINED HEREIN BELOW) ARISING OUT OF THIS AGREEMENT ON ACCOUNT OF PERSONAL INJURY, ILLNESS, DEATH, AND/OR LOSS OF OR DAMAGE TO PROPERTY.**

9.2 **COMPANY AGREES TO PROTECT, DEFEND, INDEMNIFY AND HOLD HARMLESS CONTRACTOR, ITS PARENTS, SUBSIDIARIES AND AFFILIATES, EACH OF THEIR OFFICERS, DIRECTORS, AGENTS, INSURERS, EMPLOYEES, INVITEES, EACH OF THEIR VESSELS EMPLOYED IN CONNECTION WITH OR AS THE OBJECT OF THE SERVICES BEING CARRIED OUT UNDER THIS AGREEMENT, AND EACH OF THEIR RESPECTIVE CONTRACTORS AND SUBCONTRACTORS AT ANY TIER (THE FOREGOING SHALL COLLECTIVELY BE REFERRED TO AS THE "CONTRACTOR GROUP," WHICH SHALL EXCLUDE ALL MEMBERS OF COMPANY GROUP) FROM AND AGAINST ALL CLAIMS, DEMANDS, CAUSES OF ACTION OF ANY KIND AND CHARACTER WITHOUT LIMIT AND WITHOUT REGARD TO THE CAUSE OR CAUSES THEREOF OR THE NEGLIGENCE OR FAULT (ACTIVE OR PASSIVE) OF ANY PERSON OR ENTITY (INCLUDING THE SOLE, JOINT OR CONCURRING NEGLIGENCE OR FAULT OF ANY CONTRACTOR GROUP MEMBER), AND ANY THEORY OF STRICT LIABILITY AND ANY DEFECT OF PREMISES OR UNSEAWORTHINESS OF ANY VESSEL (WHETHER OR NOT PRE-EXISTING THE DATE OF THIS AGREEMENT) MADE, BROUGHT BY OR ON BEHALF OF ANY COMPANY GROUP MEMBER, ARISING OUT OF THIS AGREEMENT ON ACCOUNT OF PERSONAL INJURY, ILLNESS, DEATH, AND/OR LOSS OF OR DAMAGE TO PROPERTY.**

9.3 **NOTWITHSTANDING ANYTHING CONTAINED IN THIS CONTRACT TO THE CONTRARY, EACH PARTY EXPRESSLY AGREES TO WAIVE AND EXCLUDE RECOVERY OF SPECIAL, PUNITIVE, INDIRECT, EXEMPLARY, OR CONSEQUENTIAL DAMAGES OR LOSSES ARISING OUT OF THIS CONTRACT, INCLUDING BUT NOT LIMITED TO LOSS OF USE, LOSS OF PROFIT, LOSS OF BUSINESS OR BUSINESS INTERRUPTION (COLLECTIVELY "CONSEQUENTIAL DAMAGES") FROM THE OTHER PARTY AND FROM CONTRACTOR GROUP AND/OR COMPANY GROUP, AS APPLICABLE. CONTRACTOR AGREES TO PROTECT, DEFEND, INDEMNIFY AND HOLD HARMLESS COMPANY GROUP FROM/FOR CONSEQUENTIAL DAMAGES ACCRUING IN FAVOR OF CONTRACTOR GROUP, AND COMPANY AGREES TO PROTECT, DEFEND, INDEMNIFY AND HOLD HARMLESS CONTRACTOR GROUP FROM/FOR CONSEQUENTIAL DAMAGES ACCRUING IN FAVOR OF COMPANY GROUP - ALL OBLIGATIONS HEREIN BEING WITHOUT REGARD TO THE CAUSE OR CAUSES THEREOF, THE NEGLIGENCE, FAULT OR LEGAL LIABILITY OF ANY ENTITY, OR THE UNSEAWORTHINESS OF ANY VESSEL.**

9.4 Notwithstanding anything to the contrary herein, it is understood and agreed that the Parties will at all times under this Agreement retain any exemption or limitation from liability ("Responder Immunity") pursuant to the Federal Water Pollution Control Act, as amended (FWPCA) 33 U.S.C.A. § 1251 et seq., the Oil Pollution Act of 1990, as amended (OPA-90) 33 U.S.C.A. § 2701 et seq., and any other applicable Federal, state or local law, regulation or ordinance which provides such responder immunity. Operation of such Responder Immunity shall be suspended if the applicable party is grossly negligent or engages in willful misconduct. For purposes of this indemnity, "gross negligence" shall not be deemed to include (a) lack of available equipment or personnel, (b) failure of equipment, (c) acts performed by the Parties at the direction of the U.S. Coast Guard or other governmental authority, or (d) acts performed by one party at the direction of the other, its members, or other contractors.

ARTICLE 10 - INSURANCE

10.1 Without limiting in any way the scope of any obligations or liabilities assumed hereunder by CONTRACTOR or COMPANY, CONTRACTOR and COMPANY where applicable or procure or cause to be procured and maintained at its expense, for the duration of this Contract, and with insurance companies designated by A.M. Best Company with a rating of A- or better and found acceptable to COMPANY, the insurance policies described below.

10.1.1 Workers' Compensation and Employer's Liability Insurance, including Worker's Compensation or other statutory insurance laws in the state having jurisdiction over such employees, and over the location where the Service is being performed. The Parties shall also provide coverage under the Longshoremen's and Harbor Worker's Compensation Act, where applicable. Employer's Liability Insurance shall have limits of One Million Dollars ($1,000,000) per occurrence, with an alternate employer endorsement.

10.1.2 General Liability Insurance including but not limited to the following extensions: contractual liability, cross liability or severability of interest clause, XCU hazards (explosion, collapse and underground), where an exposure exists and completed operations, deletion of non-owned watercraft exclusion, additional insured and waiver of subrogation, sudden & accidental pollution to cover liability for bodily injury (including death) and property damage with an amount not less than One Million Dollars ($1,000,000) per occurrence.

10.1.3 Contractor Environmental Liability Insurance, to cover losses including bodily injury, property damage and clean-up costs arising from pollution conditions that occur from the ongoing operations and completed operations of CONTRACTOR hereunder in connection with the assessment, sampling, remediation, cleanup, removal or disposal of pre-existing conditions caused by a release, spill or discharge into the environment of crude oil, petroleum products and other materials, with a combined single limit of Five Million Dollars ($5,000,000) per occurrence.

10.1.3.1 Cargo Pollution Liability Insurance, if owned, hired or non-owned automotive equipment is used in the performance of Hazardous Waste hauling operations within this Contract. Said policy shall cover losses from pollution conditions that arise from these operations, including bodily injury, sickness, disease, mental anguish or shock sustained by any person, including death; property damage including physical injury to or destruction of tangible property including the resulting loss of use thereof, clean-up costs, and the loss of use of tangible property that has not been physically injured or destroyed; and defense costs. Said policy shall be written on an occurrence basis, with limits of Five Million Dollars ($5,000,000) per occurrence.

10.1.4 Business Automobile Liability Insurance, if owned, hired or non-owned automotive equipment is used in the performance of this Contract, to cover liability for bodily injury and property damage with an amount not less than One Million Dollars ($1,000,000) per occurrence.

10.1.5 Aviation Liability or Non-owned Aviation Liability Insurance, if required or used in the performance of this Contract, for the ownership, operation and use (including chartering) of any aircraft and/or rental of any aircraft hangar, with an amount not less than Fifty Million Dollars ($50,000,000) per occurrence.

10.1.6 Protection & Indemnity Insurance, for operated, owned or chartered watercraft used in the performance

of this Agreement, coverage shall include liability for bodily injury and property damage subject to the SP-23 P&I form or equivalent with minimum limits of One Million Dollars ($1,000,000.00) per occurrence or higher as may be required by any laws or regulations of any governmental agency or subdivision. Such insurance shall be endorsed to specifically include full crew coverage, unless provided under other insurance, coverage for diving operations, if applicable, third party pollution buy-back endorsement, excess towers and collision liability, contractual liability, and removal of wreck of any vessel. Such insurance shall be endorsed to delete any "as owner" clause and any other language purporting to limit coverage to liability of an insured "as owner" of the vessel, blanket additional insured and waiver of subrogation, and cargo legal liability to the limit of the policy.

10.1.7 Vessel Pollution Liability, for operated, owned or chartered watercraft used in the performance of this Agreement, the current W.Q.I.S form of policy or equivalent with limits not less than Five Million Dollars ($5,000,000) covering The Oil Pollution Act, CERCLA and Non-OPA/Non-CERCLA.

10.1.8 Excess/Umbrella Insurance, providing following form coverage for Employer's Liability, General Liability, Business Automobile Liability, Vessel Pollution Liabilities, Sudden and Accidental Pollution Liability, and Protection & Indemnity. Limit of Liability: Nine Million Dollars ($9,000,000) any one accident or occurrence.

10.2 Duplication. Duplication of insurance coverage is not required. The Parties may provide the coverages and minimum limits required herein on different forms, or policies other than those specified, provided that the coverage is, in fact, provided as required by the terms of this Agreement.

10.3 Insurance Certificate. Company and Contractor will provide a certificate to the other evidencing the securing of such insurance where applicable, or confirming self-insurance as set forth above. The insurance maintained by Contractor will be endorsed to name Company as additional assured with a waiver of subrogation to the extent of the contractual liabilities assumed by Contractor in this Agreement and such endorsement shall additionally provide that Contractor's insurance shall be primary to any policy of Company covering the same risks. Insurance maintained by Company will be endorsed to name Contractor as additional assured with a waiver of subrogation to the extent of the contractual liabilities assumed by Company in this Agreement, and Company's insurance and/or self-insurance shall be primary to any policy of Contractor covering the same risks.

10.4 Subcontractors

CONTRACTOR shall require all its subcontractors to provide insurance of the same types and limits as required of CONTRACTOR. To the extent not provided for by the subcontractors and not covered by CONTRACTOR's insurance, deficiencies shall be the sole responsibility of CONTRACTOR.

ARTICLE 11 - DEFAULT

11.1 If CONTRACTOR should default in the performance of any of CONTRACTOR's obligations under this Contract, or if CONTRACTOR should file a petition or otherwise commence or authorize the commencement of a proceeding under any bankruptcy or similar law for the protection of creditors or have any such petition filed or proceeding commenced against it or its assets; otherwise become bankrupt or insolvent, however evidenced or be unable to pay its debts as they fall due, COMPANY may, without prejudice to any other rights or remedies it may have under this Contract or otherwise at law, immediately terminate this Contract, or any Work Order, regardless of anything to the contrary in this Contract, and take over and perform all or any part of the Work then remaining unperformed using either its own employees or another contractor.

11.2 If COMPANY should default in the performance of any of COMPANY's obligations under this Contract, or if COMPANY should file a petition or otherwise commence or authorize the commencement of a proceeding under any bankruptcy or similar law for the protection of creditors or have any such petition filed or proceeding commenced against it or its assets; otherwise become bankrupt or insolvent, however evidenced or be unable to pay its debts as they fall due, CONTRACTOR may, without prejudice to any other rights or remedies it may have under this Contract or otherwise at law, immediately terminate this Contract, or any Work Order, regardless of anything to the contrary in this Contract.

ARTICLE 12 - LIENS

12.1 CONTRACTOR shall keep the Spill Response Services and property upon which such Services are performed free and clear of all liens; however, nothing herein shall preclude CONTRACTOR from enforcing a lien for COMPANY's failure to timely pay its obligations under this CONTRACT. CONTRACTOR shall promptly and satisfactorily settle all claims, including lien claims of its subcontractors, for labor performed and supplies or materials furnished in connection with such Service, or, if allowed by Applicable Law, CONTRACTOR shall post suitable bond or security.

12.2 In the event COMPANY becomes aware of conditions, including, but not limited to action or failure to act by CONTRACTOR, that may lead to filing of a claim against the Work, then COMPANY shall be entitled to take actions to prevent such filing, including, but not limited to, issuance of two-party checks for reimbursement of portions of the Work performed by subcontractors, withholding payment of amounts otherwise due hereunder and availing itself of all available legal remedies.

ARTICLE 13 – TITLE

13.1 COMPANY shall at all times retain title to COMPANY-furnished permanent equipment.

ARTICLE 14 - TERMINATION

14.1 COMPANY shall have the right to terminate this Contract or the Spill Response Services, in whole or in part, without cause, at any time by notice in writing to CONTRACTOR. Upon receipt of any such notice, CONTRACTOR shall cease all Spill Response Services as provided in said notice and this Contract or the Spill Response Services shall terminate effective as of the date such notice is received by CONTRACTOR. In the event COMPANY terminates this Contract during CONTRACTOR's performance of Spill Response Services under a Work Order, the total settlement price through the date of cancellation shall be valued at the rates and prices on the services accrued prior to the cancellation, or if on a cost reimbursable basis, consistent with the time and material rates under this Contract. Further, COMPANY shall remain obligated to pay for CONTRACTOR's personnel and services on a portal to portal basis in accordance with CONTRACTOR's current price list, even if CONTRACTOR is ordered to discontinue its efforts before any services have been performed. In no event shall CONTRACTOR be entitled to anticipated profits or any damages because of such termination. CONTRACTOR will not be permitted to terminate this Contract while any Spill Response Services under outstanding Work Order(s) is not complete.

ARTICLE 15 - AUDIT RIGHTS

15.1 CONTRACTOR agrees to retain all records and accounts related to charges or CONTRACTOR invoices for a period of at least three (3) years from the completion date of any Spill Response Services performed pursuant to this Contract.

15.2 CONTRACTOR shall permit COMPANY or its designee (such designee to be agreed upon by COMPANY and CONTRACTOR) access to, either in the field or at the home office, for review and audit, at all reasonable times and at COMPANY's expense:

15.2.1 All records and accounts relating to costs and expenses invoiced to COMPANY under this Contract, including, but not limited to, DOT and OSHA records and reports, supporting documentation, and all reimbursable costs and expenses for the Spill Response Services;

15.2.2 All records required to validate payments of Social Security, payroll, unemployment, Workers' Compensation, or other federal, state, or local taxes or insurance, pursuant to Article 6.2 herein; and

15.2.3 All manuals, policies and procedures and other documentation supporting the processes by which CONTRACTOR performs employee background security checks, and supporting other formal and informal processes performed in order to ensure compliance with laws related to national security.

15.3 CONTRACTOR shall respond in writing to COMPANY within thirty (30) days of submission by COMPANY or its designee of its audit findings. CONTRACTOR shall work diligently with COMPANY to resolve any

differences with respect to the audit. Any adjustments or payments which must be made as a result of any such audit, inspection or examination of CONTRACTOR's invoices and/or records shall be made available within thirty (30) days of resolution of any adjustments to be made.

ARTICLE 16 - HANDLING OF WASTE

16.1 The term "Hazardous Waste(s)" refers to any and all wastes described or identified by characteristics or listing as hazardous under the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq., as amended, or similarly designated under any other federal, state, provincial and local statutes, ordinances, rules and regulations, all as amended.

16.2 The term "Waste(s)" refers to any discarded material, including any solid, liquid, semi-solid, or contained gaseous material, including but not limited to Hazardous Waste, which results or is generated during performance of the Spill Response Services hereunder.

16.3 Any Waste that contains Hazardous Wastes or other Wastes or constituents hazardous or detrimental to health, safety or the environment as defined by federal, state, provincial or local statutes, ordinances, rules and regulations, all as amended, after completion of testing and at COMPANY's expense, shall be transported to a location acceptable to COMPANY for final disposal, using a manifest signed by COMPANY as generator. COMPANY agrees to pay all costs associated with the storage, transport and disposal of such samples. COMPANY recognizes and agrees that CONTRACTOR is acting as a bailee of samples subject to manifest by COMPANY and at no time assumes title to said Waste.

16.4 Upon COMPANY's request, CONTRACTOR will assist COMPANY in arranging that all Waste is treated, stored, disposed of, labeled, transported and otherwise handled in a safe and prudent manner, and in compliance with all federal, state, provincial and local requirements. ***Notwithstanding anything to the contrary herein, COMPANY agrees to indemnify, defend and hold CONTRACTOR harmless from all costs, penalties and fees associated with the handling, transportation, treatment, storage and disposal of wastes associated with any project covered by this Agreement.***

ARTICLE 17 - CONFIDENTIALITY

17.1 All information obtained by the CONTRACTOR in the performance of this Contract not in the public domain shall be considered confidential by CONTRACTOR. CONTRACTOR agrees to prevent information and data which it or its employees, agents or subcontractors obtained, directly or indirectly, concerning the Spill Response Services, the COMPANY Work Site, or any of COMPANY's property, plans or operations, from being disclosed to others without the prior written consent of COMPANY. CONTRACTOR will use the information solely for performance of the Spill Response Services and for no other purpose. CONTRACTOR will not make or consent to publicity releases or announcements concerning this Contract or CONTRACTOR's participation in the Spill Response Services. CONTRACTOR shall not take photographs of the COMPANY Work Site or any of COMPANY's property without first obtaining COMPANY's written consent. CONTRACTOR shall require each of its subcontractors and agents to agree to the same limitations and obligations provided for in this paragraph. The provisions of this paragraph shall remain binding obligations on CONTRACTOR until the earlier of the date which is five (5) years after the expiration or termination of this Contract or the date the confidential information has become part of the public domain by means other than disclosures or releases prohibited by this Contract.

17.2 Upon completion of the Spill Response Services under this Contract, CONTRACTOR will (i) return all originals and copies of the confidential information to COMPANY, (ii) destroy any documents, reports, or drawings developed by CONTRACTOR and embracing confidential information of COMPANY, and (iii) remove from computer memory and diskettes all of said confidential information therein residing.

ARTICLE 18 - PROPRIETARY RIGHTS

18.1 All drawings, flow diagrams, sketches, specifications, field notes, photographs, computer printouts, computer data or other records, regardless of form (hereinafter collectively referred to as "Records") prepared by CONTRACTOR under the provisions of this Contract, shall be the property of COMPANY and may be used by COMPANY for any purpose. As part of the fulfillment of this Contract, CONTRACTOR shall deliver to COMPANY physical possession of all Records upon completion of the Service, or in the event the Service is

terminated for any reason, then immediately upon such termination of the Service. CONTRACTOR is permitted to keep a copy of the Records at its own expense. Ownership of all other intellectual property rights to work developed by CONTRACTOR under this Contract shall remain with CONTRACTOR.

ARTICLE 19 - COMPLIANCE WITH APPLICABLE LAW AND COMPANY POLICIES AND RULES

19.1 For purposes of this Contract, the term "Applicable Law" shall mean any applicable treaty, constitution, charter, act, statute, federal, state and local laws, ordinance, code, rule, regulation, resolution, permit, order, decree, mandate, injunction, writ, directive, interpretation, or final non-appealable judgment adopted, enacted, issued, promulgated or ratified by any governmental entity and having the force of law, including, but not limited to, those laws affecting employment, business opportunities, national security, the environment, those pertaining to employment or working conditions, workers' compensation, social security, federal, state and local income tax withholding, unemployment insurance, the Occupational Safety and Health Act, the Immigration Reform and Control Act of 1986, the Americans with Disabilities Act, 29 C.F.R. Part 1910.1200, Hazard Communication; 29 C.F.R. Part 1910.120, Hazardous Waste Operations & Emergency Response (HAZWOPER); 29 C.F.R. Part 1910.147, Control of Hazardous Energy; 29 C.F.R. 1910.146, Permit-Required Confined Spaces; 29 C.F.R. Part 1926.650-652, Excavations, Trenching and Shoring; 29 C.F.R. Part 1910.1028, Benzene; 29 C.F.R. Part 1910.119, Process Safety Management; 29 C.F.R. 1910, Subpart L, Fire Protection or that relate to CONTRACTOR, COMPANY, the Work or the COMPANY Work Site.

19.2 CONTRACTOR will fully comply with Applicable Law. CONTRACTOR is responsible for the timely payment of any and all employment-related taxes with respect to Service performed by CONTRACTOR. In the event that CONTRACTOR's employees or its subcontractors' employees are deemed to be COMPANY employees by any government authority, CONTRACTOR shall reimburse COMPANY for any corresponding taxes or fees paid by the COMPANY.

19.3 CONTRACTOR acknowledges receipt of, has read and understands, and shall abide by COMPANY's Policies applicable to CONTRACTORS, a list of which is attached and made a part hereof as Exhibit A and which may be amended from time to time by COMPANY.

19.4 CONTRACTOR also acknowledges receipt of, and shall abide by COMPANY's Contractor Safety Rules and Procedures Manual, if applicable, while performing any Service hereunder. In addition, CONTRACTOR shall abide by site-specific safety and security rules of COMPANY Work Site locations where Work is performed.

ARTICLE 20 - INDEPENDENT CONTRACTOR

20.1 CONTRACTOR is an independent contractor with the right to supervise, manage, control, and direct the manner and methods for performing the Spill Response Services. COMPANY is interested only in the results to be obtained; provided, however, the COMPANY shall be entitled to review and inspect the Spill Response Services to ensure compliance with applicable requirements and ensure that safety, security and protection of the environment are not compromised.

20.2 COMPANY shall have the right to request removal from services hereunder any employee(s) of CONTRACTOR who in COMPANY's reasonable sole opinion, has engaged in improper conduct, is not performing in a satisfactory manner or is not qualified to perform assigned Service. CONTRACTOR shall promptly comply with such request.

ARTICLE 21 - FORCE MAJEURE

21.1 The term "force majeure," as used herein, shall mean an unforeseen event or occurrence beyond the reasonable control and without the fault or negligence of the affected party including, but not limited to, earthquakes, fire, explosions, malicious mischief, insurrection, riot, strikes, lockouts, boycotts, picketing, labor disputes or disturbances, (excluding strikes, lockouts, boycotts, pickets, labor disputes or disturbances or other industrial disputes or action involving the either party's employees or their subcontractors or vendors or any of their employees acts of the public enemy, war (declared or undeclared), compliance with any order or directive of any governmental agencies or authorities or representatives of any government acting under claim or color of authority, loss of transportation facilities ordinarily available to and used by a party in the performance of the obligations imposed by this Contract; where such event, occurrence or compliance would render the affected party's performance illegal or physically impossible.

21.2 Neither CONTRACTOR nor COMPANY shall be under any obligations or subject to any liability for failure to carry out respectively the terms and provisions of this Contract during the time and to the extent that such failure is due solely to force majeure. The party affected by force majeure must give notice stating the time of occurrence and full particulars of the force majeure in writing, to the other party as soon as possible after the occurrence of the force majeure. The obligation of the party giving notice of force majeure shall be suspended during the continuance of the force majeure event. Nothing in this Article shall be construed to relieve either party of its obligation to pay monies due under the Contract.

ARTICLE 22 - SUBCONTRACTING AND ASSIGNMENTS

22.1 CONTRACTOR may subcontract any part of the Spill Response Services with prior written approval of COMPANY, but CONTRACTOR shall not be relieved of or released from, any of its obligations or responsibilities under this Contract. COMPANY expressly reserves the right to approve or disqualify subcontractors recommended by CONTRACTOR to perform the Work. For purposes of this Contract, Spill Response Services performed by subcontractors shall be deemed to be Service performed by CONTRACTOR. If requested, CONTRACTOR shall provide COMPANY with an executed copy of each subcontract and purchase order issued by CONTRACTOR for the performance of the Service. CONTRACTOR shall ensure that the terms and conditions of any such subcontract or purchase order shall comply with and correspond to the terms and conditions of this Contract. Changes in subcontractors, nature of Service sublet, or scope of Service sublet shall also be subject to the prior written approval of COMPANY.

22.2 Neither this Contract nor any rights thereunder shall be assignable by CONTRACTOR without the prior written consent of the COMPANY and any such assignment without COMPANY's prior written consent will be void as to COMPANY.

ARTICLE 23 - GOVERNING LAW

23.1 The validity, interpretation and performance of this Contract shall be governed and construed in accordance with the laws of the state where the COMPANY Work Site is located as referenced in the applicable Job Order without reference to the choice of law doctrine of such state.

ARTICLE 24 - NOTICES

24.1 No notice required or permitted hereunder shall be valid unless given in writing and shall be deemed to have been validly given only if delivered in person or sent by registered or certified mail, postage prepaid, return receipt requested, facsimile or commercial courier to:

COMPANY
Enbridge (U.S.) Inc.
Attn: Law Dept and Emergency Response Dept.
1100 Louisiana, Suite 3300, Houston, Texas 77002

CONTRACTOR
T & T Marine Salvage, Inc.
[redacted]
9723 Teichman Road
Galveston, Texas 77554
24 Hour Emergency Phone: 409-744-1222
Secondary Emergency Phone: 586-773-5246

ARTICLE 25 - ENTIRETY OF CONTRACT

25.1 This Contract, any Work Order issued hereunder and attachments to this Contract or any Work Order represent the entire understanding and agreement between the parties hereto and supersedes any and all prior contracts, whether written or oral, that may exist between the parties regarding the Spill Response Services. No terms, conditions, prior course of dealings, course of performance, usage or trade, understandings, purchase orders, or contract purporting to modify, vary, supplement or explain any provision of this Contract shall be effective unless in writing and signed by representatives of both parties authorized to amend this Contract.

25.2 This Contract may be amended or modified only by written amendment signed by both parties. Any attempt by either party, through a Work Order, purchase order, invoice, or other document, to vary in any degree any of the terms of this Contract shall be deemed immaterial and shall be void, unless this provision is expressly waived in an amendment executed as specified hereinabove.

ARTICLE 26 - SEVERABILITY

26.1 The provisions of this Contract are severable, and if any clause or provisions hereof shall be held invalid or unenforceable in whole or in part in any jurisdiction, then such invalidity or unenforceability shall affect only such clause or provision, or part thereof, in such jurisdiction and shall not in any manner affect such clause or provision in any other jurisdiction, or any other clause or provision in this Contract in any jurisdiction. Any such clause or provision held invalid or unenforceable, in whole or in part, to the extent permitted by law, shall be restricted in applicability or reformed to the minimum extent required for such clause or provision to be enforceable.

ARTICLE 27 - BINDING EFFECT

27.1 All rights conferred by this Contract shall be binding upon, inure to the benefit of, and be enforceable by or against the respective successors and assigns of the parties hereto.

ARTICLE 28 – HEADINGS

28.1 The subject headings in this Contract are for convenience only and are not determinative of the substance of the subject clause.

ARTICLE 29 - WAIVER

29.1 Any waiver by either party of any provision or condition of this Contract shall not be construed or deemed to be a waiver of any other provision or condition of this Contract, nor a waiver of a subsequent breach of the same provision or condition, unless such waiver is expressed in writing and signed by the parties. COMPANY's consent to delay in the performance by CONTRACTOR of any obligation shall not be applicable to any other obligation. Delay in the enforcement of any remedy in the event of a breach of any term or condition, or in the exercise by either party of any right, shall not be construed as a waiver of such remedy or right.

ARTICLE 30 - ETHICAL BUSINESS PRACTICES

30.1 No director, officer, employee or agent of CONTRACTOR shall give or receive any commission, fee, rebate, or gift, except those articles of nominal value given as sales promotion or holiday remembrances, or the value of reasonable entertainment consistent with local social and business custom, or enter into any business arrangement with any director, employee or agent of COMPANY without prior written notification thereof to COMPANY. CONTRACTOR shall promptly notify COMPANY of any violation of this paragraph and any consideration received as a result of such violation shall be paid or credited to COMPANY.

30.2 CONTRACTOR shall disclose in writing and shall assist COMPANY in identifying any financial transactions between any employee of COMPANY, including family members, and CONTRACTOR, its officers, directors, shareholders/owners and employees.

ARTICLE 31 - SURVIVAL

31.1 Except as otherwise provided herein warranties, covenants and obligations at Articles 8, 9, 15, and 17 shall survive termination or cancellation of this Contract, regardless of the reason for such termination or cancellation, and shall continue in full force and effect.

ARTICLE 32 – PRECEDENCE

32.1 In the event of a conflict between the terms and conditions in the Contract and those contained in the Work Order, the terms and conditions of the Contract shall control. In the absence of a written Work Order, the terms and conditions of the Contract shall apply.

IN WITNESS WHEREOF, the parties hereto by their duly authorized representatives have executed this Contract as of the day and year first above written.

CONTRACTOR:
T & T Marine Salvage, Inc.

By: [redacted]
Printed Name:
Title:
Taxpayer ID #:

COMPANY:
Enbridge (U.S.) Inc.

By: [redacted]
Printed Name:
Title:

2.3.4 T & T Marine Salvage, Inc. Facilities and Equipment

Exhibit B

T&T Marine Salvage, Inc.
Response Times

Road Travel Time is determined using Google Maps
Air Travel Time is determined by T&T's Owned Jet
Note: Actual times will vary depending on traffic and other factors

Great Lakes Response Center - Roseville, Mi

		Time	
Location	**Miles**	**Road**	**Air**
Port Huron, Mi	47	0 Hour 45 Minutes	
Toledo, Oh	74	1 Hour 30 Minutes	
Marshall, Mi	121	2 Hour 0 Minutes	
Kalamazoo, Mi	155	2 Hour 30 Minutes	
Buffalo, Ny	253	4 Hour 0 Minutes	
Mackinaw City, Mi	288	4 Hour 20 Minutes	
Chicago, Il	296	4 Hour 40 Minutes	
Milwaukee, Wi	396	6 Hour 0 Minutes	
Green Bay, Wi	515	7 Hour 45 Minutes	
New Tork, Ny	629	10 Hour 0 Minutes	
Superior, Wi	700	11 Hour 40 Minutes	
Duluth, Mn	720	11 Hour 40 Minutes	
Fargo, Nd	950	14 Hour 0 Minutes	

Gulf Coast Response Center - Galveston, Tx

		Time	
Location	**Miles**	**Road**	**Air**
Toledo, Oh	1,283	20 Hour 30 Minutes	2 Hours 30 Minutes
Roseville, Mi	1,393	21 Hours 15 Minutes	2 Hours 30 Minutes
Mackinaw City, Mi	1,509	23 Hour 0 Minutes	2 Hours 50 Minutes
Buffalo, Ny	1,527	24 Hour 0 Minutes	2 Hours 45 Minutes
New Tork, Ny	1,645	24 Hour 30 Minutes	3 Hours 0 Minutes

T&T Marine Salvage, Inc. Equipment List

Floating Assets

Item	Number	Description	Location
D/B BIG-T	1	182' x 68' x 13.5', 600-Ton Derrick Barge, 300-Ton Jib	9723 Teichman Road Galveston, TX 77554
D/B BIG RUDY	1	195' x 72' x 12.5', 600-Ton Derrick Barge, 300-Ton Jib	735 Peters Road Harvey, LA 70058
D/B KEVIN-T	1	300-Ton Ringer Barge measuring 180' x 72' x 10'	9723 Teichman Road Galveston, TX 77554
C/B CURTIS-T	1	230-Ton Crane Barge measuring 150' x 60' x 8'	9723 Teichman Road Galveston, TX 77554
C/B GEORGE-T	1	150-Ton Crane Barge measuring 130' x 52' x 8'	9723 Teichman Road Galveston, TX 77554
Deck Barges	2	120' x 30' x 7'	9723 Teichman Road Galveston, TX 77554
Deck Barge	1	60' x 29' x 4'	9723 Teichman Road Galveston, TX 77554
Work Floats	8	20' x 8'	9723 Teichman Road Galveston, TX 77554
Inland Push Boats	4	1,200 HP to 800 HP	9723 Teichman Road Galveston, TX 77554
Offshore Crew Boats	3	110' triple screw 2,100 HP capable of carrying deck cargo and up to 56 passengers	9723 Teichman Road Galveston, TX 77554
Offshore Crew Boat	1	65' twin screw 1,400 HP	9723 Teichman Road Galveston, TX 77554
Fast Response Vessels	1	35' triple screw 900 HP, 74 MPH	9723 Teichman Road Galveston, TX 77554
Fast Response Vessels	7	26' to 45' twin screw 500 HP to 300 HP with large deck area	9723 Teichman Road Galveston, TX 77554
Fast Response Vessels	4	22' to 26' Twin Outboard	30580 Edison Drive Roseville, MI 48066
Dredge Vessel	1	Portable 6" or 4" dredge hydraulic operated built to recover Group V oils	9723 Teichman Road Galveston, TX 77554
Work Boats	8	18' to 16' single outboard	9723 Teichman Road Galveston, TX 77554
Work Boats	6	10' to 18' single outboard	30580 Edison Drive Roseville, MI 48066
Work Boats	4	16' to 18' single jet drive	30580 Edison Drive Roseville, MI 48066
Work Boats	7	10' to 16' Jon Boat Single Outboard	30580 Edison Drive Roseville, MI 48066
Work Boat	1	14' Work Barge	30580 Edison Drive Roseville, MI 48066
Work Platform	1	14' Pontoon Work Platform	30580 Edison Drive Roseville, MI 48066
Work Boats	1	38' Pontoon Work Barge Single Outboard	30580 Edison Drive Roseville, MI 48066

Vehicles/Trailers

Item	Number	Description	Location
Vacuum Truck	1	70 Bbl Stainless Steel Tank with VOC Scrubber	9723 Teichman Road Galveston, TX 77554
Vacuum Truck	1	70 Bbl Stainless Steel Tank	9723 Teichman Road Galveston, TX 77554
Response Vehicles	30	Tractor trucks, pick-up trucks, vans, box trucks, ATV's	9723 Teichman Road Galveston, TX 77554
Response Vehicles	6	Pick-up trucks	30580 Edison Drive Roseville, MI 48066
Response Vehicle	1	Stake Truck	30580 Edison Drive Roseville, MI 48066

53' Command Trailer	1	Full communications including cellular/land-line phones/fax, complete office equipment, broad range of radio communications, satellite internet access, satellite TV, 60' telescoping antenna	9723 Teichman Road Galveston, TX 77554
44' Command Trailer	1	Full communications including cellular/land-line phones/fax, complete office equipment, broad range of radio communications, satellite TV, 50' telescoping antenna, supplies in rear of trailer	9723 Teichman Road Galveston, TX 77554
20' Command Trailer	2	Used as stand alone or in connection with larger trailers	9723 Teichman Road Galveston, TX 77554
Antenna Trailer	1	Used for remote video system, repeater tower, light tower	9723 Teichman Road Galveston, TX 77554
Dive Trailers	2	Stocked with complete shallow water diving systems	9723 Teichman Road Galveston, TX 77554
Response Trailers	5	Stocked with complete spill response gear	9723 Teichman Road Galveston, TX 77554
Response Trailers	5	Stocked with complete spill response gear	30580 Edison Drive Roseville, MI 48066
Equipment trailers	12	40' - 12'	9723 Teichman Road Galveston, TX 77554
Enclosed Trailers	8	32' - 16'	9723 Teichman Road Galveston, TX 77554
Diving Assets			
Item	**Number**	**Description**	**Location**
Control Units	6	Climate controlled control houses	9723 Teichman Road Galveston, TX 77554
Control Units	2	Climate controlled control house	735 Peters Road Harvey, LA 70058
Shallow Water Package	8	Complete system for diving to 50' water depth	9723 Teichman Road Galveston, TX 77554
Shallow Water Package	2	Complete system for diving to 50' water depth	735 Peters Road Harvey, LA 70058
Dive Chamber	2	With Med Lock	9723 Teichman Road Galveston, TX 77554
Hot Water Heaters	4	Cold Water Diving	9723 Teichman Road Galveston, TX 77554
Video Units/Camera	8	Underwater video system	9723 Teichman Road Galveston, TX 77554
Video Units	2	Underwater video system	735 Peters Road Harvey, LA 70058
Hull/Propeller Cleaning	2	Two brush hydraulic	9723 Teichman Road Galveston, TX 77554
Hull/Propeller Cleaning	2	Two brush hydraulic	735 Peters Road Harvey, LA 70058
Hull Cleaning	1	Three brush hydraulic	9723 Teichman Road Galveston, TX 77554
Hull Cleaning	2	Three brush hydraulic	735 Peters Road Harvey, LA 70058

Hot Tap Systems			
Item	**Number**	**Description**	**Location**
TTMS-2000*	1	Remote hot tap system capable of attaching to submerged object to remove fluids	9723 Teichman Road Galveston, TX 77554
Hydraulic Hot Tap	3	Diver controlled hot tap capable of drilling a 12" hole	9723 Teichman Road Galveston, TX 77554
Hydraulic Power Unit			
Item	**Number**	**Description**	**Location**
DHP-200EX	2	Zone II Lloyds approved, 54 GPM @ 5,000 psi	9723 Teichman Road Galveston, TX 77554
DHP-280	4	74 GPM @ 5,000 psi	9723 Teichman Road Galveston, TX 77554
DHP-280	1	74 GPM @ 5,000 psi	30580 Edison Drive Roseville, MI 48066
DHP-120	12	32 GPM @ 5,000 psi	9723 Teichman Road Galveston, TX 77554
HT75DJD	4	40 GPM @ 2,500 psi	9723 Teichman Road Galveston, TX 77554
TT-35	3	30 GPM @ 3,000 psi	9723 Teichman Road Galveston, TX 77554
TTHP-12	8	12 GPM a 2,500 psi	9723 Teichman Road Galveston, TX 77554
HPUD-04-12	1	70 HP HPU 31 GPM @ 2900 PSI	30580 Edison Drive Roseville, MI 48066
HPU	20	Various sizes 3 GPM to 10 GPM	30580 Edison Drive Roseville, MI 48066
Hydraulic Submersible Pumps			
Item	**Number**	**Description**	**Location**
MSP-700	4	6", 3,300 GPM/495' head, used for foodstuff, molasses, fuel oil, salvage	9723 Teichman Road Galveston, TX 77554
MSP-500	2	6", 2,200 GPM	9723 Teichman Road Galveston, TX 77554
MSP-150	12	6", 1,800 GPM/344' head, used for foodstuff, molasses, fuel oil, salvage (high viscosity materials)	9723 Teichman Road Galveston, TX 77554
MSP-150	1	6", 1,800 GPM/344' head, used for foodstuff, molasses, fuel oil, salvage (high viscosity materials)	30580 Edison Drive Roseville, MI 48066
MSP-200	12	6", 1,545 GPM	9723 Teichman Road Galveston, TX 77554
TK-150	1	6", 1,455 GPM/200' head, used for foodstuff, molasses, fuel oil, chemicals, salvage	30580 Edison Drive Roseville, MI 48066
MSP-300 (SS)	33	4", 1,455 GPM/344' head, used for foodstuff, molasses, fuel oil, chemicals, salvage	30580 Edison Drive Roseville, MI 48066
MSP-300 (aluminum)	24	4", 1,455 GPM/344' head, used for foodstuff, molasses, fuel oil, salvage	30580 Edison Drive Roseville, MI 48066
MSP-300 (SS)	15	4", 1,455 GPM/344' head, used for foodstuff, molasses, fuel oil, chemicals, salvage	9723 Teichman Road Galveston, TX 77554
MSP-300 (aluminum)	6	4", 1,455 GPM/344' head, used for foodstuff, molasses, fuel oil, salvage	9723 Teichman Road Galveston, TX 77554
MSP 125 / 120 / 100	4	4", 800 GPM	9723 Teichman Road Galveston, TX 77554
S6P	4	1,200 GPM	9723 Teichman Road Galveston, TX 77554
S3TC	4	450 GPM	9723 Teichman Road Galveston, TX 77554
Mono Pump	8	4", exptremely viscous material handling	9723 Teichman Road Galveston, TX 77554
Booster Pump	2	3" - 8", high viscous long range pumping	9723 Teichman Road Galveston, TX 77554
Dredge Pump	1	4" Gulf Atlantic Dredge Pump	30580 Edison Drive Roseville, MI 48066

Dredge Pump	1	6" Gulf Atlantic Dredge Pump	30580 Edison Drive Roseville, MI 48066
Screw Pump	2	Lamor GTA50 4" Archimedes Screw Pump	30580 Edison Drive Roseville, MI 48066
Dewatering Pump	1	2" Hydratech Dewatering Pump	30580 Edison Drive Roseville, MI 48066
Dewatering Pump	1	3" Hydratech Dewatering Pump	30580 Edison Drive Roseville, MI 48066
Marco Pump	1	3" Marco Pump	30580 Edison Drive Roseville, MI 48066
Jet Pumps			
Item	**Number**	**Description**	**Location**
Jet Pump	3	6" x 4" 800 GPM x 190 PSI	9723 Teichman Road Galveston, TX 77554
Miscellaneous Pumps			
Item	**Number**	**Description**	**Location**
Sludge Master	3	4", 750 GPM hydraulic poppit pump	9723 Teichman Road Galveston, TX 77554
Centrifugal pumps	20	6,000 GPM to 90 GPM	9723 Teichman Road Galveston, TX 77554
Air Diaphragm	10	3' to 4", aluminum, stainless steel and plastic	9723 Teichman Road Galveston, TX 77554
Discharge Hose			
Item	**Number**	**Description**	**Location**
6"	3,000'	Fuel transfer	9723 Teichman Road Galveston, TX 77554
6"	300'	Fuel transfer	30580 Edison Drive Roseville, MI 48066
4"	6,000'	Fuel transfer	9723 Teichman Road Galveston, TX 77554
2"	1,000'	Fuel transfer	9723 Teichman Road Galveston, TX 77554
4"	3,200'	Composite (chemical)	9723 Teichman Road Galveston, TX 77554
6"	400'	Composite (chemical)	9723 Teichman Road Galveston, TX 77554
6"	1,000'	Layflat	9723 Teichman Road Galveston, TX 77554
6"	3,000'	Fuel transfer	9723 Teichman Road Galveston, TX 77554
Inert Gas / Nitrogen Generators			
Item	**Number**	**Description**	**Location**
Inert Gas Generator	1	portable 2,000 M3/hour @ 0.15 bar	9723 Teichman Road Galveston, TX 77554
Nitrogen Generator	1	portable, 500 m3/hour @ 8 bar	9723 Teichman Road Galveston, TX 77554
Miscellaneous Salvage Assets			
Item	**Number**	**Description**	**Location**
Crawler Cranes	1	70-Ton	9723 Teichman Road Galveston, TX 77554
Mobile Hydraulic Cranes	4	60 to 35 ton	9723 Teichman Road Galveston, TX 77554
Hydraulic Excavators	1	90,000 pound	9723 Teichman Road Galveston, TX 77554
Bulldozer	1	Case 1150	9723 Teichman Road Galveston, TX 77554
Forklift	8	44,000 to 5,000 pound	9723 Teichman Road Galveston, TX 77554

Forklift	1	8,000 Pound	30580 Edison Drive Roseville, MI 48066
Pneumatic Roller Bags	40	9,000 ton total capacity	9723 Teichman Road Galveston, TX 77554
Generators	12	250Kw to 4Kw	9723 Teichman Road Galveston, TX 77554
Pneumatic Fenders	8	3.5m x 2m Yokohama	9723 Teichman Road Galveston, TX 77554
AirLifts	5	18" to 6"	9723 Teichman Road Galveston, TX 77554
Buckets	4	Clam shell, grapple	9723 Teichman Road Galveston, TX 77554
Salvage Chisel	1	30' x 48"	9723 Teichman Road Galveston, TX 77554
Underwater Magnet	1	66"	9723 Teichman Road Galveston, TX 77554
Welding Machines	10	Portable diesel	9723 Teichman Road Galveston, TX 77554
Spooling Machines	2	Up to 13.5' diameter by 20' wide spools	9723 Teichman Road Galveston, TX 77554
Rigging		Various shackles, wire rope, kevlar and chain	9723 Teichman Road Galveston, TX 77554
ROV			
Item	**Number**	**Description**	**Location**
Outland 1000	2	1,000' water depth with manipulator arm	9723 Teichman Road Galveston, TX 77554
Video Ray Pro 3 GTO	1	500' water depth with manipulator arm	9723 Teichman Road Galveston, TX 77554
Accessories		Fiber optic gyro system, scanning sonar, imaging sonar, altimeter, LARS, recording systems, portable climate controlled command units	9723 Teichman Road Galveston, TX 77554
Fire Pump Assets			
Item	**Number**	**Description**	**Location**
TT-1400 B	1	6,000 GPM skid mounted fire pump with (3) monitors	Galveston, TX 77554
TT-1400	1	6,000 GPM skid mounted fire pump with (1) monitor, built-in foam proportioner	735 Peters Road Harvey, LA 70058
TT-1400	1	6,000 GPM skid mounted fire pump with (1) monitor, built-in foam proportioner	9723 Teichman Road Galveston, TX 77554
TT-750	4	3,300 GPM skid mounted fire pump with (1) monitor, built-in foam proportioner	9723 Teichman Road Galveston, TX 77554
TT-450	2	2,000 GPM skid mounted fire pump with (1) built-in monitor	9723 Teichman Road Galveston, TX 77554
TT-400	2	1,500 GPM skid mounted fire pump with (1) built-in monitor and built-in foam proportioner	9723 Teichman Road Galveston, TX 77554
TT-400	1	1,500 GPM skid mounted fire pump with (1) built-in monitor and built-in foam proportioner	30580 Edison Drive Roseville, MI 48066
Miscellaneous Fire Fighting Assets			
Item	**Number**	**Description**	**Location**
AFFF	10,200	Gallons Foam	9723 Teichman Road Galveston, TX 77554
AFFF	15,000	Gallons Foam	9723 Teichman Road Galveston, TX 77554
Monitor	3	Portable	9723 Teichman Road Galveston, TX 77554
Monitor	1	Portable	30580 Edison Drive Roseville, MI 48066
Fittings		Various wye, splitters, etc.	9723 Teichman Road Galveston, TX 77554

Eductors		Various	9723 Teichman Road Galveston, TX 77554
Bunker Gear	12	Complete set	9723 Teichman Road Galveston, TX 77554
SCBA	15	Complete set	9723 Teichman Road Galveston, TX 77554
SCBA	3	Complete set	30580 Edison Drive Roseville, MI 48066
HP Air Compressor	1	Diesel Portable	9723 Teichman Road Galveston, TX 77554
Hand Lines	3,000'	Various 5" and under	9723 Teichman Road Galveston, TX 77554
Hand Nozzles	12	Various	9723 Teichman Road Galveston, TX 77554
Skimming Assets			
Item	**Number**	**Description**	**Location**
Skimming Barges	2	CLEAN CHANNEL 2 & 3, 120' x 30' x 7' shallow water skimmers with 1,500 Bbl storage capacity complete with accomodations, eletric, air and hydraulic systems, heating coils in storage tanks. Working draft of 1.5'.	9723 Teichman Road Galveston, TX 77554
Skimming Arms	5 Sets	High capacity skimming system with a derated capacity of 9,100 Bbls/day/arm capable of pumping high viscous material	9723 Teichman Road Galveston, TX 77554
Skimming Arms	6 Sets	High capacity skimming system with a derated capacity of 9,100 Bbls/day/arm capable of pumping high viscous material	735 Peters Road Harvey, LA 70058
Skimming Arm Cranes	3 Sets	Portable containerized crane system for offshore use	9723 Teichman Road Galveston, TX 77554
Skimming Arm Cranes	3 Sets	Portable containerized crane system for offshore use	735 Peters Road Harvey, LA 70058
GALVESTON ISLAND	1	95' Offshore Skimming Vessel with Infrared Camera System, (2) Lamor LSC-3CS skimmers and 10,458 gallons of storage capacity. EDRC - 12,500 Bbls/day	9723 Teichman Road Galveston, TX 77554
H.I. RICH	1	95' Offshore Skimming Vessel with Infrared Camera System, (2) Lamor LSC-3CS skimmers and 10,458 gallons of storage capacity. EDRC - 12,500 Bbls/day	735 Peters Road Harvey, LA 70058
56' Skimmer	1	56' shallow water skimmer with (2) belt skimmers and 249 Bbls storage capacity. EDRC - 7,500 Bbls/day.	9723 Teichman Road Galveston, TX 77554
46' Skimmer	1	46' shallow near shore skimmer with (2) brush skimmers and 65 Bbls storage caacity. EDRC - 5,000 Bbls/day.	9723 Teichman Road Galveston, TX 77554
HOSS BARGE	1	174' skimming barge with (4) belt skimmers, 4,100 Bbls storage capacity, Infrared Camera System, 1,320' of 67" ocean boom, helipad and full accomodations. EDRC - 43,000	735 Peters Road Harvey, LA 70058
Marco Skimmers	1	Shallow water skimmer with 34 Bbls storage capacity. EDRC - 3,500 Bbls/day	9723 Teichman Road Galveston, TX 77554
Egmopol Skimmers	1	Shallow water skimmer with 90 Bbls storage capacity. EDRC - 3,000 Bbls/day	9723 Teichman Road Galveston, TX 77554
FRU	1	Skid mounted skimmer with 100 Bbls storage capacity. EDRC - 3,400 Bbls/day	9723 Teichman Road Galveston, TX 77554
FRU	1	Skid mounted skimmer with 100 Bbls storage capacity. EDRC - 3,400 Bbls/day	735 Peters Road Harvey, LA 70058
Skimming Barge	1	JULIE-T, 30' x 10' x 4' self propelled shallow water skimmer with 5,000 gallon storage capacity	9723 Teichman Road Galveston, TX 77554
Aqua-Guard Triton- 150	1	650 GPM hydraulic skimming system	9723 Teichman Road Galveston, TX 77554
Aqua-Guard Triton- 150	1	650 GPM hydraulic skimming system	735 Peters Road Harvey, LA 70058
Drum Skimmer	8	100 GPM to 70 GPM air and hydraulic operated systems	9723 Teichman Road Galveston, TX 77554
GT-185	1	Derated capacity of 40 GPM Hydraulic skimming system	9723 Teichman Road Galveston, TX 77554

Lamor MM-12	68	230 GPM - Hydraulic Operated	9723 Teichman Road Galveston, TX 77554
Lamor LAM-30	22	230 GPM - Hydraulic Operated	9723 Teichman Road Galveston, TX 77554
Komara Star	53	400 GPM - Hydraulic Operated (heavy oil)	9723 Teichman Road Galveston, TX 77554
Weir Skimmers	4	Douglas Skim Pack - Derated capacity of 60 GPM	9723 Teichman Road Galveston, TX 77554
Marco Skimmer	1	Kvichak/Marco Harbor Class Belt Skimmer EDRC 32,466 GPH	30580 Edison Drive Roseville, MI 48066
Mini D Drum	1	Mini D Drum Skimmer/EDRC 600GPH	30580 Edison Drive Roseville, MI 48066
Fast Water Circus Skimme	1	Fast Water Circus Skim/EDRC 1,584GPH	30580 Edison Drive Roseville, MI 48066
Hydraulic Skimmer	1	36" Hydraulic Fuzzy Drum Skimmer/ Crucial	30580 Edison Drive Roseville, MI 48066
Air Double Drum	2	Air Double Drum Skimmer/ Elastec	30580 Edison Drive Roseville, MI 48066
Hydrualic Double Drum	2	Hydraulic Double Drum Skimmer/ Elastec	30580 Edison Drive Roseville, MI 48066
Weir Skimmer	1	Foilex Weir Skimmer	30580 Edison Drive Roseville, MI 48066
Skimpak	1	304 SS Skimmer Skimpak	30580 Edison Drive Roseville, MI 48066
Aqua-Guard Triton 35	8	Brush Skimmer 1142 EDRC	30580 Edison Drive Roseville, MI 48066
Lamor Mini-Max MM 12	12	906 EDRC	30580 Edison Drive Roseville, MI 48066
Lamor LAM-30	10	230 GPM - Hydraulic Operated	30580 Edison Drive Roseville, MI 48066
Lamor MM-12	8	230 GPM - Hydraulic Operated	30580 Edison Drive Roseville, MI 48066
Vikoma	5	Star Disc Skimmer- 1887 EDRC	30580 Edison Drive Roseville, MI 48066
Lamor	15	1200 Gallon Towable Bladders	30580 Edison Drive Roseville, MI 48066
Sheen Machine	2	Sheen Machine	30580 Edison Drive Roseville, MI 48066
Oil/water Seperator	2	Gravity	9723 Teichman Road Galveston, TX 77554
Decantor	2	Floating, for pumping bilges on salvaged vessels	9723 Teichman Road Galveston, TX 77554
Containment Boom			
Item	**Number**	**Description**	**Location**
61" Inflatable Boom	2,624'	34" skirt / 17" float	9723 Teichman Road Galveston, TX 77554
18" Hard Boom	100,000'	12" skirt / 6" float	9723 Teichman Road Galveston, TX 77554
18" Hard Boom	100,000'	12" skirt / 6" float	780 Rickets Lane Ardmore, OK 73401
18" Hard Boom	15,000	12" skirt / 6" float	30580 Edison Drive Roseville, MI 48066
18" Hard Boom	12,000'	12" skirt / 6" float	735 Peters Road Harvey, LA 70058
10" Hard Boom	1,000'	6" skirt / 4" float	9723 Teichman Road Galveston, TX 77554
18" Hard Boom	1,000'	Stored in 20' Container	30580 Edison Drive Roseville, MI 48066
18" Hard Boom	9,000'	Stored in (2) 40' Containers	30580 Edison Drive Roseville, MI 48066
18" Hard Boom	6,000'	Stored on Response Trailers	30580 Edison Drive Roseville, MI 48066

18" Hard Boom	26,100'	Stored in Warehouse	30580 Edison Drive Roseville, MI 48066
Fast Water Boom	1,000'	Stored on Response Trailer	30580 Edison Drive Roseville, MI 48066
Mini Boom	300'	Stored in Warehouse	30580 Edison Drive Roseville, MI 48066
36" Protective Boom	3,400'	Stored in Warehouse	30580 Edison Drive Roseville, MI 48066

Miscellaneous Spill Response Assets

Item	Number	Description	Location
Boom Reel	4	656' of inflatable boom per reel with covers, etc.	9723 Teichman Road Galveston, TX 77554
HPU for Boom Reel	2	With all related gear (hoses, air blower, etc.)	9723 Teichman Road Galveston, TX 77554
Portable Storage	25	5,000 to 300 gallon	9723 Teichman Road Galveston, TX 77554
Decontamination Pools	10	110' to 20'	9723 Teichman Road Galveston, TX 77554
Pressure Washers	8	10,000 to 3,500 psi	9723 Teichman Road Galveston, TX 77554
Vacuum Units	8	Trucks, portable diesel skid units	9723 Teichman Road Galveston, TX 77554
Hand tools	200	Rakes, shovels, etc	9723 Teichman Road Galveston, TX 77554

Electronic Assets

Item	Number	Description	Location
Side Scan Sonar	1	Portable and vessel mounted	9723 Teichman Road Galveston, TX 77554
Echoscope	1	Portable	9723 Teichman Road Galveston, TX 77554
Multi-Beam / Oil Detection System	1	Capable of finding oil in the water column, on sea floor and sub surface - T&T Braveheart Survey, LLC	9723 Teichman Road Galveston, TX 77554
Magnetometer	1	Portable and vessel mounted	9723 Teichman Road Galveston, TX 77554
Vessel Tracking	2	Used with side scan, multi beam, oil detection, etc.	9723 Teichman Road Galveston, TX 77554
4-Gas Monitors	8	Various	9723 Teichman Road Galveston, TX 77554
4-Gas Monitors	2	Various	30580 Edison Drive Roseville, MI 48066
PID Monitors	4	Various	9723 Teichman Road Galveston, TX 77554
Field Computers	10	Various	9723 Teichman Road Galveston, TX 77554
Field Computers	2	Various	30580 Edison Drive Roseville, MI 48066
Handheld Radio	50	Intrinsically Safe	9723 Teichman Road Galveston, TX 77554
Two Way Radio	1	VHF	30580 Edison Drive Roseville, MI 48066
Portable GPS	5	Various	9723 Teichman Road Galveston, TX 77554
Portable GPS	2	Various	30580 Edison Drive Roseville, MI 48066

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3.0 Unusually Sensitive Area Information

As part of the High Consequence Areas ("HCAs") the Unusually Sensitive Areas ("USAs") that are detailed and defined for this Plan are an integral part of the Enbridge Superior Response Zone for emergency response. Due to the magnitude of the mapping involved the Enbridge Superior Region HCA Mapbook has been compressed into electronic media, and is accessible through LP Environment.

In the event of an incident, a review of the *3.1.1 Unusually Sensitive Area Tables* (reflecting USAs within a 50 mile segment of the pipeline) - would alert responders to the USAs within the area and direct them to the HCA Manual for specific stationing of locations and HCA and Control Point ("CP") Maps to protect environmentally and economically sensitive areas.

Regions maintain maps identifying all USAs along the pipeline, this list includes:

- US/ESA- U.S. identified Environmentally Sensitive Areas
- E/ESA- Enbridge identified Environmentally Sensitive Areas
- US/DW/SW- U.S. identified Drinking Water/Surface Water
- US/DW/GW- U.S. identified Drinking Water/Ground Water
- US/CNW- U.S. Identified Commercially Navigable Waters
- E/DW/SW- Enbridge identified Drinking Water/Surface Water
- E/DW/GW- Enbridge identified Drinking Water/Ground Water
- E/CNW- Enbridge identified Commercially Navigable Waters

Regions maintain CP Map sets that identify product containment and recovery sites (control points) on high risk water-bodies that could be impacted by a pipeline leak. The impact mechanism could be via direct crossing, overland flow or spray.

Below are the specifically identified Unusually Sensitive Areas. This information should be considered when responding to an incident within the Mid Continent Response Zone.

3.0.1 Environmentally Sensitive Areas ("ESA")

Environmentally Sensitive Areas are represented in the attached USA Significant and Substantial Harm Maps and tables- Unusually Sensitive Area Pipe Segments by Stationing.

In the event of an incident these tables will alert responders to the USAs within the area and direct them to the HCA maps for further site overview.

3.0.2 Public Water Supplies/ Water Intakes / Wellhead Protection Areas ("DW")

Drinking Water (drinking water, wellhead protection areas, and water intakes) are also represented in the attached maps and tables-Unusually Sensitive Area Pipe Segments by Stationing.

3.0.3 Tribal Lands

There are six Tribal lands (based on census data) within 5 miles of the response area corridor located in Minnesota, Wisconsin and Michigan. See USA Significant and Substantial Harm Maps below.

[redacted]

3.0.4 State/local and National Parks/ Forests

There are 15 State/local Parks, 7 State Forests and 2 National Forests within 5 miles of the response zone corridor.

State/Local Parks

[redacted]

State Forests

[redacted]

National Forests

[redacted]

3.0.5 Schools

There are [redacted] schools within ½ mile of the response area corridor. These include both urban and rural schools; all are included on the Public Awareness mailing list.

3.0.6 Cemeteries

There are [redacted] cemeteries within ½ mile from the response area corridor.

3.0.7 Medical Facilities

There are [redacted] medical facilities within ½ mile of the response area corridor. All (Clinics, Hospitals, Offices, etc.) are included on the Public Awareness mailing list.

3.0.8 Residential Areas

There are several residential clusters within the area corridor referred to as OPAs and HPAs accessible in the electronic version of the HCA maps. These maps are updated annually to include urban development.

3.0.9 Businesses

Numerous business concerns exist within the area corridor. Because of the large number of businesses in the various metropolitan and urban areas along the pipeline route, contact listings for these businesses are not listed. It is expected that businesses would receive notification of pipeline spills over public communications media in the same way as metropolitan and urban areas.

3.0.10 Recreational Areas

There are [redacted] recreational areas within ½ mile from the response area corridor.

[redacted]

3.0.11 Wildlife Refuges

There are National Wildlife Refuges located in the vicinity of the pipeline ROW as shown on the attached maps.

3.0.12 Wetlands/Other Sensitive Environments

There are numerous wetlands, as defined in *40CFR§230.3*, in this area. Facility managers in each area will keep wetlands inventory information.

3.0.13 Water Resources/Lakes and Streams

[redacted]

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

Water Body Name	Number of Pipeline Crossings	Lines Impacted	Approx Line MP	Approx Latitude	Approx Longitude
[redacted]					

3.0.14 Historical/Archaeological Sites

There are several Historical/Archaeological sites within the response area corridor. Environmental impact on a Historical/Archaeological site will be a major concern and impact response activities. Prior to initiating response activities contact the State Historical Preservation Office.

3.0.15 Transportation Areas

The below table represents the highway crossings along the pipeline route, that may be affected during a response. Refer to *Annex2 –Notifications* for the listings and contacts for foreign pipelines within ½ mile of pipelines and the railroad crossings of the pipelines in the Superior Response Zone.

State and Interstate Highway Crossings

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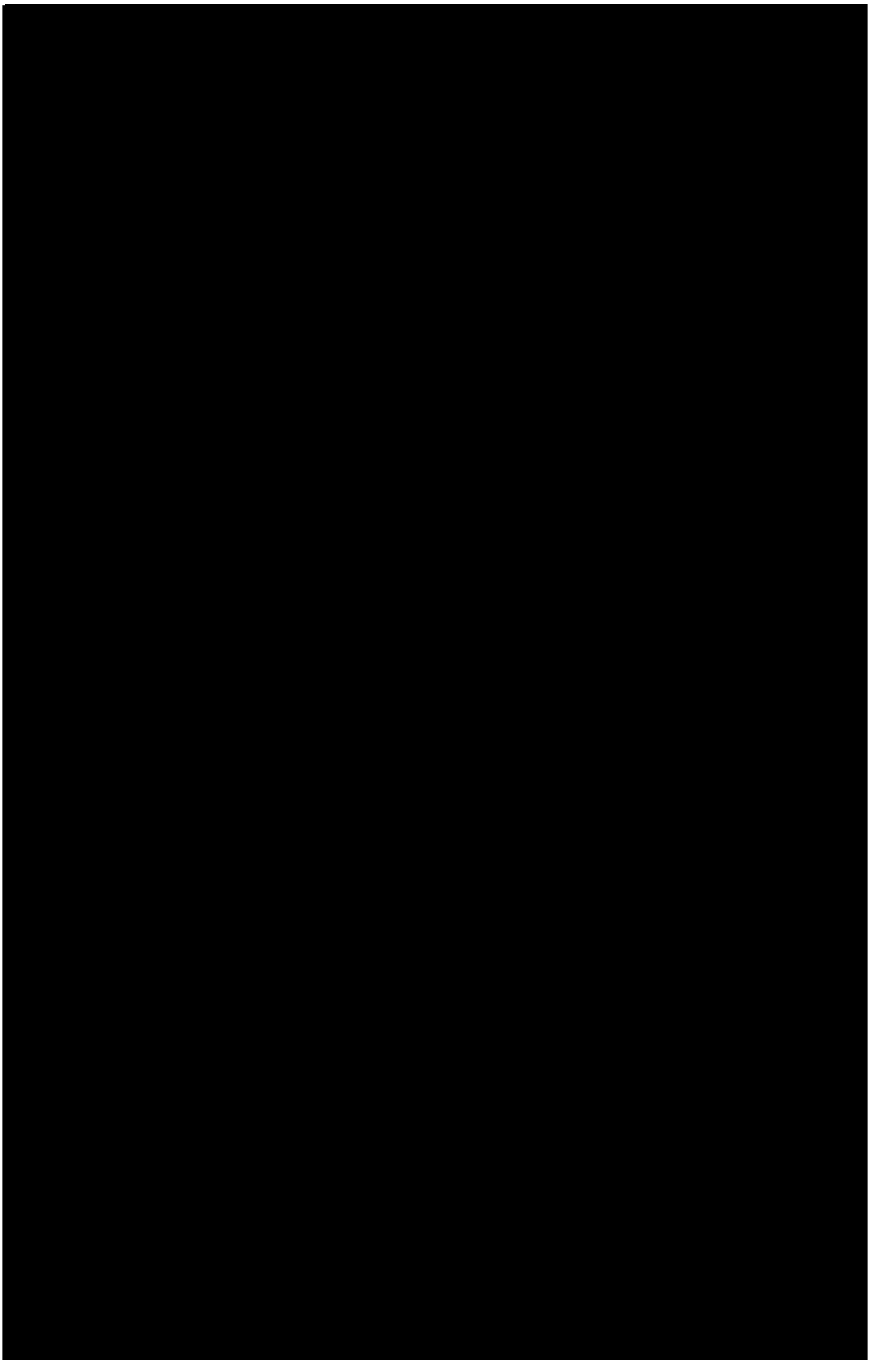
3.1 Significant and Substantial Harm Maps



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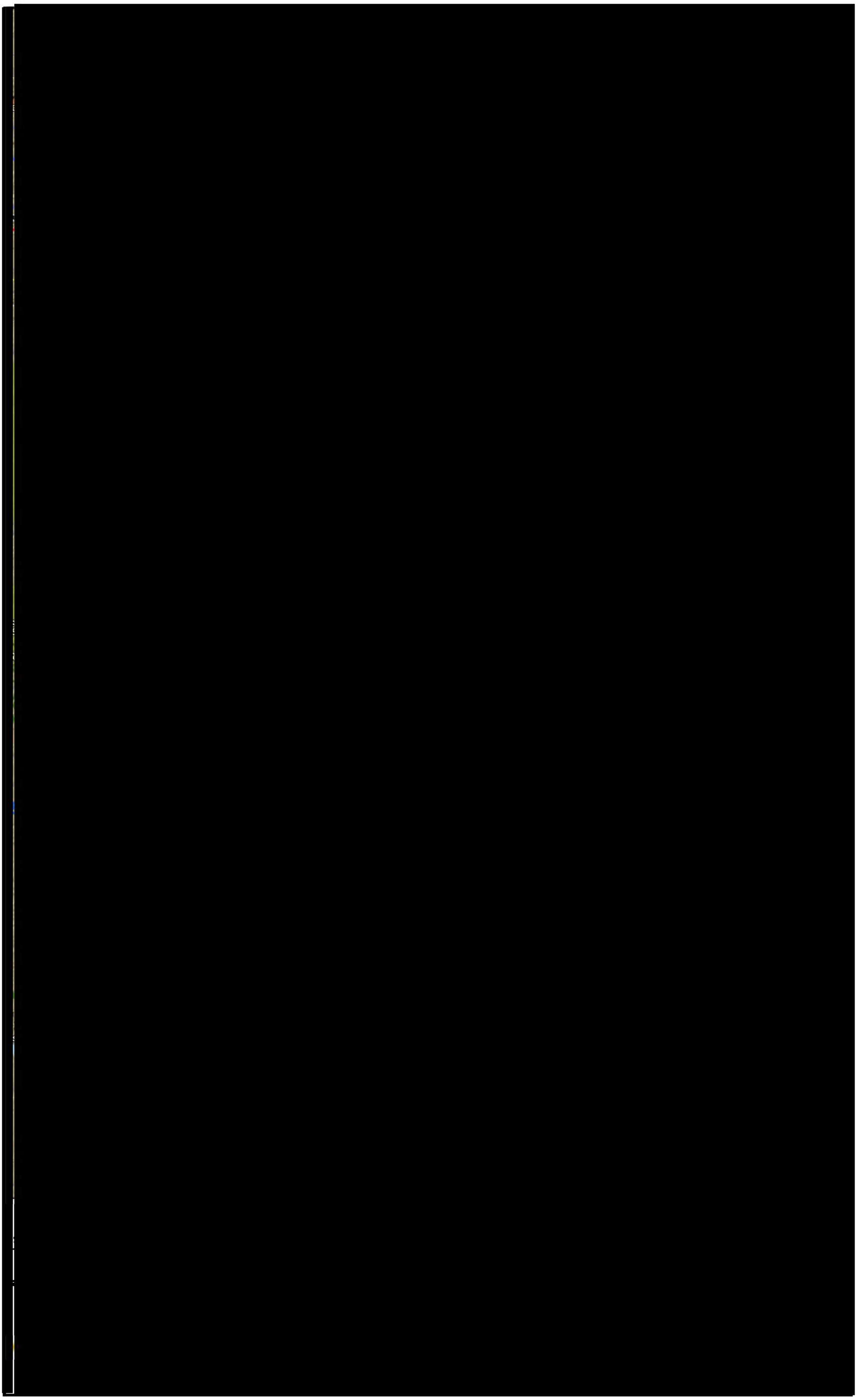

[redacted]

[redacted]

3.1.1 Unusually Sensitive Area Tables

Line	MP Start	MP End	USA Impact
1 CO	777	826	1 US/ESA, 3 US/DW/SW, 3 E/DW/SW, 5 E/CNW
1 CO	827	876	1 US/ESA, 6 US/DW/GW,1 E/DW/GW
1 CO	877	926	2 US/ESA, 2 E/DW/GW
1 CO	927	976	11 US/ESA, 3 US/DW/SW
1 CO	977	1026	9 US/ESA, 4 US/DW/GW, 3 E/CNW
1 CO	1027	1076	NONE
1 CO	1077	1098	1 US/ESA, 2 US/DW/SW, 2 E/DW/GW
1 NGL	800	849	2 E/CNW
1 NGL	850	899	1 US/ESA
1 NGL	900	949	4 US/ESA
1 NGL	950	999	8 US/ESA, 1 E/CNW
1 NGL	1000	1024	1 US/ESA
2	777	826	1 US/ESA, 3 US/DW/SW, 3 E/DW/SW, 4 E/CNW
2	827	876	1 US/ESA, 4 US/DW/GW, 2 US/DW/GW, 1 E/DW/GW
2	877	926	2 US/ESA, 2 E/DW/GW
2	927	976	12 US/ESA, 3 US/DW/GW
2	977	1026	11 US/ESA, 4 E/DW/GW,
2	1027	1076	NONE
2	1077	1098	1 US/ESA, 1 US/DW/SW, 2 E/DW/GW
3	777	826	1 US/ESA, 3 US/DW/SW, 3 E/DW/SW, 4 E/CNW
3	827	876	1 US/ESA, 4 US/DW/SW, 2 US/DW/GW, 1 E/DW/GW
3	877	926	2 US/ESA, 2 E/DW/GW
3	927	976	12 US/ESA, 3 US/DW/GW, 1 E/DW/GW
3	977	1026	11 US/ESA, 3 E/DW/GW, 4 E/CNW
3	1027	1076	NONE
3	1077	1098	1 US/ESA, 1 US/DW/SW, 2 E/DW/GW
4	777	826	2 US/ESA, 3 US/DW/SW, 2 E/DW/SW, 1 E/DW/GW, 5 E/CNW
4	827	876	1 US/ESA, 4 US/DW/SW, 2 US/DW/GW, 1 E/DW/GW
4	877	926	2 US/ESA, 2 E/DW/GW
4	927	976	12 US/ESA, 3 US/DW/GW, 1 E/DW/GW
4	977	1026	11 US/ESA, 3 E/DW/GW, 3 E/CNW
4	1027	1076	NONE
4	1077	1098	1 US/ESA, 2 US/DW/SW, 2 E/DW/GW
5 CO	1101	1151	9 US/ESA, 1 E/ESA, 4 US/DW/SW, 3 US/DW/GW,
5 CO	1151	1201	2 E/ESA, 5 US/DW/SW, 4 US/DW/GW, 1 US/DW/GW,
5 CO	1201	1251	15 US/ESA, 6 US/DW/GW, 2 E/DW/GW
5 CO	1251	1301	6 US/ESA, 5 US/DW/GW, 4 E/DW/GW
5 CO	1301	1351	3 US/ESA, 1 E/DW/GW

Line	MP Start	MP End	USA Impact
5 NGL	1101	1151	1 US/ESA, 1 US/CNW
5 NGL	1151	1201	1 E/ESA
5 NGL	1201	1251	3 US/ESA
5 NGL	1251	1301	1 US/ESA
5 NGL	1301	1351	2 US/ESA
5 NGL	1351	1401	2 US/ESA
5 NGL	1401	1451	5 US/ESA, 1 US/CNW
5 NGL	1451	1501	38 US/ESA, 4 E/ESA, 8 US/CNW
6A	1	50	5 US/ESA, 3 US/DW/SW, 1 US/DW/GW, 1 US/CNW
6A	51	100	21 US/ESA, 5 US/DW/GW
6A	101	150	3 US/DW/GW
6A	151	200	1 US/ESA, 1 US/DW/GW, 3 E/DW/GW, 2 E/CNW
6A	201	250	8 US/ESA, 3 E/CNW
6A	251	300	1 US/ESA, 4 US/DW/GW, 3 E/DW/GW
6A	301	350	3 US/DW/GW, 3 E/DW/GW, 5 E/CNW
10	1929	1952	9 US/DW/SW, 2 E/DW/SW, 6 US/CNW, 1 E/CNW
18 "			
13	777	826	1 US/ESA, 3 US/DW/SW, 4 E/CNW
13	827	876	1 US/ESA, 6 US/DW/SW, 1 E/DW/SW
13	877	909	2 E/DW/SW
20"			
13	789	839	13 US/ESA, 4 US/DW/GW, 1 E/DW/GW
13	840	890	12 US/ESA, 2 US/DW/GW, 3 E/CNW
13	891	992	NONE
13	942	964	1 US/ESA, 1 US/DW/SW, 2 E/DW/GW
13	774	824	8 US/ESA, 4 US/DW/SW, 1 US/DW/GW, 2 US/CNW
13	825	875	28 US/ESA, 5 US/DW/GW
13	825	875	28 US/ESA, 5 US/DW/GW
13	876	926	2 US/ESA, 4 US/DW/GW
13	927	977	3 US/ESA, 1 US/DW/GW, 3 E/DW/GW, 3 E/CNW
13	978	1028	7 US/ESA, 2 E/CNW
13	1029	1079	6 US/DW/GW, 3 E/DW/GW
14	1	50	5 US/ESA, 3 US/DW/SW, 1 US/DW/GW, 2 US/CNW
14	51	100	25 US/ESA, 6 US/DW/SW
14	101	150	4 US/DW/SW
14	151	200	1 US/ESA, 4 E/DW/GW, 2 E/CNW
14	201	250	8 US/ESA, 3 E/CNW
14	251	300	5 US/DW/GW, 4 E/DW/GW
14	301	350	3 US/DW/GW, 3 E/DW/GW, 6 E/CNW
61	0	49	6 US/ESA, 3 US/DW/SW, 1 US/DW/GW, 1 US/CNW
61	50	99	20 US/ESA, 5 US/DW/GW
61	100	149	3 US/ESA, 4 US/DW/GW
61	150	199	2 E/DW/GW

Line	MP Start	MP End	USA Impact
61	200	249	8 US/ESA, 1 US/DW/GW, 5 E/CNW
61	250	299	5 US/DW/GW, 3 E/DW/GW
61	300	349	1 US/DW/GW, 2 E/DW/GW, 4 E/CNW
65	777	826	1 US/ESA, 3 US/DW/SW, 3 E/DW/SW, 5 E/CNW
65	827	876	1 US/ESA, 4 US/DW/SW, 1 US/DW/GW, 1 E/DW/GW
65	877	910	1 US DW/GW, 2 E/DW/GW
67	777	826	1 US/ESA, 3 US/DW/SW, 3 E/DW/SW, 5 E/CNW
67	827	876	1 US/ESA, 4 US/DW/SW, 1 US/DW/GW, 1 E/DW/GW
67	877	926	2 US/ESA, 2 US/DW/GW, 1 E/DW/GW
67	927	976	11 US/ESA, 4 E/DW/GW
67	977	1026	12 US/ESA, 3 E/DW/GW, 3 E/CNW
67	1027	1076	3 US/OPA
67	1077	1101	1 US/ESA, 1 US/DW/SW, 2 E/DW/GW

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Annex 4 – Table of Contents Page

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UNITED STATES FEDERAL REGULATIONS

4.0 DOT 49CFR§191

DOT/PHMSA 49 CFR PART 192		
§191.5	**Brief Description**	**Location**
Immediate notice of certain incidents.		
(a)	At the earliest practicable moment following discovery, but no later than one hour after confirmed discovery, each operator must give notice in accordance with paragraph (b) of this section of each incident as defined in §191.3.	Annex 2.2.3f- External Notifications
(b)	Each notice required by paragraph (a) of this section must be made to the National Response Center either by telephone to 800-424-8802 (in Washington, DC, 202 267-2675) or electronically at *http://www.nrc.uscg.mil* and must include the following information:	Annex 2.2.3f- External Notifications
(b)(1)	Names of operator and person making report and their telephone numbers.	Annex 2.2.3f- External Notifications
(b)(2)	The location of the incident.	
(b)(3)	The time of the incident.	
(b)(4)	The number of fatalities and personal injuries, if any.	
(b)(5)	All other significant facts that are known by the operator that are relevant to the cause of the incident or extent of the damages.	
(c)	Within 48 hours after the confirmed discovery of an incident, to the extent practicable, an operator must revise or confirm its initial telephonic notice required in paragraph (b) of this section with an estimate of the amount of product released, an estimate of the number of fatalities and injuries, and all other significant facts that are known by the operator that are relevant to the cause of the incident or extent of the damages. If there are no changes or revisions to the initial report, the operator must confirm the estimates in its initial report.	Annex 2.2.3f

4.1 DOT 49CFR§192

DOT/PHMSA 49 CFR PART 192		
§192.615	Brief Description	Location
	Emergency Plans	
(a)	Each operator shall establish written procedures to minimize the hazard resulting from a gas pipeline emergency. At a minimum, the procedures must provide for the following:	--
(a)(1)	Receiving, identifying, and classifying notices of events which require immediate response by the operator.	Core 2.1 & 2.4
(a)(2)	Establishing and maintaining adequate means of communication with appropriate fire, police, and other public officials.	Core 1.3, 2.2.5, 2.3.1, & 2.4
(a)(3)	Prompt and effective response to a notice of each type of emergency, including the following:	Core 1.5.3, 2.0.1, & 2.3.1
(a)(3)(i)	Gas detected inside or near a building.	Core 2.3, 2.4.3.4
(a)(3)(ii)	Fire located near or directly involving a pipeline facility.	Core 2.3, 2.4.3.9
(a)(3)(iii)	Explosion occurring near or directly involving a pipeline facility.	Core 2.3, 2.4.3.9
(a)(3)(iv)	Natural disaster.	Core 2.3, 2.4.3.12-14
(a)(4)	The availability of personnel, equipment, tools, and materials, as needed at the scene of an emergency.	Annex 1.7 & 2.4
(a)(5)	Actions directed toward protecting people first and then property.	Core 2.0.1
(a)(6)	Emergency shutdown and pressure reduction in any section of the operator's pipeline system necessary to minimize hazards to life or property.	Core 1.5.2 & 2.0.1
(a)(7)	Making safe any actual or potential hazard to life or property.	Core 1.5.2, 2.0.1, 2.2, 2.3
(a)(8)	Notifying appropriate fire, police, and other public officials of gas pipeline emergencies and coordinating with them both planned responses and actual responses during an emergency.	Core 2.2, 2.3.1 & Annex 2.2
(a)(9)	Safely restoring any service outage.	Core 2.5.2
(a)(10)	Beginning action under §192.617, if applicable, as soon after the end of the emergency as possible.	Core 2.5.2
(b)	Each operator shall:	--
(b)(1)	Furnish its supervisors who are responsible for emergency action a copy of that portion of the latest edition of the emergency procedures established under paragraph (a) of this section as necessary for compliance with those procedures.	Core 2.5.2, Core Pre-Tab Revisions Record
(b)(2)	Train the appropriate operating personnel to assure that they are knowledgeable of the emergency procedures and verify that the training is effective.	Core 3
(b)(3)	Review employee activities to determine whether the procedures were effectively followed in each emergency.	Core 2.5.2

4.1 DOT 49CFR§192 (Cont.)

DOT/PHMSA 49 CFR PART 192		
§192.615	Brief Description	Location
(c)	Each operator shall establish and maintain liaison with appropriate fire, police, and other public officials to:	--
(c)(1)	Learn the responsibility and resources of each government organization that may respond to a gas pipeline emergency;	Core 2.4
(c)(2)	Acquaint the officials with the operator's ability in responding to a gas pipeline emergency;	Core 1.5.5, 2.2.5, 2.4.3.4, 3.5
(c)(3)	Identify the types of gas pipeline emergencies of which the operator notifies the officials; and	Core 2.2, 2.3 Annex 2
(c)(4)	Plan how the operator and officials can engage in mutual assistance to minimize hazards to life or property.	Core 1.5.5 & 3.5

4.2 DOT 49CFR§194

DOT/PHMSA 49 CFR PART 194		
§194.103	**Brief Description**	**Location**
Response Plans For Onshore Pipelines		
(a)	Each operator shall submit a statement with its response plan, as required by §194.107 and §194.113, identifying which line sections in a response zone can be expected to cause significant and substantial harm to the environment in the event of a discharge of oil into or on the navigable waters or adjoining shorelines.	Annex 1.5 Significant and Substantial Harm & Annex 1.9 and 3.1
§194.105	**Brief Description**	**Location**
(a)	Each operator shall determine the worst-case discharge for each of its response zones and provide the methodology, including calculations, used to arrive at the volume.	Core 1.2.2 Glossary WCD & Annex 1.9
(b)	The worst-case discharge is the largest volume, in barrels, of the following (b)(1).	Core 1.2.2 Glossary WCD & Annex 1.9
§194.107	**Brief Description**	**Location**
(a)	Each response plan must plan for resources for responding, to the maximum extent practicable, to a worst-case discharge, and to a substantial threat of such a discharge.	Annex 1.9 & 2.3 OSRO
(b)	An operator must certify in the response plan that it reviewed the NCP and each applicable ACP and that its response plan is consistent with the NCP and each applicable ACP as follows:	Annex 1.2
(b)(1)	As a minimum to be consistent with the NCP as a facility response plan must:	
(b)(1)(i)	Demonstrate an operator's clear understanding of the function of the Federal response structure, including procedures to notify the National Response Center reflecting the relationship between the operator's response organization's role and the Federal On Scene Coordinator's role in pollution response;	Core 2.2, 2.4, 3.0 & Annex 2.0.1
(b)(1)(ii)	Establish provisions to ensure the protection of safety at the response site; and	Core 2.0.1, 2.2, & 2.4.6
(b)(1)(iii)	Identify the procedures to obtain any required Federal and State permissions for using alternative response strategies such as in-situ burning and dispersants as provided for in the applicable ACPs; and	Core 2.4.7.6
(b)(2)	As a minimum, to be consistent with the applicable ACP the plan must:	--
(b)(2)(i)	Address the removal of a worst-case discharge and the mitigation or prevention of a substantial threat of a worst-case discharge;	Core 2.4.5
(b)(2)(ii)	Identify environmentally and economically sensitive areas;	Annex 3
(b)(2)(iii)	Describe the responsibilities of the operator and of Federal, State and local agencies in removing a discharge and in mitigating or preventing a substantial threat of a discharge;	Core 2.4

4.2 DOT 49CFR§194 (Cont.)

DOT/PHMSA 49 CFR PART 194		
§194.107	Brief Description	Location
(b)(2)(iv)	Establish the procedures for obtaining an expedited decision on use of dispersants or other chemicals.	Core 2.4.7.7
(c)	Each response plan must include:	--
(c)(1)	A core plan consisting of --	--
(c)(1)(i)	An information summary as required in §194.113,	Annex 1.7
(c)(1)(ii)	Immediate notification procedures,	Core 2.2, Annex 2.0.1 & 2.2.4a
(c)(1)(iii)	Spill detection and mitigation procedures,	Core 1.5.2, 2.1
(c)(1)(iv)	The name, address, and telephone number of the oil spill response organization, if appropriate,	Annex 2.3 & 2.2.4a
(c)(1)(v)	Response activities and response resources,	Core 2.4.3, Annex 1.7, 1.8 & 2.3.2
(c)(1)(vi)	Names and telephone numbers of Federal, state, and local agencies which the operator expects to have pollution control responsibilities or support,	Annex 2.2.4a
(c)(1)(vii)	Training procedures,	Core 3
(c)(1)(viii)	Equipment testing,	Core 2.5.1 & 3.5.8
(c)(1)(ix)	Drill program – an operator will satisfy the requirement for a drill program by following the National Preparedness for Response Exercise Program (PREP) guidelines. An operator choosing not to follow PREP guidelines must have a drill program that is equivalent to PREP. The operator must describe the drill program in the response plan and OPS will determine if the program is equivalent to PREP.	Core 3.5
(c)(1)(x)	Plan review and update procedures;	Annex 5.1
(c)(2)	An appendix for each response zone that includes the information required in paragraph (c)(1)(i)-(ix) of this section and the worst-case discharge calculations that are specific to that response zone. An operator submitting a response plan for a single response zone does not need to have a core plan and a response zone appendix. The operator of a single response zone onshore pipeline shall have a single summary in the plan that contains the required information in §194.113.7; and.	Core 1.2.2 Glossary WCD & Annex 1.9
(c)(3)	A description of the operator's response management system including the functional areas of finance, logistics, operations, planning, and command. The plan must demonstrate that the operator's response management system uses common terminology and has a manageable span of control, a clearly defined chain of command, and sufficient trained personnel to fill each position.	Core 2.4.1.4

4.2 DOT 49CFR§194 (Cont.)

DOT/PHMSA 49 CFR PART 194		
§194.109	**Brief Description**	**Location**
(a)	In lieu of submitting a response plane required by §194.103, an operator may submit a response plan that complies with a state law or regulation, if the state law or regulation requires a plan provides equivalent or greater spill protection than a plane required under this part.	N/A
§194.111	**Brief Description**	**Location**
(a)	Each operator shall maintain relevant portions of its response plan at the operator's headquarters and at other locations from which response activities may be conducted, for example, in field offices, supervisor's vehicles, or spill response trailers.	Annex 5.0
(b)	Each operator shall provide a copy of its response plan to each qualified individual.	Annex 5.0
§194.113	**Brief Description**	**Location**
(a)	The information summary for the core plan, required by §194.107, must include:	--
(a)(1)	The name and address of the operator.	Core 1.0 & Annex 1.0
(a)(2)	For each response zone which contains one or more line sections that meet the criteria for determining significant and substantial harm as described in §194.103, a listing and description of the response zones, including county(s) and state(s).	Annex 1.6.2 & Annex 3.1
(b)	The information summary for the response zone appendix, required in §194.107, must include:	--
(b)(1)	The information summary for the core plan.	Core 1.3
(b)(2)	The names or titles and 24-hour telephone numbers of the qualified individual(s) and at least one alternate qualified individual(s);	Annex 1.4, 2.0.1 & 2.2.4a
(b)(3)	The description of the response zone, including county(s) and state(s), for those zones in which a worst-case discharge could cause substantial harm to the environment.	Annex 1.6.2 & 1.9
(b)(4)	A list of line sections for each pipeline contained in the response zone, identified by milepost or survey station number, or other operator designation.	Annex 1.6.2
(b)(5)	The basis for the operator's determination of significant and substantial harm.	Annex 1.5
(b)(6)	The type of oil and volume of the worst-case discharge.	Annex 1.9, & 1.11

4.2 DOT 49CFR§194 (Cont.)

DOT/PHMSA 49 CFR PART 194		
§194.115	**Brief Description**	**Location**
(a)	Each operator shall identify and ensure, by contract or other approved means, the resources necessary to remove, to the maximum extent practicable, a worst-case discharge and to mitigate or prevent a substantial threat of a worst-case discharge.	Annex 1.7 & 2.3
(b)	An operator shall identify in the response plan the response resources which are available to respond within the time specified, after discovery of a worst-case discharge, or to mitigate the substantial threat of such a discharge.	Annex 1.7, 1.10 & 2.3.2
§194.117	**Brief Description**	**Location**
(a)	Each operator shall conduct training to ensure that:	--
(a)(1)	All personnel know --	--
(a)(1)(I)	Their responsibilities under the response plan.	Core 3.2 & 3.3
(a)(1)(ii)	The name and address of, and the procedure for contacting, the operator on a 24-hour basis.	Core 1.0 & Annex 1.0
(a)(1)(iii)	The name of, and procedures for contacting, the qualified individual on a 24-hour basis.	Core 2.2.1 & Annex 1.4 & 2.2.4a
(a)(2)	Reporting personnel know –	--
(a)(2)(I)	The content of the information summary of the response plan.	Core 1.3 & Annex 1.6
(a)(2)(ii)	The toll-free telephone number of the National Response Center.	Core 1.0, 3.0 & Annex 2.2.4a
(a)(2)(iii)	The notification process.	Core 2.2 & Annex 2.0
(a)(3)	Personnel engaged in response activities know --	--
(a)(3)(I)	The characteristics and hazards of the oil discharged.	Annex 1.11 SDS
(a)(3)(ii)	The conditions that are likely to worsen emergencies, including the consequences of facility malfunctions or failures, and the appropriate corrective actions.	Core 2.4.3
(a)(3)(iii)	The steps necessary to control any accidental discharge of oil and to minimize the potential for fire, explosion, toxicity, or environmental damage.	Core 2.0, 2.1.1.2 & 2.4.3
(a)(3)(iv)	The proper firefighting procedures and use of equipment, fire suits, and breathing apparatus.	Core 2.0.3 & 3.4.1
(b)	Each operator shall maintain a training record for each individual that has been trained as required by this section. These records must be maintained in the following manner as long as the individual is assigned duties under the response plan according to (b)(1) and (b)(2).	Core 3.1
(c)	Nothing in this section relieves an operator from the responsibility to ensure that all response personnel are trained to meet the OSHA standards for emergency response operations in *29CFR§1910.120*.	--

4.2 DOT 49CFR§194 (Cont.)

DOT/PHMSA 49 CFR PART 194		
§194.121	Brief Description	Location
(a)	Each operator shall update its response plan to address new or different operating conditions or information. In addition, each operator shall review its response plan in full at least every 5 years from the date of the last submission or the last approval as required by (a)(1) and (a)(2).	Annex 5.2
(b)	If a new or different operating condition or information would substantially affect the implementation of a response plan, the operator must immediately modify its response plan to address such a change and, within 30 days of making such a change, submit the change to PHMSA. Examples of changes in operating conditions that would cause a significant change to an operator's response plan as defined in (B)(1-8).	Annex 5.1

4.3 DOT 49CFR§195

DOT/PHMSA 49 CFR PART 195.402 & .403 CROSS REFERENCE		
§195.402	**Brief Description**	**Location**
Procedural manual for operations, maintenance, and emergencies.		
(c)	*Maintenance and Normal Operations:* The manual required by paragraph (a) of this section must include procedures for the following to provide safety during maintenance and normal operations:	--
(c)(4)	Determining which pipeline facilities are located in areas that would required an immediate response by the operator to prevent hazards to the public if the facilities failed or malfunctioned.	Annex 3.1
(c)(5)	Analyzing pipeline accidents to determine their causes.	Core 2.5.2.2
(c)(6)	Minimizing the potential for hazards identified under paragraph (c)(4) of this section and the possibility of recurrence of accidents analyzed under paragraph (c)(5) of this section.	Core 2.5.2.2
(c)(9)	In the case of facilities not equipped to fail safe that are identified under paragraph §195.402 (c)(4) or that control receipt an delivery of the hazardous liquid or carbon dioxide, detecting abnormal operating conditions by monitoring pressure, temperature, flow or other appropriate operational data and transmitting this data to an attended location.	N/A
(c)(12)	Establish and Maintain Liaison with Public Officials	Core 1.5.5, 2.2.5
(e)	Emergencies	
(e)(1)	Receive, Identify, and Classify Notices of Events	Core 2.1.1, & 2.2.3
(e)(2)	Procedures for Prompt and Effective Response	Core 2.1.1.2 & 2.2
(e)(3)	Availability of Response Personnel and Resources	Annex 1.7 & 2.3
(e)(4)	Emergency Shutdown and Pressure Reduction Procedures	Core 2.1.1.2
(e)(5)	Control and Minimization of Released Hazardous Liquid	Core 2.1.1.2
(e)(6)	Evacuation, Traffic, and Security Control	Core 1.5.8, 2.3.4, 2.4.2 & Annex 1.8
(e)(7)	Notification of Emergency Officials	Core 2.2, Annex 2 & 2.2.3a
(e)(8)	Assessment of HVL Clouds	Core 2.3.1, 2.3.2, 2.3.3, 2.4.1.6, & 2.4.3.4
(e)(9)	Post Incident Critique	Core 2.5.2.3
§195.403	**Brief Description**	**Location**
(a)	Operator Personnel Training	Core 3
(a)(1)	Carry Out §195.402 Emergency Procedures	Core 2
(a)(2)	Characteristics and Hazards of Liquids and HVLs	Annex 1.11
(a)(3)	Recognition of Emergency Causes and Preventative Actions	Core 2.3
(a)(4)	Steps to Control and Minimize Effects of Accidental Release	Core 2.3
(a)(5)	Firefighting Procedures and Equipment	Core 2.4.3.9/3.3.1
(b)	Operator's Training Program	Core 3
(b)(1)	Review and Evaluate Response Personnel Performance	Core 2.5.2.1
(b)(2)	Implement Training Program Changes Where Appropriate	Core 3
(c)	Supervise Knowledge of Applicable Response Procedures	Core 3.1

4.3 DOT 49CFR§195 (Cont.)

§195.52	Brief Description	Location
	Reporting accidents.	
(a)	**Within one hour** after confirmed discovery, the operator of the system must give notice, in accordance with paragraph (b) of this section of any failure that:	Annex 2.2.3f- External Notifications
(a)(1)	Caused a death or a personal injury requiring hospitalization;	External Notifications- Condition
(a)(2)	Resulted in either a fire or explosion not intentionally set by the operator;	
(a)(3)	Caused estimated property damage, including cost of cleanup and recovery, value of lost product, and damage to the property of the operator or others, or both, exceeding $50,000;	
(a)(4)	Resulted in pollution of any body of water that violated applicable water quality standards, caused a discoloration of the surface of the water or adjoining shoreline, or deposited a sludge or emulsion beneath the surface of the water or upon adjoining shorelines; or	
(a)(5)	In the judgment of the operator was significant even though it did not meet the criteria.	
(b)	Information required. Must be made to the National Response Center either by telephone to 800-424-8802 (in Washington, DC, 202-267-2675) or electronically at *http://www.nrc.uscg.mil* and must include the following information:	Annex 2.2.3f- External Notifications
(b)(1)	Name, address and identification number of the operator.	External Notifications- Who To Notify
(b)(2)	Name and telephone number of the reporter	
(b)(3)	The location of the failure.	
(b)(4)	The time of the failure.	
(b)(5)	The fatalities and personal injuries, if any.	
(b)(6)	Initial estimate of amount of product released in accordance with paragraph (c) of this section.	
(b)(7)	All other significant facts known by the operator that are relevant to the cause of the failure or extent of the damages.	
(c)	Calculation. A pipeline operator must have a written procedure to calculate and provide a reasonable initial estimate of the amount of released product.	Core 2.4.4.5
(d)	*New information.* **Within 48 hours** after the confirmed discovery of an accident, to the extent practicable, an operator must revise or confirm its initial telephonic notice required in paragraph (b) of this section with a revised estimate of the amount of product released, location of the failure, time of the failure, a revised estimate of the number of fatalities and injuries, and all other significant facts that are known by the operator that are relevant to the cause of the accident or extent of the damages. If there are no changes or revisions to the initial report, the operator must confirm the estimates in its initial report.	Annex 2.2.3f

4.4 OSHA 29CFR§1910.120

Hazardous Waste Operations and Emergency Response		
§1910.120	Brief Description	Location
(q)	Emergency response to hazardous substance release	Core 2.4.6
(q)(1)	Emergency response plan	Core 1.3
(q)(2)	Elements of an emergency response plan	Core 1.3
(q)(2)(i)	Pre-emergency planning and coordination with outside parties	Core 3.6.1
(q)(2)(ii)	Personnel roles, lines of authority and communication	Core 2.4.1.1
(q)(2)(iii)	Emergency recognition and prevention	Core 2.4
(q)(2)(iv)	Safe distances and places of refuge	Core 2.4.6
(q)(2)(v)	Site security and control	Core 2.4.2
(q)(2)(vi)	Evacuation routes and procedures	Core 2.3.4 & Annex 1.8
(q)(2)(vii)	Decontamination procedures	Core 2.4.7.9
(q)(2)(viii)	Emergency medical treatment and first aid	Core 2.4.3.1
(q)(2)(ix)	Emergency alerting and response procedures	Core 2.2
(q)(2)(x)	Critique of response and follow-up	Core 2.5.2.3
(q)(2)(xi)	PPE and emergency equipment	Core 2.0.3
(q)(2)(xii)	Emergency response organizations	Annex 2.3 & 2.2.4a
(q)(3)	Procedures for handling emergency response	Core 2.4
(q)(4)	Skilled support personnel	Core 3
(q)(5)	Specialist employees	Core 3.3
(q)(6)	Training	Core 3.1, 3.2, 3.3, 3.4
(q)(7)	Trainers	Core 3
(q)(8)	Refresher Training	Core 3
(q)(9)	Medical surveillance and consultation	Core 2.4.3.1
(q)(10)	Chemical protective clothing	Core 2.0.3
(q)(11)	Post-emergency response operations	Core 2.5

STATE REGULATIONS/ LEGISLATION

4.5 Minnesota Statute 115E

MINNESOTA STATUTE 115E- CROSS REFERENCE		
Subdivision	**Brief Description**	**Location**
2	*115E.04- Prevention and Response Plans - Plan Contents:*	
(1)	Consistent with the requirements of the NCP and ACPs	Annex 1.2
(2)	Measures taken to prevent any discharges from occurring, including prevention of a worst-case discharge.	Core 1.3 & 1.4
(3)	Identify the individual or individuals having full authority to implement response actions, and those individuals' qualifications and titles;	Annex 1.4
(4)	Identify how communication and Incident Command relationships will be established between the individuals in command of a facility response and employees responding, Federal, State and local officials, and other contractors providing equipment and personnel.	Core 2.4, Annex 1.7, Annex 2
(5)	Describe facility and identify locations and characteristics of potential worst-case discharge.	Annex 1.6, 1.9
(6)	Identify means to satisfy adequate equipment and personnel to respond to a worst-case discharge.	Annex 1.9, Annex 2.2 & 2.3
(7)	Contain copies of contracts showing that adequate personnel and equipment is available	Annex 2.3
(8)	Describe actions to be taken by personnel responding to an incident.	Core 2.3
(9)	Describe training, equipment testing, periodic drills, and unannounced drills to ensure preparation for response.	Core 3.0 & 3.5, Annex 1.7
3 (a)	*Notification*: Commissioner of Public Safety to be notified when submission of Plan to the federal government occurs.	
4 (a)	*Review of Prevention and Response Plan*: Submit a copy of ICP to any commissioner that requests it.	

OTHER REGULATORY REFERENCE

4.6 WORST-CASE DISCHARGE

Term	Description
Worst-Case Discharge Methodology	The approach for calculating Worst-Case Discharge (WCD) volume uses Enbridge's Automated Valve Placement (AVP) System. The AVP program performs a calculation to determine the total volume out at any given point along the pipeline in the event of a rupture, which includes the initial volume out and maximum stabilization loss. The calculation used to determine the worst-case discharge volume uses: • An assumption of a guillotine rupture; • Design pipeline capacity to determine the amount of product released prior to a rupture being isolated by closure of remote-controlled mainline valves; and • An assumption that all of the product in the pipe except that isolated by either elevation or existing remote-controlled valves will be discharged at a rupture location. This yields a conservative estimate of the worst-case discharge volume regardless of weather conditions. The steps used to calculate the worst case discharge are: 1) Obtain an elevation profile for the pipeline ➢ This can be through either LIDAR elevation data or elevation collected from an ILI run 2) Determine pipeline attribute data (diameter, wall thickness, location of remote controlled valves) 3) Determine time to identify a release and close a remote controlled valve ➢ Enbridge's standard is 10 minutes for the Control Centre to detect a rupture and perform a shutdown, and a 3 minute design standard valve closure time 4) Identify the design flow rate 5) Calculate the initial volume out (13 minutes x design flow rate) 6) Calculate the stabilization loss. The stabilization loss is defined as the amount of product between two remote controlled valves that is at a higher elevation than the rupture and is not isolated by elevation. The figure below illustrates the volume included in the calculation of stabilization loss. The grey sections of pipe represent the volume that would drain out at the rupture point, while the orange segments would remain in the pipe.

Using the elevation data obtained in step 1), a rupture location is selected. The closest upstream and downstream isolation points (remote controlled valves) are then located. At this time, only the elevation data for the length of pipe between these two points is considered.

Calculations are performed for each pipe segment upstream of the rupture. Initially, the minimum elevation to drain is set to the elevation of the data point closest to the rupture point. Each location point upstream of the rupture point, starting with the closest, is then examined to determine if it is above the minimum drainage elevation. If it is, the portion of the segment between that elevation point and the previous one that is above the minimum drainage elevation is determined, and the volume of that segment is calculated using the formulas below. That elevation point then becomes the new minimum drainage elevation.

Volume of product in the segment = (length of segment)*(cross section of pipe)

Length of segment = SQRT[(y2-y1)^2+(x2-x1)^2], where (x1,y1) is the relative location and elevation of start of the segment and (x2, y2) is the relative location and elevation of the end of the segment.

Cross section of pipe = Pi()*r^2 = Pi()* ([Outer Diameter]/2-[Wall Thickness])^2

The same procedure is repeated on the downstream side of the rupture location. The drainage volume is the sum of the volumes of all of these identified segments upstream and downstream of the rupture location.

7) Repeat step 6) for every point along the pipeline
8) Combine the initial volume out and the stabilization loss to obtain total volume out at all points along the pipeline
   - Total Liquid Volume Release (LVR) = Initial Volume Out + Stabilization Loss;
9) Sort in descending order of total LVR. The largest is the worst-case discharge.

Annex 5 – Table of Contents Page

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5.0 Distribution List

An updated Distribution List for this Plan is maintained on the Emergency Management SharePoint site. The plan is available to all staff on the Governance Document Library at https://esites.enbridge.com/sites/GDL/SitePages/Home.aspx

In addition to the Company Corporate Office, the entire Plan with appropriate Geographical Annexes will be kept at each regional office, with Qualified Individual / Incident Commander and with spill response trailers where appropriate. Additionally, the Field Emergency Response Plan is a concise truncated version of this plan, will be kept by designated response personnel.

5.1 Revision Process

The ICP will be reviewed annually or when an operating condition change occurs. Examples may include:

- Extension of existing pipeline;
- Construction of new pipeline;
- The Qualified Individual / Incident Commander or designee as identified in *Annex 1* will be updated if needed to reflect accurate accountability in the Region;
- New response Procedures, such as new preferred response tactics, or SDSs that would alter how Enbridge manages a response.

The annual review process of the ICP Annexes will ensure that the most accurate drawings and references are integrated into the Plan.

In the event of a revision requirement before the annual review, a revision request to update the Core Plan and/or a Regional Annex may be submitted for consideration by completing and sending an ESM Management of Change Form, Part A (see next page) to the Document Owner of this Plan or to ESM@enbridge.com.

In addition, pursuant to *49CFR194.121* the Company will review its plan in full and resubmit its plan in full to PHMSA every 5 years from the date of last submittal or approval.

The Emergency Management Department is the ICP Administrator. All revision requests shall be forwarded to this Department. The revision request will be examined, prioritized and when the revision is integrated into the ICP electronic version, electronic notifications will be sent to the Region(s) and updates will be mailed out to hard copy plan holders.

5.2 Record of Revisions

A simplified record of revisions can be found at the beginning of this document. A full detailed record of revisions for all Integrated Contingency Plans is kept with the Emergency Management Department.

For internal use only ID:

Management of Change
PART A: Change Request Form

Change Requestor:	**Date:**
Department:	
Change Title:	**Published Version:**

PRIORITY

Priority:

☐ Non-Critical OR (Critical (Select one):

- ☐ Emergency & Security Management Department finding/mandated change
- ☐ Significant change in process, function and/or authority*
- ☐ Regulatory requirement / recommendation

DOCUMENT SECTION/ANNEX (if applicable)

Document Name:

Section Part/Annex Part Name & Number:

Page Number(s) or Major Document Revision:

REVISION REQUEST

Current Wording of process or document if known (or attached markup if available):

Proposed Wording (or attached markup)/Proposed Change:

Reason for Change (Please be specific):

For internal use only ID:

Management of Change – PART A
Change Request Form

Suggested Stakeholders:
Impact of Change:
Risk of not doing change:

Submit PART A to esm@enbridge.com

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