

**PULP AND PAPER CHEMICAL RECOVERY COMBUSTION SOURCES
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS
40 CFR PART 63 SUBPART MM**

INSPECTOR CHECKLIST

NOVEMBER 2003

Note: This checklist is a tool to evaluate compliance with the Pulp and Paper NESHAP. It does not contain an exhaustive list or description of all federal environmental regulations that may apply to a pulp and paper facility. Additionally, some facilities have separate standards as outlined in the Federal Register. Check the regulations for applicable rules for the Weyerhaeuser Paper Company's Cosmopolis, Washington facility.

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INTRODUCTION

On January 12, 2001, EPA promulgated the final rule for the National Emission Standards for Hazardous Air Pollutants for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite and Stand-Alone Semicemical Pulp Mills. This is Subpart MM of 40 CFR part 63. On July 19, 2001, EPA issued several technical corrections to the final rule. Subpart MM of 40 CFR part 63 was subsequently amended on February 18, 2003, May 8, 2003, and July 18, 2003. The compliance date for new affected sources is March 13, 2001, and the compliance date for existing affected sources is March 13, 2004.

The items contained in this document are geared towards inspecting the facility, hence, a number of requirements contained in 40 CFR part 63 and Subpart MM, such as permitting protocols, definitions and ancillary information, are not included. For example, many of the notification requirements are not included as they pertain to the permitting of the source. However, those notifications necessary for compliance purposes are included.

TERMS

The term, “new”, as used in Subpart MM should not be confused with the “new source” category of the New Source Performance Standards program. (The NSPS Subpart BB applies only to new Kraft pulping sources with a commencement of construction or modification date after September 24, 1976.) For Subpart MM, a new source is one that began construction or reconstruction after April 15, 1998.

For the purposes of this Subpart, there are two types of Hazardous Air Pollutants (HAPs). §63.862(a) and §63.862(b) address “HAP metals” (from existing and new sources, respectively) and §63.862(c) address “gaseous organic HAPs” from new sources. Gaseous organic HAPs from existing sources are not regulated.

Throughout this document the term “the facility” is used in place of “the owner or operator”. The meaning is still clear and fewer words are used. It also uses “emission unit” in place of “affected source”, “process unit”, “combustion unit” and “combustion device” unless the meaning is not clear.

STAGES OF THE INSPECTION

Prior to visiting the mill, a thorough pre-inspection file review should be done. This should include reviewing any reports submitted since the last inspection, the Start-up, Shutdown, and Malfunction Plan (SSM), data from Performance Tests, and the history of exceedances, violations and compliance.

Finally, the on-site inspection allows the inspector to see first hand how the facility operates, to evaluate the operation of the process and control equipment, review the records required by this subpart and to discuss specific issues of concern to the inspector.

APPROACH

The Subpart MM regulations cover new and existing units, various pulping methods including Kraft, Soda, Sulfite and Semi-chemical, different control technology including Electrostatic Precipitators (ESPs), Wet Scrubbers, and Regenerative Thermal Oxidizers (RTOs), as well as allowing alternative emission control methods and emission limits. For this reason, the approach taken in this document is to create custom forms for each of the possible combinations so the user can cull out only those forms that apply to the configuration they are working with at a mill. Each form provides only the requirements specific to those units.

Forms are also presented for mill-wide recordkeeping and reporting requirements. There are contingencies in Subpart MM that allow a facility to combine existing emission units under a compliance bubble and adjust individual emission limits from these regulated sources. Further, they can petition for different control device type and methods other than those specified in the subpart. A "FORM SELECTION" flow chart, located in Appendix E, is used to select the forms needed for each emission unit. By using the flowchart, a package of forms can be assembled that is a custom fit for the mill being inspected for compliance with Subpart MM. The necessary forms are located in the appropriate appendices.

There are three types of forms in this manual, custom, generic and supporting. Custom forms are unique to a given situation (e.g. the combination of new or existing, process type and control equipment type or specific option) and are grouped as COMPLIANCE REQUIREMENTS or OTHER REQUIREMENTS.

The later applies to specific options allowed in the subpart. These allow one to only have to deal with the requirements that apply to that combination.

Generic forms apply to items that apply to all combinations. These save repeating the same information on each custom form. They are also found in the appendices.

COMPLIANCE REQUIREMENT FORMS

These forms are found in Appendix A. They list the compliance requirements that are unique to a specified combination of emission unit, process type and air pollution control method. If a facility elects to use an alternative emission control system, operating parameters, emission standards for HAP Metal in new Recovery Furnaces or a PM Compliance Bubble, these forms would not apply in their entirety. These forms are as follows:

APPENDIX A-1	NEW KRAFT AND SODA NDCE RECOVERY FURNACE-ESP
APPENDIX A-2	NEW KRAFT AND SODA NDCE OR DCE RECOVERY FURNACE- SCRUBBER
APPENDIX A-3	NEW KRAFT AND SODA DCE RECOVERY FURNACE-ESP
APPENDIX A-4	NEW KRAFT OR SODA SMELT DISSOLVING TANK-SCRUBBER
APPENDIX A-5	NEW KRAFT OR SODA LIME KILN-ESP
APPENDIX A-6	NEW KRAFT OR SODA LIME KILN-SCRUBBER
APPENDIX A-7	ALL NEW STAND ALONE SEMICHEMICAL (ALL RECOVERY METHODS)- RTO
APPENDIX A-8	ALL NEW SULFITE COMBUSTORS -WET SCRUBBER
APPENDIX A-9	EXISTING KRAFT AND SODA DCE OR NDCE RECOVERY FURNACE-ESP
APPENDIX A-10	EXISTING KRAFT AND SODA DCE OR NDCE RECOVERY FURNACE- SCRUBBER
APPENDIX A-11	EXISTING KRAFT AND SODA SMELT DISSOLVING TANK-SCRUBBER
APPENDIX A-12	EXISTING KRAFT OR SODA LIME KILN-ESP
APPENDIX A-13	EXISTING KRAFT OR SODA LIME KILN-SCRUBBER
APPENDIX A-14	ALL EXISTING STAND ALONE SEMICHEMICAL (ALL RECOVERY METHODS)-RTO
APPENDIX A-15	EXISTING SULFITE COMBUSTORS-SCRUBBER

OTHER CUSTOM FORMS

There are some options in the subpart that only apply to an emission unit if the facility chooses to use them. The forms for these options are found in Appendix B. They are the following:

Custom forms include:

APPENDIX B-1	PM COMPLIANCE BUBBLE ALTERNATIVE
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These forms are provided to verify the validity the PM Compliance Bubble emission limits and to evaluate the mill against these limits. There are also forms that contain the requirements associates with this alternative.

GENERIC FORMS

All those requirements that apply to all combinations are contained in generic forms. They are found in Appendix C and are:

APPENDIX C-1	START UP, SHUTDOWN AND MALFUNCTION PLANS
APPENDIX C-2	RECORDKEEPING REQUIREMENTS
APPENDIX C-3	CMS REPORTING REQUIREMENTS
APPENDIX C-4	START UP, SHUTDOWN AND MALFUNCTION REPORT
APPENDIX C-5	GENERAL REPORTING REQUIREMENTS
APPENDIX C-6	EXCESS EMISSION REPORTING REQUIREMENTS
APPENDIX C-7	OPERATION / MAINTENANCE REQUIREMENTS
APPENDIX C-8	SEMI-ANNUAL REPORTS
APPENDIX C-9	IMMEDIATE REPORTING
APPENDIX C-10	MONITORING REQUIREMENTS

APPLICABILITY DETERMINATION

APPENDIX E-1	APPLICABILITY ASSESSMENT
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There are two criteria for applicability to Subpart MM. One is the appropriate Chemical Recovery technologies as discuss above. The other is the amount of HAPs emitted by the facility. The appendix can be used to assess this applicability:

APPENDIX E-2	FORM SELECTION PROTOCOL
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Since the appendices contain custom forms for each combination of age, pulping process and type of control equipment, a selection protocol is provided in this appendix.

OBSERVING / REVIEWING THE INITIAL PERFORMANCE TEST

Since the IPT is the basis for showing compliance, establishing operational ranges for air pollution control equipment and establishing emission limits for the PM compliance bubble, there are forms available to use in evaluation the IPT and the data resulting form it. Part of evaluation the IPT is to determine that the air pollution control equipment is operating as designed. There are forms showing how to make these calculations.

Prior to inspecting a facility for 40 CFR part 63 Subpart MM requirements, the inspector should observe the Initial Performance Test or review the results (any supporting Performance Tests) to serve as a baseline for the inspection.

There are three main important values of the Initial Performance Test:

- This provides data to determine that air pollution control equipment is being operated in a manner consistent with good air pollution control practices for minimizing emissions at least to the levels required by all relevant standards [§40CFR63.6(e)]
- It is the basis of the operation ranges for the surrogate operation parameters.
- It demonstrates whether or not the control unit is capable of operating in compliance with emission standards.
- Where applicable, the alternative methods and standards can be substantiated.

There is a discussion and package of forms in the appendices for each of the three types of air pollution control equipment specifically referenced in the subpart, Electrostatic Precipitators (ESP), Wet Scrubbers and Regenerative Thermal Oxidizers (RTO). For each emission unit, the applicable package can be selected and used.

COMPLIANCE INSPECTIONS

Since emission units in bubbled sources each have their own emission limit, the inspector needs to confirm that the volumetric flow rate observed during the compliance inspection is consistent with the flow rate observed during the IPT.

APPENDIX D-1 INSPECTING PM COMPLIANCE BUBBLED SOURCES

There are three main important values of compliance inspections:

- Determine that the facility is in compliance with all MACT requirements at the time of the inspection.
- Judge whether or not the facility has been in continuous compliance since the last inspection and the likelihood it will be in continuous compliance in the future.
- Verify all reporting requirements are being complied with.

During inspections, the air pollution control equipment needs to be evaluated and there are forms for that.

APPENDIX F-1 INSPECTING ELECTROSTATIC PRECIPITATORS

Whether observing the IPT or evaluating the operation of the control equipment during an inspection, forms are needed to record the pertinent data. Appendix F contains forms and theory for this evaluation. The locations of forms for the various ESPs normally encountered are:

APPENDIX F-2	SINGLE PASS, 2 FIELD ESP
APPENDIX F-3	SINGLE PASS, 3 FIELD ESP
APPENDIX F-4	TWO CHANNEL, 2 FIELD ESP
APPENDIX F-5	TWO CHANNEL, 3 FIELD ESP

APPENDIX F-6 TWO CHANNEL, 4 FIELD ESP
APPENDIX F-7 TWO CHANNEL, 5 FIELD ESP
APPENDIX F-8 TWO CHANNEL, 6 FIELD ESP

APPENDIX G-1 INSPECTING WET SCRUBBERS

Whether observing the IPT or evaluating the operation of the control equipment during an inspection, forms are needed to record the pertinent data. This Appendix contains forms and theory for this evaluation.

APPENDIX G-2 EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN VIEW)
APPENDIX G-3 EXAMPLE OF DATA FORM FOR WET SCRUBBER (FRONT VIEW)
APPENDIX G-4 EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN AND FRONT VIEW)
APPENDIX G-5 EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN AND FRONT VIEW)
APPENDIX G-6 EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN VIEW)
APPENDIX G-7 EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN VIEW)
APPENDIX G-8 EXAMPLE OF DATA FORM FOR PACKED TOWER WET SCRUBBER (FRONT VIEW)
APPENDIX G-9 EXAMPLE OF DATA FORM FOR VENTURI WET SCRUBBER (PLAN VIEW)

APPENDIX H-1 REGENERATIVE THERMAL OXIDIZERS
APPENDIX H-2 INSPECTING REGENERATIVE THERMAL OXIDIZERS

SAMPLE CALCULATIONS

APPENDIX I-1 SAMPLE CALCULATIONS FOR ELECTROSTATIC PRECIPITATORS
APPENDIX I-2 SAMPLE CALCULATIONS FOR WET SCRUBBERS
APPENDIX I-3 SAMPLE CALCULATIONS FOR REGENERATIVE THERMAL OXIDIZERS

APPENDIX A-1. NEW KRAFT AND SODA NDCE RECOVERY FURNACE - ESP

Compliance date: 3/13/01

Limits

PM: 0.015 gr/dscf @ 8% O₂. [63.862(b)(1)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] (Since it has a NDCE, if the ESP is the dry type, no IPT is needed for PM.) Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

HAPS: 0.025 lbs/ton black liquor solids fired (As Methanol.) [63.862(c)(1)] Only one exceedance can be attributed to any given 24-hour period for purposes of determining the number of nonopacity monitoring exceedances.

Opacity: 20%

TRS (NSPS): 5 ppm_{dv} @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: ESP - Monitor Opacity at least once every 10 seconds or administrative approved alternative
Dry ESP - No monitoring required

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: ESP - Average of 10 consecutive 6-minute averages results in a measurement greater than 20% opacity.

Performance Criteria for Violation (Tier II)

PM: ESP - Opacity is greater than 20% for 6 percent or more of the operating time within any quarterly period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-2. NEW KRAFT AND SODA NDCE OR DCE RECOVERY FURNACES - WET SCRUBBER

Compliance date: 3/13/01

Limits

PM: 0.015 gr/dscf @ 8% O₂. [63.862(b)(1)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 can be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf if added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

HAPS: 0.025 lbs/ton black liquor solids fired (As Methanol.) [63.862(c)(1)] Only one exceedance can be attributed to any given 24-hour period for purposes of determining the number of nonopacity monitoring exceedances. Method 308 in Appendix A of 40 CFR part 60 must be used as well as Methods 1 through 4 in Appendix A of part 60 to determine compliance. The sampling time and sample volume for each Method 308 run must be at least 60 minutes and 0.50 dscf, respectively. [63.865(c)]

Opacity (NSPS): 35%

TRS (NSPS): 5 ppmdv @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative. (Both monitoring devices must be accurate within the limits proscribed in 63.864(3)(10))

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value is outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

APPENDIX A

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-3. NEW KRAFT AND SODA DCE RECOVERY FURNACE - ESP

Compliance date: 3/13/01

Limits

PM: 0.015 gr/dscf @ 8% O₂. [63.862(b)(1)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

HAPS: 0.025 lbs / ton black liquor solids fired (As Methanol.) [63.862(c)(1)] Only one exceedance can be attributed to any given 24-hour period for purposes of determining the number of nonopacity monitoring exceedances. [63.864(c)(3)] Method 308 in Appendix A of 40 CFR part 60 must be used as well as Methods 1 through 4 in Appendix A of part 60. The sampling time and sample volume for each Method 308 run must be at least 60 minutes and 0.50 dscf, respectively. [63.865(c)]

Opacity: 20%

TRS (NSPS): 5 ppmdv @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: ESP - Monitor Opacity at least once every 10 seconds or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: ESP - Average of 10 consecutive 6-minute averages results in a measurement greater than 20%.

Performance Criteria for Violation (Tier II)

PM: ESP - Opacity is greater than 20% for 6 percent or more of the operating time within any quarterly period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-4. NEW KRAFT OR SODA SMELT DISSOLVING TANK - WET SCRUBBER

Compliance date: 3/13/01

Limits

PM: 0.12 lb/ton black liquor solids fired. [63.862(b)(2)]
Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant 0.004 gr/dscf is added to the results.
[63.865(b)(1)]

TRS (NSPS): 0.033 lb/ton black liquor solids fired (Post September 24, 1976).

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value is outside the ranges established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values within any 6 month reporting period are outside the range established during the IPT (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-5. NEW KRAFT OR SODA LIME KILN - ESP

Compliance date: 3/13/01

Limits

PM: 0.010 gr/dscf @ 10% O₂. [63.862(b)(3)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Opacity: 20%

TRS (NSPS): 8 ppmdv @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: ESP - Monitor Opacity at least once every 10 seconds or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: ESP - Average of 10 consecutive 6-minute averages results in a measurement greater than 20% opacity.

Performance Criteria for Violation (Tier II)

PM: ESP - Opacity is greater than 20% for 6% or more of the operating time within any quarterly period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-6. NEW KRAFT OR SODA LIME KILN - WET SCRUBBER

Compliance date: 3/13/01

Limits

PM: 0.010 gr/dscf @ 10% O₂. [63.862(b)(3)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Opacity: 20%

TRS (NSPS): 8 ppmdv @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value is outside the range of values established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values outside the ranges established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-7. ALL NEW STAND ALONE SEMI-CHEMICAL (ALL RECOVERY METHODS) - RTO

Compliance date: 3/13/01

Limits

HAPS: Reduce gaseous organic HAPS to 2.97 lbs/ton Black Liquor Solids fired, as measured as total hydrocarbons reported as carbon [63.862(c)(2)(i)] or,

Reduce gaseous organic HAPS by 90%, as measured as total hydrocarbons reported as carbon. [63.862(c)(2)(ii)] Use equation 12 and measure both inlet and outlet mass loadings. [63.865(d)(2)] Method 25A as well as Methods 1 through 4 in Appendix A of 40 CFR part 60 must be used and the sampling time for each Method 25 run must be at least 60 minutes. [63.865(d)] The emission rate must be determined using Equation 11. [63.865(d)(1)]

Performance Monitoring Requirement

PM: RTO - Monitor Temperature at least once every 15-minute period using the procedures in §63.8(c) or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: RTO - 1-hour average temperature falls below the temperature established during the IPT.

Performance Criteria for Violation (Tier II)

PM: RTO - 3-hour average temperature falls below the temperature established during the IPT.

APPENDIX A-8. ALL NEW SULFITE COMBUSTORS - WET SCRUBBER

Compliance date: 3/13/01

Limits

PM: 0.020 gr/dscf @ 8% O₂. [63.862(b)(4)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value is outside the range established during the IPT within any 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values are outside the range established during the IPT within any 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-9. EXISTING KRAFT AND SODA DCE OR NDCE RECOVERY FURNACE - ESP

Compliance date: 3/13/04

Limits

PM: 0.044 gr/dscf @ 8% O₂. [63.862(a)(1)(i)(A)]
 Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and 0.004 gr/dscf is added to the result. [63.865(b)(1)]
 Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Opacity: 20%/35%

TRS (NSPS): 5 ppm_{dv} @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: ESP - Monitor Opacity at least once every 10 seconds or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: ESP - Average of 10 consecutive 6-minute opacity readings is greater than 20%.

Performance Criteria for Violation (Tier II)

PM: ESP - Opacity is greater than 35% for 6% or more of the operating time within any quarterly period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-10. EXISTING KRAFT AND SODA DCE OR NDCE RECOVERY FURNACE - WET SCRUBBER

Compliance date: 3/13/04

Limits

PM: 0.044 gr/dscf @ 8% O₂. [63.862(a)(1)(i)(A)]
Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the result. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Opacity: 35%

TRS (NSPS): 5 ppmdv @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3 hour average scrubber parameter value outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3 hour average scrubber parameter values outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-11. EXISTING KRAFT AND SODA SMELT DISSOLVING TANK - WET SCRUBBER

Compliance date: 3/13/04

Limits

PM: 0.20 lb/ton black liquor solids fired.
[63.862(a)(1)(i)(B)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)]

TRS (NSPS): 0.033 lb/ton black liquor solids fired (Post September 24, 1976).

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-12. EXISTING KRAFT OR SODA LIME KILN - ESP

Compliance date: 3/13/04

Limits

PM: 0.064 gr/dscf @ 10% O₂. [63.862(a)(1)(i)(C)]
 Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Opacity: 20%

TRS (NSPS): 8 ppmdv @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: ESP - Monitor Opacity at least once every 10 seconds or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: ESP - Average of 10 consecutive 6-minute averages results in a measurement greater than 20% opacity.

Performance Criteria for Violation (Tier II)

PM: ESP - Opacity is greater than 20% for more than 6% of the operating time within any quarterly period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX A-13. EXISTING KRAFT OR SODA LIME KILN - WET SCRUBBER

Compliance date: 3/13/04

Limits

PM: 0.064 gr/dscf @ 10% O₂. [63.862(a)(1)(i)(C)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Opacity (NSPS): 20%

TRS (NSPS): 8 ppm_{dv} @ 8% O₂ (Post September 24, 1976)

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value is outside the ranges established during the IPT within the 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values outside the range of values established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

**APPENDIX A-14. ALL EXISTING
STAND ALONE SEMICHEMICAL (ALL RECOVERY METHODS) - RTO**

Compliance date: 3/13/04

Limits

HAPS: Reduce gaseous organic HAPS to 2.97 lbs/ton Black Liquor Solids, as measured as total hydrocarbons reported as carbon [63.862(c)(2)(i)] or,

Reduce gaseous organic HAPS by 90%, as measured as total hydrocarbons reported as carbon. [63.862(c)(2)(ii)] Use equation 12 and measure both inlet and outlet mass loadings. [63.865(d)(2)] Method 25A as well as Methods 1 through 4 in appendix A of 40 CFR part 60 must be used and the sampling time for each Method 25 run must be at least 60 minutes. [63.865(d)] The emission rate must be determined using Equation 11. [63.865(d)(1)]

Performance Monitoring Requirement

PM: RTO - Monitor Temperature at least once every 15-minute period using the procedures in §63.8(c) or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: RTO - 1-hour average temperature falls below the temperature established during the IPT.

Performance Criteria for Violation (Tier II)

PM: RTO - 3-hour average temperature falls below the temperature established during the IPT.

APPENDIX A-15. ALL EXISTING SULFITE COMBUSTORS - WET SCRUBBER

Compliance date: 3/13/04

Limits

PM: 0.040 gr/dscf @ 8% O₂. [63.862(a)(2)] Method 5 or Method 29 in Appendix A of 40 CFR part 60 must be used, except that Method 17 may be used if the stack temperature is no greater than 400 ° F and a constant value of 0.004 gr/dscf is added to the results. [63.865(b)(1)] Method 3A or 3B in Appendix A of 40 CFR part 60 must be used to determine the oxygen concentration. [63.865(b)(3)] The oxygen correction must be made with equation 7. [63.865(b)(2)]

Performance Monitoring Requirement

PM: Wet Scrubber - Monitor Pressure Differential across the scrubber (inches of water) and the scrubbing liquid into it (gallons per minute) at least once every 15 minutes or administrative approved alternative.

Performance Monitoring Criteria for Corrective Action to be Taken (Tier I)

PM: Wet Scrubber - Any 3-hour average scrubber parameter value outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours).

Performance Criteria for Violation (Tier II)

PM: Wet Scrubber - Six or more 3-hour average scrubber parameter values outside the range established during the IPT within a 6 month reporting period (no more than one exceedance per 24 hours) in addition to excused periods under the start-up, shutdown or malfunction provisions.

APPENDIX B-1. PM COMPLIANCE BUBBLE ALTERNATIVE

Compliance date: 3/13/04

[63.862(a)(1)(ii)] As an alternative to meeting the requirements of 63.862(a)(1)(i), each kraft or soda facility may establish PM emission limits for each recovery furnace, smelt dissolving tank and lime kiln that operated 6,300 hours per year or more by:

- establishing an overall PM emission limit for each existing process unit using methods in §63.865(a)(1) and §63.865(a)(2)
- the emission limits for each kraft process unit cannot be less stringent than those in §60.282 (Note. This is NSPS Subpart BB)
- the facility must ensure that PM emissions emitted are less than or equal to limits established using methods in §63.865(a)(1)
- the facility must reestablish emission limits if
 - an emission unit is
 - modified as defined in §63.861, or
 - shut down for more than 60 consecutive days

§63.865 Performance test requirements and test methods

[63.865(a)] The facility seeking to comply with a PM emission limit under 63.862(a)(1)(ii)(A) (existing sources only) must use the procedures in paragraphs 63.865(a)(1) through 63.865(a)(4).

§63.867 Reporting requirements

[63.867(b)(1)] The facility must submit the PM emissions limits determined in 63.865(a) for each affected Kraft or Soda recovery furnace, smelt dissolving tank, and lime kiln to the Administrator for approval. The emission limits must be submitted as part of the notification of compliance status required under Subpart A of this part This is 63.9(h).

[63.867(b)(2)] The facility must submit the calculations and supporting documentation used in 63.865(a)(1) and 63.865(a)(2) to the Administrator as part of the notification of compliance status required under subpart A of this part [63.9(h)].

[63.867(b)(3)] After the Administrator has approved the emissions limits for any process unit, the facility must notify the Administrator before:

- the air pollution control system for any process unit is modified or replaced
- any Kraft or Soda recovery furnace, smelt dissolving tank, or lime kiln is shut down for more than 60 consecutive days
- a continuous monitoring parameter or the value or range of values of a continuous monitoring parameter for any process unit is changed

- the black liquor solids firing rate for any Kraft or Soda recovery furnace during any 24-hour averaging period is increased by more than 10 percent above the level measured during the most recent performance test

[63.867(b)(4)] A facility seeking to perform the actions in 63.867(b)(3)(i) or 63.867(b)(3)(ii) must recalculate the overall PM emissions limit for the group of process units and resubmit the documentation required in 63.867(b)(2) to the Administrator. All modified PM emissions limits are subject to approval by the Administrator.

APPENDIX C-1. STARTUP, SHUTDOWN, AND MALFUNCTION PLANS

The facility must develop and implement a written Startup, Shutdown, and Malfunction (SSM) Plan [§63.866(a)] no later than

- March 13, 2004, for existing emission units. [§63.866(a)]
- March 12, 2001, for emission units that had an initial startup date after March 13, 2001, [§63.866(b)]

The purpose of the SSM plan is to

- ensure that, at all times, including periods of startup, shutdown, and malfunction, facilities operate and maintain affected sources, including associated air pollution control equipment, in a manner consistent with good air pollution control practices for minimizing emissions at least to the levels required by all relevant standards [§63.6(e)(1)(i)]
- ensure that facilities are prepared to correct malfunctions as soon as practicable after their occurrence in order to minimize excess emissions of hazardous air pollutants in accordance with the startup, shutdown, and malfunction plan. [§63.6(e)(1)(ii)]
- reduce the reporting burden associated with periods of startup, shutdown, and malfunction (including corrective action taken to restore malfunctioning processes and air pollution control equipment to its normal or usual manner of operation.) [§63.6(e)(3)(i)]
- provide procedures under which the facility must operate and maintain its equipment (including associated air pollution control equipment) during periods of start up, shutdown, and malfunction. [§63.6(e)(3)(ii)]

The SSM Plan

- shall describe, in detail:
 - procedures for operating and maintaining the source during periods of startup, shutdown, and malfunction
 - a program of corrective action for malfunctioning process and air pollution control equipment used to comply with the relevant standard
- must identify all routine or otherwise predictable CMS malfunctions. (For the purposes of this subpart CMSs include:
 - for any Kraft or Soda recovery furnace or lime kiln equipped with an ESP
 - Continuous Opacity Monitor (COM)
 - for any Kraft or Soda recovery furnace, smelt dissolving tank or lime kiln or sulfite combustion unit equipped with a wet scrubber
 - CMS for pressured drop of the gas stream across the scrubber
 - CMS for the scrubbing liquid flow rate
 - for any semichemical combustion unit equipped with an Regenerative Thermal Oxidizer (RTO)
 - CMS for the operating temperature at the point of incineration
 - for any alternative air pollution control system approved by the Administrator

- CMS for monitoring equipment or process parameters approved by the Administrator.)
- must be incorporated by reference into the source's Title V permit. [§63.6(e)(3)(i)].
- shall include
 - procedures for responding to any process parameter level that is inconsistent with the level(s) established under §63.864(j) including
 - procedures to determine and record
 - the cause of an operating parameter exceedance
 - the time the exceedance began
 - the time the exceedance ended
 - corrective actions to be taken in the event of an operating parameter exceedance, including procedures for recording the actions taken to correct the exceedance.[§63.866(a)(1)]
 - a maintenance schedule for each control technique that is consistent with but not limited to
 - the manufacturer's instructions
 - recommendations for routine and long term maintenance
 - an inspection schedule for each CMS required under §63.864 to ensure, at least once in each 24-hour period, that each continuous monitoring system is properly functioning.§63.866(a)(1).
- may be part of the facility's
 - standard operating procedures (SOP) manual, OSHA plan or other plan provided the alternative plans
 - meet all the requirements for an SSM plan
 - are made available for inspection when requested by the Administrator. [§63.6(e)(3)(vi)]
- shall be kept on record and made available for inspection, upon request, by the Administrator for the life of the emission unit or until the emission unit is no longer subject to the provision of this part. If the SSM plan is revised, any previous (i.e. superseded) versions shall, likewise, be made available for a period of 5 years after each revision to the plan. [§63.6(e)(3)(v)]

The Administrator may require reasonable revisions to a SSM plan, under the authority of §63.6(e)(2)

- if the Administrator finds that the plan does not provide adequate procedures for correcting malfunctioning process and or air pollution control equipment as quickly as practicable [§63.6(e)(3)(vii)]
- it must be revised within 45 days after the event to include
 - detailed procedures for operating and maintaining the source during similar malfunction events
 - program of corrective action for similar malfunctions of process or air pollution control equipment. [§63.6(e)(3)(viii)]

The SSM Plan must include

- procedures for responding to any process parameter level that is inconsistent with the level(s) established under §63.864(j) including
 - procedures to determine and record the cause of an operating parameter exceedance and the time the exceedance began and ended [§63.866(a)(1)(i)]
 - corrective actions to be taken in the event of an operating parameter exceedance, including procedures for recording the actions taken to correct the exceedance. [§63.866(a)(1)(ii)]
- schedules
 - a maintenance schedule for each control technique that is consistent with, but not limited to, the manufacturer's instructions and recommendations for routine and long term maintenance [§63.866(a)(2)(i)]
 - an inspection schedule for each CMS required under §63.864 to ensure, at least once in each 24-hour period, that each CMS is properly functioning. [§63.866(a)(2)(ii)]

APPENDIX C-2. RECORDKEEPING REQUIREMENTS

[§63.866(b)] The facility must maintain records of any occurrence when corrective action is required under §63.864(k)(1) and when a violation is noted under §63.864(k)(2)

Facility must maintain files of all required information in a form suitable and readily available for expeditious inspection and review. (Note: these files must be maintained at least 5 years with the most recent 2 years being on site.) Electronic and microform formats are acceptable.

[§63.10(b)(1)]

The facility shall maintain relevant records of:

- the occurrence and duration of each startup, shutdown and malfunction of the processes and air pollution control equipment and all maintenance performed on the air pollution control equipment. [§63.10(b)(2)(i), (ii) and (iii)]
- actions taken during startup, shutdown or malfunction that are not covered by the SSM Plan. [§63.10(b)(2)(iv)]
- sufficient information necessary to demonstrate conformance with the SSM [§63.10(b)(2)(v)]
- each period (???) during which a CMS malfunction or inoperative (including out-of-control periods as defined in §63.8(c)(7)(i)). [§63.10(b)(2)(vi)]
- all measurements needed to demonstrate continuous compliance (including but not limited to):
 - required CMS data averages including where appropriate [§63.10(b)(2)(vii)]
 - 10-second average opacity
 - 15-minute average pressure drop and scrubbing liquid flow in wet scrubbers
 - 15-minute average incineration temperature in a RTO
 - any control equipment or process parameter averaging time specified under alternative air pollution control measures approval by the Administrator

(Note: If a Continuous Emission Monitoring system is in use and the data averages include periods of CEMS breakdown or malfunction, then less data needs to be maintained on file unless the regulatory authority decides otherwise. [§63.10(b)(2)(vii)].
 - If the CEMS data analysis is automated, only the most recent (???) consecutive three hour average period of subhourly measurement need to be retained and a file of the algorithm used to reduce the measurement data into the reportable form. (Note: “automated” means a computerized data acquisition system that records and reduces the data.) [§63.10(b)(2)(vii)(A)]
 - If the CEMS data analysis is manually reduced, only the subhourly measurements for the most recent reporting period need to be

retained. This data set needs to be retained for 120 days from the date of the most recent summary or excess emission report.
[§63.10(b)(2)(vii)(B)]

- results of performance tests, CMS performance evaluations and opacity and visibility emission observations. [§63.10(b)(2)(viii)]
 - (Note: “Performance testing” includes the execution of a test method (usually three emission test runs) used to demonstrate compliance with a relevant emission standard.)
 - (Note: “Performance evaluations” are relative accuracy testing, calibration error testing and other measurements used in validating the CMS data.)
- measurements necessary to determine the condition of performance tests and performance evaluations. [§63.10(b)(2)(ix)]
- CMS calibration checks as well as all adjustments and maintenance performed on CMS. [§63.10(b)(2)(x) and §63.10(b)(2)(xi)]
- data demonstrating whether a source is meeting the requirements of any waiver. [§63.10(b)(2)(xii)]
- relating to obtaining permission to use an alternative to the relative accuracy test if granted such option. [§63.10(b)(2)(xiii)]
- documentation supporting initial notifications and notifications of compliance status. [§63.10(b)(2)(xiv)]
- records of
 - black liquor solids firing rate (tons per day) for all recovery furnaces and semichemical combustion units where applicable [§63.866(c)(1)]
 - CaO production rates in tons/day for all lime kilns where applicable [§63.866(c)(2)]
 - parameter monitoring data required under §63.864 including
 - any period when the operating parameter levels were inconsistent with the levels established during the initial performance test
 - with a brief explanation of the cause of the deviation
 - the time the deviation occurred
 - the time corrective action was initiated
 - the time corrective action was completed
 - the corrective action taken. [§63.866(c)(3)]
 - and documentation of supporting calculations for compliance determinations made under §63.865(a) through §63.865(e). [§63.866(c)(4)]
 - monitoring parameter ranges established for each affected source or process unit. [§63.866(c)(5)]
 - only in the case of new recovery furnaces equipped with a dry ESP system, records certification of this fact. [§63.866(c)(6)]

APPENDIX C-3. CMS REPORTING REQUIREMENTS

§63.10(c) Additional recordkeeping requirements for sources with continuous monitoring systems

A facility that must install a CMS shall maintain records of:

- all required CMS measurements (including monitoring data recorded during unavoidable CMS breakdowns and out-of-control periods. [63.10(c)(1)]
- the date and time identifying each period during which the CMS was inoperative except zero (low-level) and high-level checks.[63.10(c)(5)]
- the date and time identifying each period during which the CMS was out of control as defined in 63.8(c)(7). [63.10(c)(6)]
- the specific identification (i.e. the date and time of commencement and completion) of each period of excess emissions and parameter monitoring exceedances that occurs during startups, shutdowns and malfunctions. [63.10(c)(7)]
- the specific identification (i.e. the date and time of commencement and completion) of each period of excess emissions and parameter monitoring exceedances that occurs during periods other than startups, shutdowns and malfunctions. [63.10(c)(8)]
- the nature and cause of any malfunction (if known). [63.10(c)(10)]
- the corrective action taken or preventative measures adopted. [63.10(c)(11)]
- the nature of the repairs or adjustments to the CMS that was inoperative or out of control. [63.10(c)(12)]
- the total process operating time during the reporting period. [63.10(c)(13)]
- all procedures that are part of a quality control program developed and implemented for CMS under 63.8(d). [63.10(c)(14)]

Some of the reporting may be satisfied with elements of the startup, shutdown and malfunction plant reports.

APPENDIX C-4. STARTUP, SHUTDOWN, AND MALFUNCTION REPORT

[§63.6(e)(3)(iii)part] (If the SSM Plan is followed and the CMS repaired immediately, this action shall be reported in the semiannual startup, shutdown, and malfunction report required under 63.10(d)(5)(i).)

[§63.6(e)(3)(iii)] When actions taken by the facility during a startup, shutdown, or malfunction (including actions taken to correct a malfunction) are consistent with the procedures specified in the affected source's SSM plan, the facility shall keep records for that event that demonstrate that the procedures specified in the plan were followed. These records may take the form of a "checklist", or other effective form of recordkeeping, that confirms conformance with the SSM plan for that event. In addition, the owner or operator shall keep records of these events as specified in §63.10(b) (and elsewhere in this part), including records of the occurrence and duration of each startup, shutdown, or malfunction of operation and each malfunction of the air pollution control equipment. Furthermore, the facility shall confirm that actions taken during the relevant reporting period during periods of startup, shutdown and malfunction were consistent with the affected source's SSM plan in the semiannual (or more frequent) SSM report required in §63.10(d)(5).

[§63.6(e)(3)(iv)] If an action taken by the facility during a SSM (including an action taken to correct a malfunction) is not consistent with the procedures specified in the affected source's SSM plan, the facility shall record the actions taken for that event and shall report such actions within 2 working days after commencing actions inconsistent with the plan, followed by a letter within 7 working days after the end of the event, in accordance with §63.10(d)(5) (unless the facility makes alternative reporting arrangements, in advance, with the Administrator (see §63.10(d)(5)(ii)).

§63.866(b) REQUIRED GENERAL RECORDS

[§63.866(b)] The facility must maintain records of any occurrence when corrective action is required under §63.864(k)(1) and when a violation is noted under §63.864(k)(2).

APPENDIX C-5. GENERAL REPORTING REQUIREMENTS

[63.867(a)] The facility must submit the applicable notifications from subpart A of this part (§63.1 through §63.15) as specified in Table 1 of this subpart.

CMS REPORTING

§63.10(c) Additional recordkeeping requirements for sources with continuous monitoring systems

A facility that must install a CMS shall maintain records of:

- all required CMS measurements including monitoring data recorded during unavoidable CMS breakdowns and out-of-control periods. [63.10(c)(1)]
- the date and time identifying each period during which the CMS was inoperative except zero (low-level) and high-level checks.[63.10(c)(5)]
- the date and time identifying each period during which the CMS was out of control as defined in 63.8(c)(7). [63.10(c)(6)]
- the specific identification (i.e. the date and time of commencement and completion) of each period of excess emissions and parameter monitoring exceedances that occurs during startups, shutdowns and malfunctions. [63.10(c)(7)]
- the specific identification (i.e. the date and time of commencement and completion) of each period of excess emissions and parameter monitoring exceedances that occurs during periods other than startups, shutdowns and malfunctions. [63.10(c)(8)]
- the nature and cause of any malfunction (if known). [63.10(c)(10)]
- the corrective action taken or preventative measures adopted. [63.10(c)(11)]
- the nature of the repairs or adjustments to the CMS that was inoperative or out of control. [63.10(c)(12)]
- the total process operating time during the reporting period. [63.10(c)(13)]
- all procedures that are part of a quality control program developed and implemented for CMS under 63.8(d). [63.10(c)(14)]

Some of the reporting may be satisfied with elements of the startup, shutdown and malfunction plan reports.

Summary report see 63.10(e)(3)(vi)

The facility must notify the Administrator before

- any air pollution control system for any process unit is modified or replaced. [§63.867(b)(3)(i)]
- a CMS parameter or the value or range of values of a CMS for any process unit is changed

APPENDIX C-6. EXCESS EMISSIONS REPORTING REQUIREMENTS

§ 63.867 (c) The owner or operator must report quarterly if measured parameters meet any of the conditions specified in paragraph (k)(1) or (2) of § 63.864. This report must contain the information specified in § 63.10(c) of this part as well as the number and duration of occurrences when the source met or exceeded the conditions in § 63.864(k)(1), and the number and duration of occurrences when the source met or exceeded the conditions in § 63.864(k)(2). Reporting excess emissions below the violation thresholds of § 63.864(k) does not constitute a violation of the applicable standard.

§ 63.867 (c)(1) When no exceedances of parameters have occurred, the owner or operator must submit a semiannual report stating that no excess emissions occurred during the reporting period.

§ 63.867 (c)(2) The owner or operator of an affected source or process unit subject to the requirements of this subpart and subpart S of this part may combine excess emissions and/or summary reports for the mill.

APPENDIX C-7. OPERATION AND MAINTENANCE REQUIREMENTS

§63.6(e) Operation and maintenance requirements.

§63.8(c)(1)(i) The facility shall

- ensure the immediate repair or replacement of Continuous Monitoring System (CMS) parts to correct “routine” or otherwise predictable CMS malfunctions as defined in the source’s startup, shutdown, and malfunction plan required by §63.6(e)(3)
- keep the necessary parts for routine repairs of the affected equipment readily available

Determination of whether acceptable operation and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to monitoring results, review of operation and maintenance procedures (including the startup, shutdown, and malfunction plan required in paragraph 63.6(e)(3) , review of operation and maintenance records, and inspection of the source. [§63.6(e)(2)]

Operation and maintenance requirements established pursuant to section 112 of the Act are enforceable independent of emissions limitations or other requirements in relevant standards. [§63.6(e)(1)(iii)]

APPENDIX C-8. SEMI-ANNUAL REPORTS

§63.8(c)(1)(i) requires that if actions are taken during a startup, shutdown or malfunction (including actions taken to correct a malfunction) are consistent with the procedures specified in the SSM plan they shall be reported by the 30th day following the end of each calendar half (or other calendar reporting period, as appropriate.)

The report shall consist of a letter with the name, title and signature of the owner or operator or other reasonable official who is certifying its accuracy.

APPENDIX C-9. IMMEDIATE REPORTING

§63.10(d)(5)(ii) requires that if actions are taken during a startup, shutdown or malfunction (including actions taken to correct a malfunction) are not consistent with the procedures specified in the SSM plan they shall be reported within 2 working days (by telephone call or FAX) after commencing actions inconsistent with the SSM Plan followed by a letter within 7 days after the end of the event.

The report shall consist of a letter with the name, title and signature of the owner or operator or other reasonable official who is certifying its accuracy, explaining

- the circumstances of the event
- the reasons for not following the SSM Plan
- whether any excess emissions and/or parameter monitoring exceedances are believed to have occurred.

APPENDIX C-10. MONITORING REQUIREMENTS

§63.864(j) *Determination of operating ranges* (1) During the initial performance test required in §63.865, the owner or operator of any affected source or process unit must establish operating ranges for the monitoring parameters in paragraphs (e)(10) through (14) of this section; or

§63.864(j)(2) The owner or operator may base operating ranges on values recorded during previous performance tests or conduct additional performance tests for the specific purpose of establishing operating ranges, provided that test data used to establish the operating ranges are or have been obtained using the test methods required in this subpart. The owner or operator of the affected source or process unit must certify that all control techniques and processes have not been modified subsequent to the testing upon which the data used to establish the operating parameter ranges were obtained.

§63.864(j)(3) The owner or operator of an affected source or process unit may establish expanded or replacement operating ranges for the monitoring parameters values listed in paragraphs (e)(10) through (14) of this section and established in paragraph (j)(1) or (2) of this section during subsequent performance tests using the test methods in §63.865.

§63.864(k) *On-going compliance provisions* (1) Following the compliance date, owners or operators of all affected sources or process units are required to implement corrective action, as specified in the **STARTUP, SHUTDOWN, AND MALFUNCTION PLAN** section AND IN §63.866(a) if the monitoring exceedances identified as Tier I in Appendix A occur. (Also see §63.864(k)(1)(i) through (vii))

§63.864(k)(2) Following the compliance date, owners or operators of all affected sources or process units are in violation of the standards of §63.862 if the monitoring exceedances identified as Tier II in Appendix A occur. (Also see §63.864(k)(2)(i) through (vii))

§63.864(k)(3) For the purposes of determining the number of nonopacity monitoring exceedances, no more than one exceedance will be attributed in any given 24-hour period.

§63.865 The owner or operator of each affected source or process unit subject to the requirements of this subpart is required to conduct an initial performance test using the test methods and procedures listed in §63.7 and paragraph (b) of this section except as provided in paragraph 63.865(c)(1)

§63.865(c)(1) The owner or operator complying through the use of an NDCE recovery furnace equipped with a dry ESP system is not required to conduct any performance testing to demonstrate compliance with the gaseous organic HAP standard.

APPENDIX D-1. INSPECTING PM COMPLIANCE BUBBLED SOURCES

(§63.862 (a)(1)(ii)(A) - Existing kraft or soda pulp mill PM emission limits)

This applies to recovery furnace, smelt dissolving tanks and like kilns that operate 6,300 hours per year or more. The equation to be used is as follows:

$$EL_{PM} = [(C_{ref, RF})(Q_{RFtot}) + (C_{ref, LK})(Q_{LKtot})](F1) / (BLS_{tot}) + ER1_{ref, SDT}$$

Where:

- EL_{PM} = overall PM emission limit for all existing process units in the chemical recovery system at the kraft or soda pulp mill, kg/Mg (lb/ton) of black liquor solids fired.
- $C_{ref, RF}$ = reference concentration of 0.10 g/dscm (0.044 gr/dscf) corrected to 8 percent oxygen for existing kraft or soda recovery furnaces.
- Q_{RFtot} = sum of the average volumetric gas flow rates measured during the performance test and corrected to 8 percent oxygen for all existing recovery furnaces in the chemical recovery system at the kraft or soda pulp mill, dry standard cubic meters per minute (dscm/min) (dry standard cubic feet per minute [dscf/min]).
- $C_{ref, LK}$ = reference concentration of 0.15 g/dscm (0.064 gr/dscf) corrected to 10 percent oxygen for existing kraft or soda lime kilns.
- Q_{LKtot} = sum of the average volumetric gas flow rates measured during the performance test and corrected to 10 percent oxygen for all existing lime kilns in the chemical recovery system at the kraft or soda pulp mill, dscm/min (dscf/min).
- $F1$ = conversion factor, 1.44 minutes ;kilogram/day gram (min kg/d g) (0.206 minutes pound/day grain [min lb/d gr]).
- BLS_{tot} = sum of the average black liquor solids firing rates of all existing recovery furnaces in the chemical recovery system at the kraft or soda pulp mill measured during the performance test, megagrams per day (Mg/d) (tons per day [tons/d]) of black liquor solids fired.
- $ER1_{ref, SDT}$ = reference emission rate of 0.10 kg/Mg (0.20 lb/ton) of black liquor solids fired for existing kraft or soda smelt dissolving tanks.

Verify overall PM emission limit (EL_{PM})

Data from performance tests.

Recovery Furnaces (Identification)	Average Q _{RF} (dscf/min)	Average BLS fired (tons/day)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Q_{RFtot} = _____

BLS_{tot} = _____

Lime Kilns (Identification)	Average Q _{LK} (dscf/min)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Q_{LKtot} = _____

Calculation

$$A = [(C_{ref, RF})(Q_{RFtot}) + (C_{ref, LK})(Q_{LKtot})](F1)$$

$$A = [(0.044)(\quad) + (0.064)(\quad)] (1.44) = \underline{\hspace{2cm}}$$

$$EL_{PM} = [(A) / (BLS_{tot})] + ER_{1ref, SDT}$$

$$EL_{PM} = [(\quad) / (\quad)] + 0.20 = \underline{\hspace{2cm}}$$

Verify established emission limits for recovery furnaces (ER_{RF})

$$ER_{RF} = (F1)(C_{EL, RF})(Q_{RF})/(BLS)$$

Where:

ER_{RF} = emission rate from each recovery furnace, kg/Mg (lb/ton) of black liquor solids.

F1 = conversion factor, 1.44 min kg/d g (0.206 min /d gr).

C_{EL, RF} = PM emission limit proposed by the facility for the recovery furnace, g/dscm (gr/dscf) corrected to 8 percent oxygen.

Q_{RF} = average volumetric gas flow rate from the recovery furnace measured during the performance test and corrected to 8 percent oxygen, dscm/min (dscf/min).

BLS = average black liquor solids firing rate of the recovery furnace measured during the performance test, Mg/d (ton/d) of black liquor solids.

Data from performance tests.

Recovery Furnaces Furnaces (Identification)	F1	Proposed Limit (gr/dscf)	Average Q _{RF} (dscf/min)	/Average BLS fired (tons/day)	ER _{RF}
_____	1.44	_____	_____	/_____	_____
_____	1.44	_____	_____	/_____	_____
_____	1.44	_____	_____	/_____	_____
_____	1.44	_____	_____	/_____	_____
_____	1.44	_____	_____	/_____	_____

Verify established emission limits for smelt dissolving tanks (ER_{SDT})

$$ER_{SDT} = (F1)(C_{EL, SDT})(Q_{SDT}) / [(BLS)(R)]$$

Where:

ER_{SDT} = emission rate from each smelt dissolving tank, kg/Mg (lb/ton) of black liquor solids fired.

F1 = conversion factor, 1.44 min kg/d g (0.206 min /d gr).

C_{EL, SDT} = PM emission limit proposed by the facility for the recovery furnace, g/dscm (gr/dscf).

Q_{SDT} = average volumetric gas flow rate from the smelt dissolving tank measured during the performance test, dscm/min (dscf/min).

BLS = average black liquor solids firing rate of the associated recovery furnace measured during the performance test, Mg/d (ton/d) of black liquor solids. If more than one SDT is used to dissolve the smelt from a given recovery furnace, then the black liquor solids firing rate of the furnace must be proportioned according to the size of the SDT.

R = Ratio of SDT tank size to the other SDT that are used to dissolve the smelt from a given recovery furnace.

Data from performance tests.

Smelt Dissolving Tanks (Identification)	F1	Proposed Limit (gr/dscf)	Average Q _{SDT} (dscf/min)	/(Average BLS fired (tons/day)	Size) Ratio of SDT	ER _{SDT}
_____	1.44	_____	_____	/(_____	_____)	_____
_____	1.44	_____	_____	/(_____	_____)	_____
_____	1.44	_____	_____	/(_____	_____)	_____
_____	1.44	_____	_____	/(_____	_____)	_____
_____	1.44	_____	_____	/(_____	_____)	_____
_____	1.44	_____	_____	/(_____	_____)	_____
_____	1.44	_____	_____	/(_____	_____)	_____

Verify established emission limits for lime kilns (ER_{LK})

$$ER_{LK} = (F1)(C_{EL, LK})(Q_{LK})(CaO_{tot}/BLS_{tot})/(CaO_{LK})$$

Where:

ER_{LK} = emission rate from each lime kiln, kg/Mg (lb/ton) of black liquor solids.

F1 = conversion factor, 1.44 min kg/d g (0.206 min /d gr).

C_{EL, LK} = PM emission limit proposed by the facility for the lime kiln, g/dscm (gr/dscf) corrected to 8 percent oxygen.

Q_{LK} = average volumetric gas flow rate from the lime kiln measured during the performance test and corrected to 10 percent oxygen, dscm/min (dscf/min).

CaO_{tot} = sum of the average lime production rates of all existing lime kilns in the chemical recovery system at the mill measured as CaO during the performance test, Mg/d(lb/ton).

BLS_{tot} = sum of the average black liquor solids firing rate of the recovery furnaces in the chemical recovery system at the mill measured as CaO during the performance test, Mg/d (ton/d).

CaO_{LK} = lime production rate of the lime kiln, measured as CaO during the performance test, Mg/d(lb/ton) of CaO.

Data from performance tests.

Lime Kilns (ID)	F1	Proposed Limit (gr/dscf)	Average Q _{LK} (dscf/min)	(Total CaO (tons/day)	/Total)/Lime BLS fired	ER _{RF}
_____	1.44	_____	_____	(_____	_____)/_____	_____
_____	1.44	_____	_____	(_____	_____)/_____	_____
_____	1.44	_____	_____	(_____	_____)/_____	_____
_____	1.44	_____	_____	(_____	_____)/_____	_____
_____	1.44	_____	_____	(_____	_____)/_____	_____
_____	1.44	_____	_____	(_____	_____)/_____	_____

Verify established overall PM emission rate ($ER_{PU_{tot}}$)
(i.e. group by process types)

$$ER_{PU_{tot}} = (ER_{PU_1})(PR_{PU_1} / PR_{tot}) + \dots + (ER_{PU_i})(PR_{PU_i} / PR_{tot})$$

Where:

$ER_{PU_{tot}}$ = overall PM emission rate from all similar process units, kg/Mg (lb/ton) of black liquor solids fired.

ER_{PU_1} = PM emission rate from process unit No. 1, kg/Mg (lb/ton) of black liquor solids fired, calculated using Equation 2, 3, or 4 in paragraphs (a)(2)(i) through (iii) of §63.865.

PR_{PU_1} = black liquor solids firing rate in Mg/d (ton/d) for process unit No. 1, if process unit is a recovery furnace or SDT. The CaO production rate in Mg/d (ton/d) for process unit No. 1, if process unit is a lime kiln.

PR_{tot} = total black liquor solids firing rate in Mg/d (ton/d) for all recovery furnaces in the chemical recovery system at the kraft or soda pulp mill if the similar process units are recovery furnaces or SDT, or the total CaO production rate in Mg/d (ton/d) for all lime kilns in the chemical recovery system at the mill if the similar process units are lime kilns.

ER_{PU_i} = PM emission rate from process unit No. i, kg/Mg (lb/ton) of black liquor solids fired.

PR_{PU_i} = black liquor solids firing rate in Mg/d (ton/d) for process unit No. i, if process unit is a recovery furnace or SDT. The CaO production rate in Mg/d (ton/d) for process unit No. i, if process unit is a lime kiln.

i = number of similar process units located in the chemical recovery system at the kraft or soda pulp mill.

Recovery Furnaces

Data from performance tests.

Recovery Furnaces (ID)	ER_{RF} (lb/ton)(tons/day)	$(PR_{RF}$ BLS fired (tons/day)	/	PR_{tot} = BLS fired (tons/day)	
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
_____	_____	(_____)	/	(_____)	_____
				ER_{RFtot}	_____

Lime Kilns

Data from performance tests.

Lime Kilns (ID)	ER_{LK} (lb/ton)(tons/day)	$(PR_{LK}$ / CaO production (tons/day)	PR_{tot} = CaO production (tons/day)	
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
_____	_____	(_____ /	_____)	_____
			ER_{LKtot}	_____

Verify established overall PM emission rate (ER_{PUtot})

$$ER_{tot} = ER_{RFtot} + ER_{SDTtot} + ER_{LKtot}$$

Where:

ER_{tot} = overall PM emission rate for the chemical recovery system at the mill, kg/Mg (lb/ton) of black liquor solids fired.

ER_{RFtot} = PM emission rate from all kraft or soda recovery furnaces, calculated using Equation 2 or 5 in paragraphs (a)(2)(i) and (iv) of this section, where applicable, kg/Mg (lb/ton) of black liquor solids fired.

ER_{SDTtot} = PM emission rate from all smelt dissolving tanks, calculated using Equation 3 or 5 in paragraphs (a)(2)(ii) and (iv) of this section, where applicable, kg/Mg (lb/ton) of black liquor solids fired.

ER_{LKtot} = PM emission rate from all lime kilns, calculated using Equation 4 or 5 in paragraphs (a)(2)(iii) and (iv) of this section, where applicable, kg/Mg (lb/ton) of black liquor solids fired.

APPENDIX E-1 APPLICABILITY ASSESSMENT

Does the facility recover chemicals from its pulping process by combusting spent pulping liquor?

Note: the SIC codes for these were 2611, 2621 & 2631 (NAICS codes are 32211, 32212 & 32213).



Is the pulping process kraft, soda, sulfite or stand alone semi-chemical?

Note: Potential to emit means the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any federally enforceable emissions limitation shall be treated as part of the design.



Does the mill emit or have the potential to emit at least 10 tons per year of a single or at least 25 tons per year of any combination of gaseous organic HAP(s) and HAP metal emissions?

Note: You must consider all HAPs, however, the most common gaseous organic HAPs are:

- Benzene
- Formaldehyde
- Hydrochloric Acid
- Methanol
- Methyl Ethyl Ketone
- Methyl Isobutyl Ketone
- Phenol
- Toluene
- Xylene

Note: You must consider all HAPs, however, the most common metal HAPs are:

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Lead
- Manganese
- Mercury
- Nickel
- Selenium

Note: You must consider all HAPs.

Per Year

Most common gaseous organic HAPs:

- Benzene _____
- Formaldehyde _____
- Hydrochloric Acid _____
- Methanol _____
- Methyl Ethyl Ketone _____
- Methyl Isobutyl Ketone _____
- Phenol _____
- Toluene _____
- Xylene _____

Most common metal HAPs:

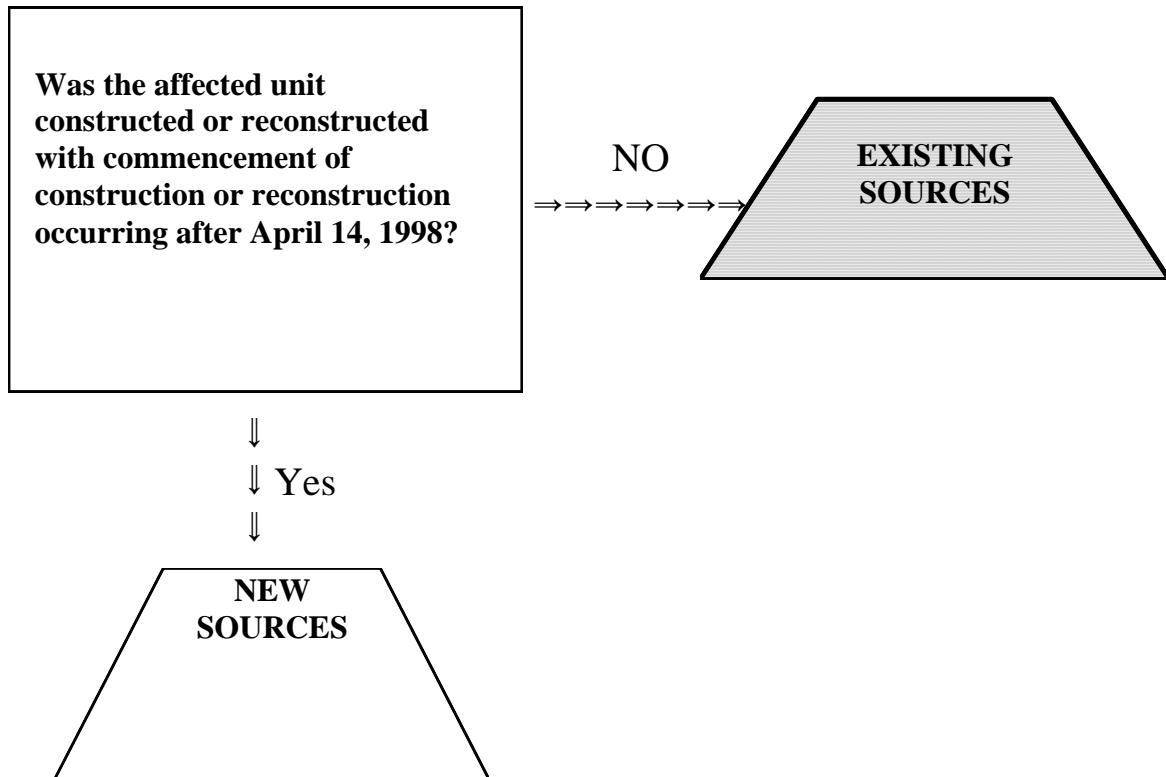
- Antimony _____
- Arsenic _____
- Beryllium _____
- Cadmium _____
- Chromium _____
- Lead _____
- Manganese _____
- Mercury _____
- Nickel _____
- Selenium _____

Additional HAPs:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Total Tons Per Year of HAPs

APPENDIX E-2 FORM SELECTION PROTOCOL





**NEW
SOURCES**

**Kraft or Soda Chemical Recovery
System?**

**NDCE Recovery Furnace?
Electrostatic Precipitator?
Use forms:**

**APPENDIX A-1. NEW KRAFT OR SODA NDCE RECOVERY
FURNACE - ESP**

**APPENDIX I-1. SAMPLE CALCULATIONS FOR
ELECTROSTATIC PRECIPITATORS**

**APPENDIX F1. INSPECTING ELECTROSTATIC
PRECIPITATORS**

APPENDIX C.

Scrubber?

Use forms:

**APPENDIX A-2. NEW KRAFT OR SODA NDCE RECOVERY
FURNACE - SCRUBBER**

APPENDIX C.

APPENDIX F-2. SAMPLE CALCULATIONS WET SCRUBBERS

APPENDIX G1. INSPECTING SCRUBBERS

**DCE Recovery Furnace?
Electrostatic Precipitator?**

Use forms:

**APPENDIX A-3. NEW KRAFT OR SODA DCE RECOVERY
FURNACE - ESP**

APPENDIX C.

**APPENDIX I-1. SAMPLE CALCULATIONS
ELECTROSTATIC PRECIPITATORS
APPENDIX F. INSPECTING ELECTROSTATIC PRECIPITATORS
Scrubber?**

Use forms:

**APPENDIX A-2. NEW KRAFT OR SODA NDCE OR DCE
RECOVERY FURNACE - WET SCRUBBER**

APPENDIX C.

**APPENDIX I-2. SAMPLE CALCULATIONS WET SCRUBBERS
APPENDIX H-2. INSPECTING REGENERATIVE THERMAL
OXIDERS**

**Smelt Dissolving Tank?
Scrubber?**

Use Form

**APPENDIX A-4 NEW KRAFT OR SODA SMELT DISSOLVING
TANK - WET SCRUBBER**

APPENDIX C.

**APPENDIX I-2. SAMPLE CALCULATIONS FOR WET SCRUBBERS
APPENDIX G-1. INSPECTING WET SCRUBBERS**

Lime Kiln?

Electrostatic Precipitator?

Use Forms:

APPENDIX A-5. NEW KRAFT OR SODA LIME KILN - ESP

APPENDIX C. IPT ELECTROSTATIC PRECIPITATORS

**APPENDIX I-1. SAMPLE CALCULATIONS ELECTROSTATIC
PRECIPITATORS**

**APPENDIX F. INSPECTING ELECTROSTATIC PRECIPITATORS
Scrubber?**

Use Forms:

APPENDIX A-6. NEW KRAFT OR SODA LIME KILN - SCRUBBER

APPENDIX C. IPT WET SCRUBBERS

APPENDIX I-2. SAMPLE CALCULATIONS FOR WET SCRUBBERS

APPENDIX G-1. INSPECTING WET SCRUBBERS

Sulfite pulping?

**Recovery Furnace?
Scrubber?**

Use Forms:

- **APPENDIX A. NEW SULFITE RECOVERY FURNACE - SCRUBBER**
- **APPENDIX C**
- **APPENDIX I-2. SAMPLE CALCULATIONS WET SCRUBBERS**
- **APPENDIX G-1. INSPECT SCRUBBERS**
-

Stand alone Semi-chemical pulping?

Regenerative Thermal Oxidizer?

Use Forms:

- **APPENDIX A-14. ALL EXISTING STAND ALONE SEMICHEMICAL (ALL RECOVERY METHODS) - RTO**
- **APPENDIX H-1. IPT REGENERATIVE THERMAL OXIDIZERS**
- **APPENDIX I-3. SAMPLE CALCULATIONS REGENERATIVE THERMAL OXIDIZERS**
- **APPENDIX I-3. INSPECTING REGENERATIVE THERMAL OXIDIZERS**
-

**EXISTING
SOURCES**

Kraft or Soda Chemical Recovery System?

**DCE or NDCE Recovery Furnace?
Electrostatic Precipitator?**
Use forms:

- **APPENDIX A-9. EXISTING KRAFT OR SODA DCE OR NDCE RECOVERY FURNACE - ESP**
- **APPENDIX C**
- **APPENDIX I-1. SAMPLE CALCULATIONS ELECTROSTATIC PRECIPITATORS**
- **APPENDIX F-1. INSPECTING ELECTROSTATIC PRECIPITATORS**

Scrubber?
Use forms:

- **APPENDIX A-10. EXISTING KRAFT OR SODA DCE OR NDCE RECOVERY FURNACE -WET SCRUBBER**
- **APPENDIX C**
- **APPENDIX I-2. SAMPLE CALCULATIONS WET SCRUBBERS**
- **APPENDIX H. INSPECTING SCRUBBERS**

**Smelt Dissolving Tank?
Scrubber?**

Use Forms:

- **APPENDIX A-1. EXISTING KRAFT OR SODA SMELT DISSOLVING TANK - WET SCRUBBER**
- **APPENDIX C**
- **APPENDIX I-2. SAMPLE CALCULATIONS WET SCRUBBERS**
- **APPENDIX G-1. INSPECTING SCRUBBERS**
-

Lime Kiln?

Electrostatic Precipitator?

Use Forms:

APPENDIX A-12. EXISTING KRAFT OR SODA LIME KILN - ESP

APPENDIX C

**APPENDIX I-1. SAMPLE CALCULATIONS FOR ELECTROSTATIC
PRECIPITATORS**

APPENDIX F-1. INSPECTING ELECTROSTATIC PRECIPITATORS

Scrubber?

Use Forms:

**APPENDIX A-13. EXISTING KRAFT OR SODA LIME KILN - WET
SCRUBBER**

APPENDIX C

APPENDIX I-2. SAMPLE CALCULATIONS WET SCRUBBERS

APPENDIX G-1. INSPECT SCRUBBERS

Semichemical pulping?

Regenerative Thermal Oxidizer?

Use Forms:

- **APPENDIX A-14. ALL EXISTING STAND ALONE SEMICHEMICAL (ALL RECOVERY METHODS) - RTO**
- **APPENDIX C**
- **APPENDIX I-3. SAMPLE CALCULATIONS REGENERATIVE THERMAL OXIDIZERS**
- **APPENDIX A-2. INSPECTING REGENERATIVE THERMAL OXIDIZERS**
- **APPENDIX H-1. REGENERATIVE THERMAL OXIDIZERS**

Sulfite pulping?

**Recovery Furnace?
Scrubber?**

Use Forms:

- **APPENDIX A-15. EXISTING SULFITE COMBUSTORS-
SCRUBBER**
- **APPENDIX C**
- **APPENDIX I-2. SAMPLE CALCULATIONS FOR WET
SCRUBBERS**
- **APPENDIX G-1. INSPECTING SCRUBBERS**

APPENDIX F-1. INSPECTING ELECTROSTATIC PRECIPITATORS

Electrostatic precipitators (ESP) are designed for sufficient collection plate area to ensure capture of particulate matter at a given volumetric flow rate. The principle design parameter is the Specific Collection Area (SCA). The SCA is defined as the total square footage of collecting area per 1000 acfm of flue gas flow rate. For pulp mills this variable typically range from 200 to 800 square feet per 1,000 actual cubic feet per minute.

COLLECTION PLATE AREA

Total Number of collection plates (N)	_____
Height of each collection plate (H)	_____ft
Width of collection each plate (W)	_____ft

Use the following formula to calculate the Total Collection Plate Area(TCPA) of the Electrostatic Precipitator

$$TCPA = (N-1)*2*W*L \quad \text{_____sq ft}$$

(Note: Some parts of the ESP may have different collection plate dimensions than in other parts. In those cases, use the above formula for each part to determine the collection plate area for each part and add them together to obtain the total collection plate area.)

VOLUMETRIC FLOW RATE AT ESP

During the source test, the volumetric flow rate in the stack (QS) is calculated. This, with the stack temperature (FS) and the temperature at the inlet of the scrubber (FCD), can be used to calculate the volumetric flow rate at the inlet which is needed to calculate the SCA. The volumetric flow rate at the ESP (QCD) is determined by the following equation:

$$QCD = (QS * (FCD + 459.67))/(FS + 459/67)$$

where the measured temperatures are in degrees F. The ESP volumetric flow rate can then be correlated with some measure of fan performance such as motor RPMs, amperes or kilowatts. In this way, volumetric flow rates can be estimated at any time.

Aside from verifying proper design, another important operational element of ESP performance is the electrical charging and collection of particulate matter. This should be evaluated for each field in the unit.

CORONA GENERATION

Before the ESP can charge and capture particles, a corona must be established at the electrodes that provides the requisite rich field of electrons. The electrical component that controls this is the Transformer - Rectifier Control (TRC). There is a minimum threshold of primary power that must be applied to ensure the corona has been established. During each run of the source test, the voltage applied and the amperes flowing through the primary side of the transformer are recorded for each TRC and checked against design specifications. The primary watts (PW), the product of the volts and the amperes) are then calculated for each field.

SECONDARY WATTS

There may be sufficient power applied to the primary side of the transformers but this does not mean the corona is established. Consequently, voltage (kilovolts) and current (milliamperes) occurring on the secondary side of the transformer are likewise recorded for each field and compared to the design specifications. The secondary watts (SW) are also calculated.

POWER FACTOR

The measure of the electrical performance of the ESP are the voltage and current readings of the TRC. It is vital that the meters are operating correctly. One method of “discovering” ESP operation problems is to calculate the power factor for each field. By establishing a Power Factor baseline for each field, these can be referred to during other times. The power factor is calculated by the following equation:

$$PF = SW/PW$$

The Power Factor is typically between 0.75 and 0.85. It can never be greater than unity. If the Power Factor is abnormally low or high, there may be reason to suspect the meters, the rapper system or distributor plate problems.

TOTAL SECONDARY WATTS

The Total Secondary Watts (TSW) is a good measure of the overall performance of the ESP in terms of particle collection. This is calculated by totaling the Secondary Watts for all the fields.

POWER DISTRIBUTION IN ESP

An important baseline evaluation is to compare the Secondary Watts for corresponding fields in the channels of the ESP. (Some ESPs are single channel units and, in those, side by side comparison would, of course, not be possible.) For example, in a two channel unit the two inlet fields should generate equal or nearly equal Secondary Watts in each. By comparing each to the total of the two, a percentage split can be calculated with a 50:50 split being ideal. A large

difference in the two might indicate inaccurate meters or malfunctioning TRC units. If these are working correctly then the rapper system may be suspect. Finally, unbalanced power distribution could indicate significant wear or plugging of the flue gas flow distributor plates. These side by side comparisons should be made for each field set. Finally, the Total Secondary Watts should be calculated for each channel and the overall split calculated. Again, this should be a 50:50 split. Once the baseline splits are calculated they will serve as the basis for future evaluation of the unit to ensure it is not deteriorating.

POWER DENSITY

Another more universal parameter to calculate during the Initial Performance Test is the Power Density (PD), in Watts per Square Foot, of the ESP. This is calculated by the following formula:

$$PD = TSW / TCPA$$

RAPPERS

In order for the ESP to operate at design efficiencies, it is important that collected particulate matter be periodically removed from the collection plates to ensure there is sufficient electrical potential difference between the particles the plate to attract them sufficiently. These units are equipped with a physical removal system that provide mass shock to various components of the ESP. This is normally done either by a hammer drop system or vibrator system or a combination of both. These systems are located on the top of the ESP and consist of a large number of individual units. These need to be observed individually to ensure they are operating correctly. Each rapper is visited and observed being actuated. Through a combination of visual and audio observation, it can be determined that is operating correctly. (If it does not physically move or make solid contact with the momentum transfer rods extending through the roof the ESP, then maintenance is necessary. If there is contact but the sound of the contact is significantly different than with other rappers, then maintenance may be needed.) Finally, with vibrator systems, there is a compressed air system providing the necessary energy. The compressed air pressure (psi) of this system should be recorded during the source test for subsequent review.

RAPPER SEQUENCE

Obtain a plot of the rapping sequence from the company for each ESP. During the inspections, the inspector “walks” the sequencing rappers to be sure they are operating correctly and sound proper. It is normal for the outlet end of an ESP to have a less frequent rapping than the inlet end. This is because the collection efficiency of each section is very high. For example, in most designs, over 90% of the flue gas laden particulate matter is collected in the first field. Consequently, only about 10% moves on to the second field where over 90% of that is removed. By the time the flue gas reaches the outlet, there is little particulate matter left to remove and the lighter accumulation requires less rapping frequency. Any time the rapping system is actuated,

however, some of the previously captured particulate matter is re-entrained to be partially captured down stream. From the outlet field, any re-entrained particulate matter will not be captured so the rapping frequency ought to be minimized at the outlet.

APPENDIX F-2. SINGLE PASS, 2 FIELD ESP

Power Factor <input type="text"/>	Primary Watts <input type="text"/>	Primary Volts	Primary Amps
	Secondary Watts <input type="text"/>	Secondary Kilovolts	Secondary Milliamps
Power Factor <input type="text"/>	Primary Watts <input type="text"/>	Primary Volt	Primary Amps
	Secondary Watts <input type="text"/>	Secondary Kilovolts	Secondary Milliamps

Total Secondary Watts

Total Plate Area (Square Feet)

Total Secondary Watts per Square Foot of Plate Area

APPENDIX F-3. SINGLE PASS, 3 FIELD ESP

Power Factor <input type="text"/>	Primary Watts <input type="text"/>	Primary Volts	Primary Amps
	Secondary Watts <input type="text"/>	Secondary Kilovolts	Secondary Milliamps
Power Factor <input type="text"/>	Primary Watts <input type="text"/>	Primary Volts	Primary Amps
	Secondary Watts <input type="text"/>	Secondary Kilovolts	Secondary Milliamps
Power Factor <input type="text"/>	Primary Watts <input type="text"/>	Primary Volts	Primary Amps
	Secondary Watts <input type="text"/>	Secondary Kilovolts	Secondary Milliamps

Total Secondary Watts

Total Plate Area (Square Feet)
Area

Total Secondary Watts per Square Foot of Plate

APPENDIX F-4. 2 CHANNEL, 2 FIELD ESP

Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power
Factor							
<input type="text"/>	<input type="text"/>					<input type="text"/>	<input type="text"/>
% Split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% Split
<input type="text"/>	<input type="text"/>					<input type="text"/>	<input type="text"/>
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power
Factor							
<input type="text"/>	<input type="text"/>					<input type="text"/>	<input type="text"/>
% Split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	%
Split							
<input type="text"/>	<input type="text"/>						

Overall % Split

Channel Secondary Watts

Total Secondary Watts

Channel Secondary Watts

Overall % Split

Total Plate Area (Square Feet)

Total Secondary Watts per Square Foot of Plate Area

APPENDIX F-5. 2 CHANNEL, 3 FIELD ESP

Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split

Overall
% Split

Channel
Secondary Watts

Total Secondary Watts

Channel
Secondary Watts

Overall
% Split

Total Plate Area (Square Feet)

Total Secondary Watts per Square Foot of Plate Area

APPENDIX F-6. 2 CHANNEL, 4 FIELD ESP

Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split

Overall
% Split

Channel
Secondary Watts

Total Secondary Watts

Channel
Secondary Watts

Overall
% Split

Total Plate Area (Square Feet)

Total Secondary Watts per Square Foot of Plate Area

APPENDIX F-7. 2 CHANNEL, 5 FIELD ESP

Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split

Overall % Split

Channel Secondary Watts

Total Secondary Watts

Channel Secondary Watts

Overall % Split

Total Plate Area (Square Feet)

Total Secondary Watts per Square Foot of Plate Area

APPENDIX F-8. 2 CHANNEL, 6 FIELD ESP

Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
% split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% split

APPENDIX F

Overall
% Split

Channel
Secondary Watts

Total Secondary Watts

Channel
Secondary Watts

Overall
% Split

Total Plate Area (Square Feet)

Total Secondary Watts per Square Foot of Plate Area

APPENDIX G-1. INSPECTING WET SCRUBBERS

LIQUID TO GAS RATIO

The principle design variable for a scrubber is the Liquid to Gas Ratio (in Gallons of Scrubbing Liquid pumped to the nozzles per 1000 Actual Cubic Feet per Minute of gas flow through the unit). This sets the proper balance between sufficient liquid to contact the pollutant with sufficient volumetric flow rate to ensure fracturing the moisture into the proper droplet size. Typically, this variable ranges from 3 to 10 gallons per 1,000 actual cubic feet.

SCRUBBING LIQUID FLOW RATE

During the source test, the scrubbing liquid flow rate, in gallons per minute, should be recorded during each test run.

SCRUBBING LIQUID PRESSURE

In some NSPS applications, such as for Smelt Dissolver Tank Vents in Kraft Pulp Mills, the line pressure of the scrubbing liquid is required to be logged. Consequently, some mills meter this parameter for non NSPS scrubbers even if not specifically required. It does not equate to the liquid to gas ratio nor does it relate to the pressure differential across the unit. It does, however, relate to the energy transfer in the scrubber not unlike the momentum change indicated by the pressure differential. If this parameter is being metered, it should be recorded during the runs of the Initial Performance Tests and during inspections.

VOLUMETRIC FLOW RATE AT SCRUBBER

During the source test, the volumetric flow rate in the stack is calculated. This, with the stack temperature and the temperature at the inlet of the scrubber, can be used to volumetric the volumetric flow rate at the inlet which is needed for the liquid to gas ratio. The volumetric flow rate at the scrubber (Q_{CD}) is determined by the following equation:

$$Q_{CD} = (Q_S * (F_{CD} + 459.67)) / (F_S + 459.67)$$

The scrubber volumetric flow rate can then be correlated with some measure of fan performance such as motor RPMs, amperes or kilowatts. In this way, volumetric flow rates can be estimated at any time.

DIFFERENTIAL PRESSURE ACROSS THE SCRUBBER

Provided there is sufficient scrubbing liquid and volumetric flow rate to theoretically capture the pollutants, another variable, the scrubber differential pressure, or pressure drop, suggests the momentum lost in the gas stream as the particles are captured in the liquid.

NOZZLE PLUGGING

Scrubber nozzles are subject to plugging since they have a very small orifice through which the liquid is forced. The head of the flue gas environment around the outside of the nozzles contributes to the build up of solids that will eventually plug it. A plugged nozzle allows an area in the cross section of the water spray matrix to be devoid of water which lets the flue gas pass through untreated. Whether or not a nozzle is plugged or plugging can be evaluated by noting the temperature of the nozzle pipe as it enters the scrubber and comparing it to the pipe temperature of the main scrubbing liquid feed. Typically, a different temperature of one nozzle pipe compared to the others indicates plugging.

INITIAL PERFORMANCE TEST EVALUATION - WET SCRUBBERData

- Scrubbing liquid flow rate (gallons per minute)
- Pressure Drop across scrubber (inches W.C.)
- Scrubbing liquid pressure (psi)
- Volumetric flow rate at stack (acfm)
- Flue gas temperature in stack (F)
- flue gas temperature at inlet to scrubber (F)
- Measured volumetric flow rate at inlet to scrubber (acfm), and/or
- Fan Motor Amperes (amperes), and/or
- Fan Motor Kilowatts (kilowatts), and/or
- Fan RPMs (rpms), and/or
- RPM reduction reading (%), and/or
- Other variable
- Evaluation of nozzles (plugging/plugged)

Calculations

- Volumetric flow rate at scrubber

$$\frac{\text{_____ acfm in stack} * (\text{_____ } ^\circ \text{ F at scrubber} + 459.67)}{\text{_____}}$$

$$(\text{_____ } ^\circ \text{ F in stack} + 459.76)$$

- Volumetric Flow Rate Surrogate

$$\text{_____ acfm at scrubber}$$

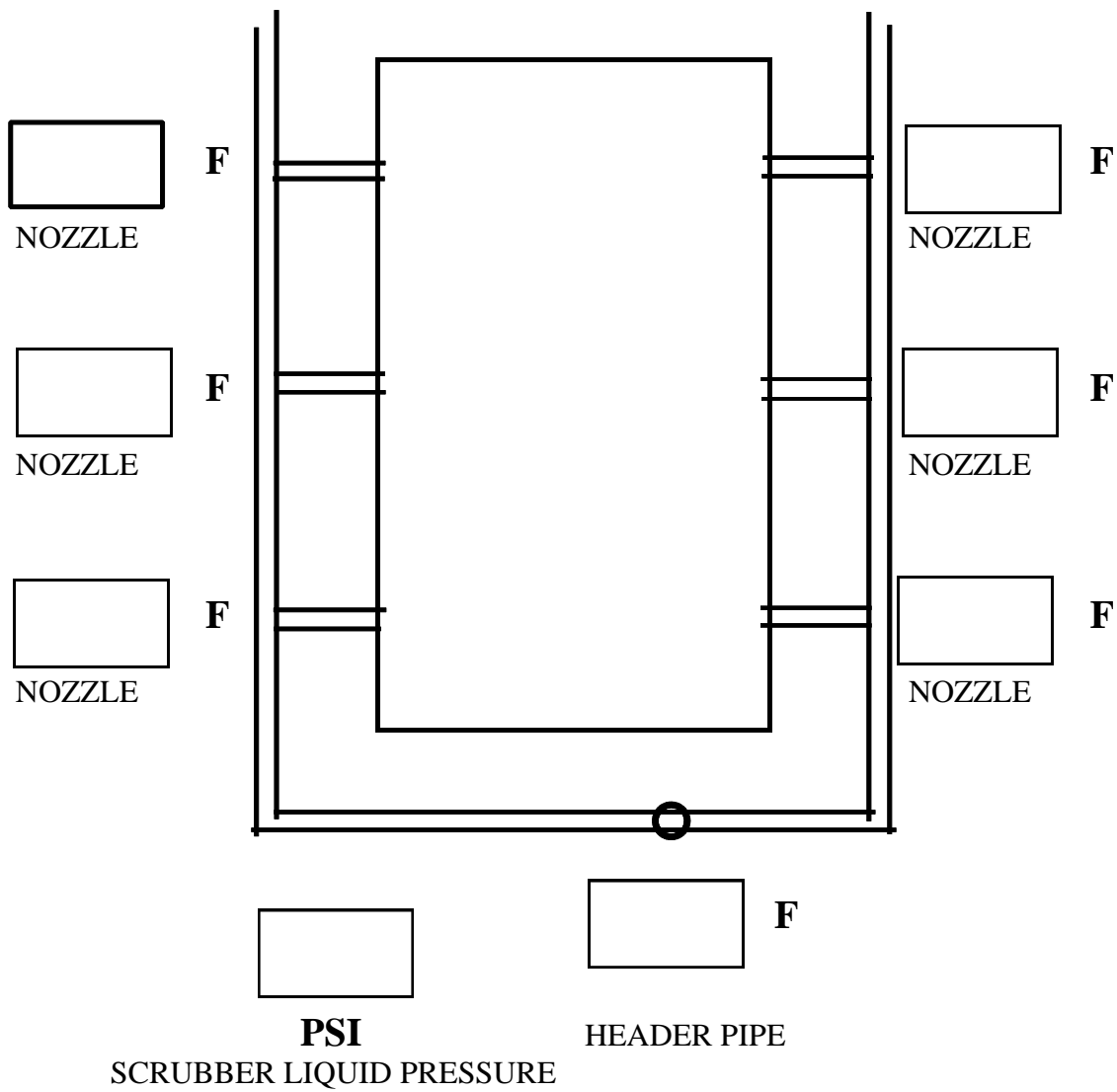
_____ amperes, or, kilowatts, or, rpm, or %, or other

- Liquid to Gas Ratio

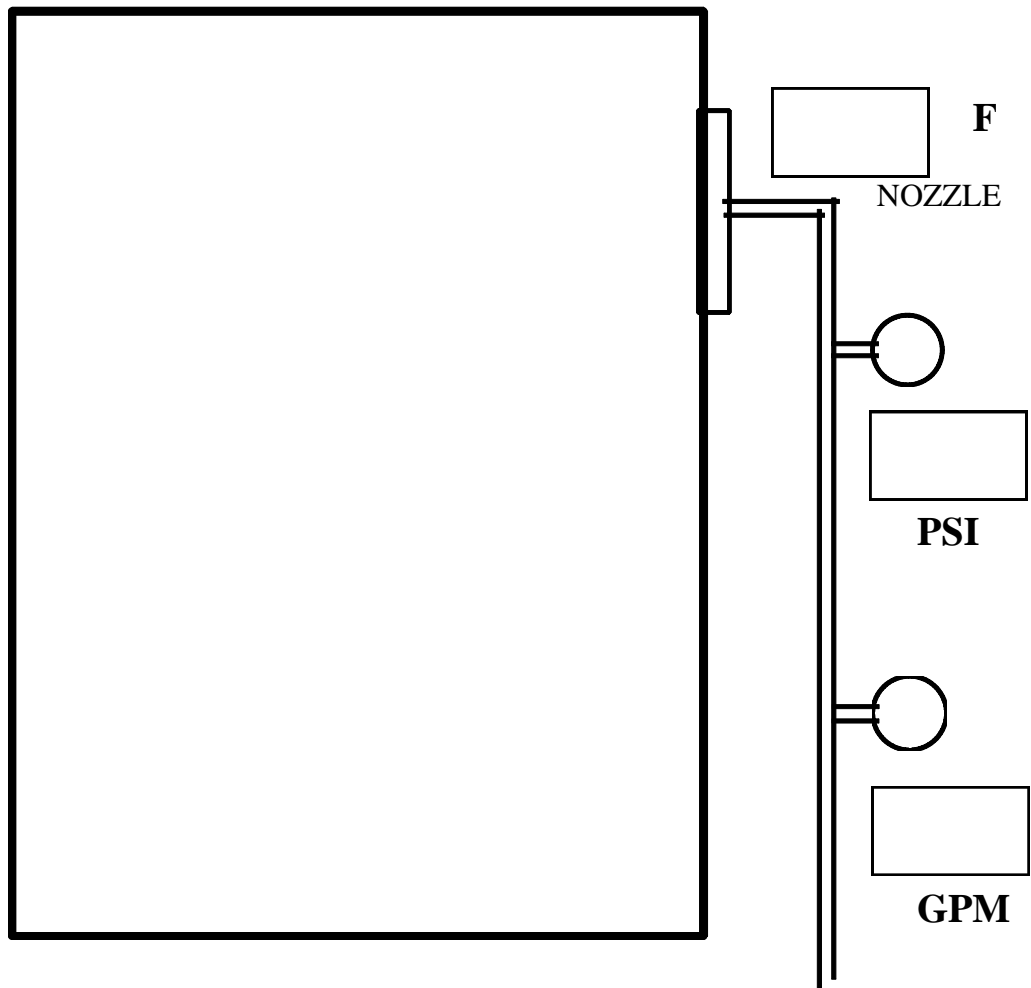
(_____ gallons per minute * 1000)

_____ acfm

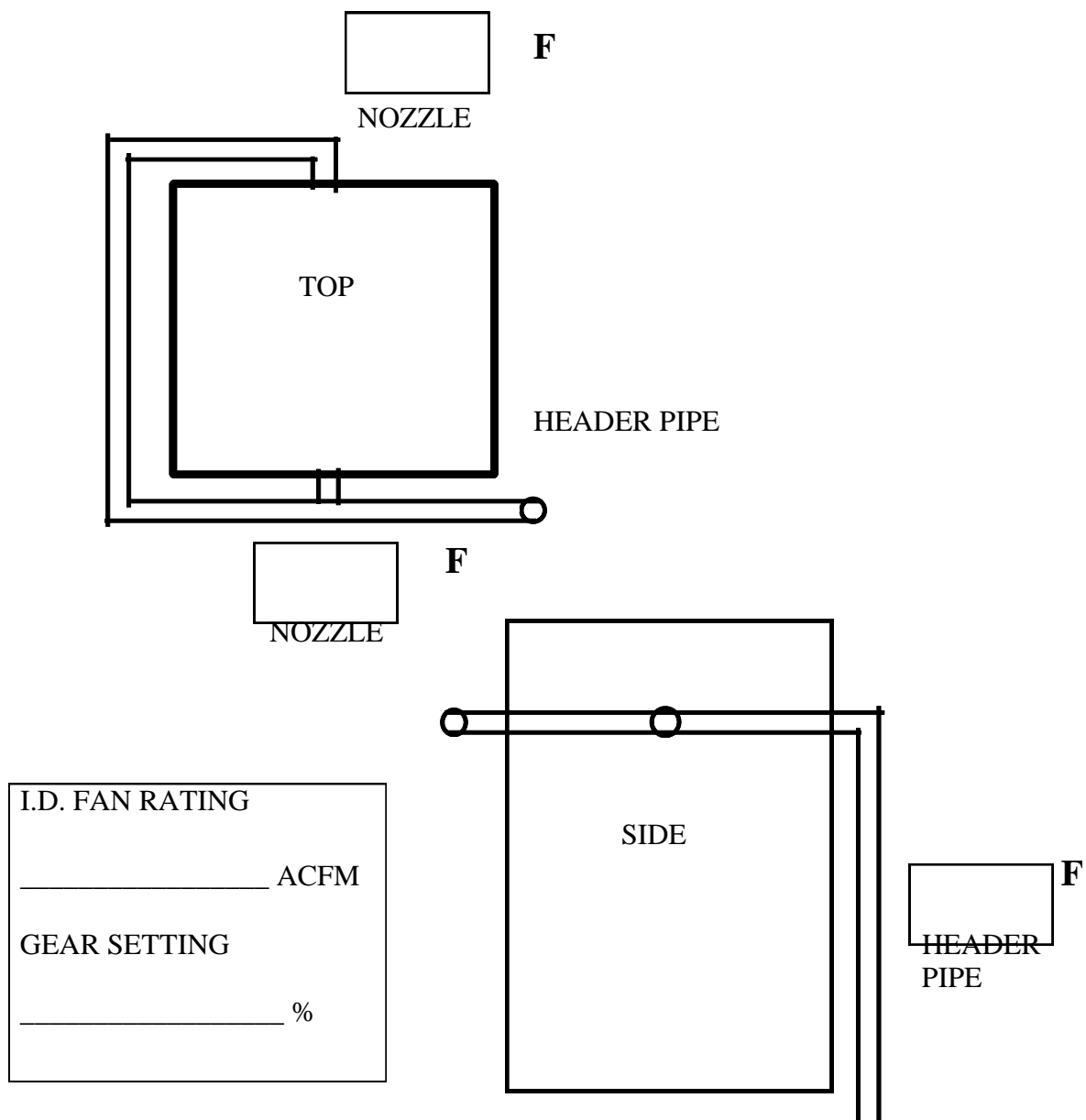
APPENDIX G-2. EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN VIEW)



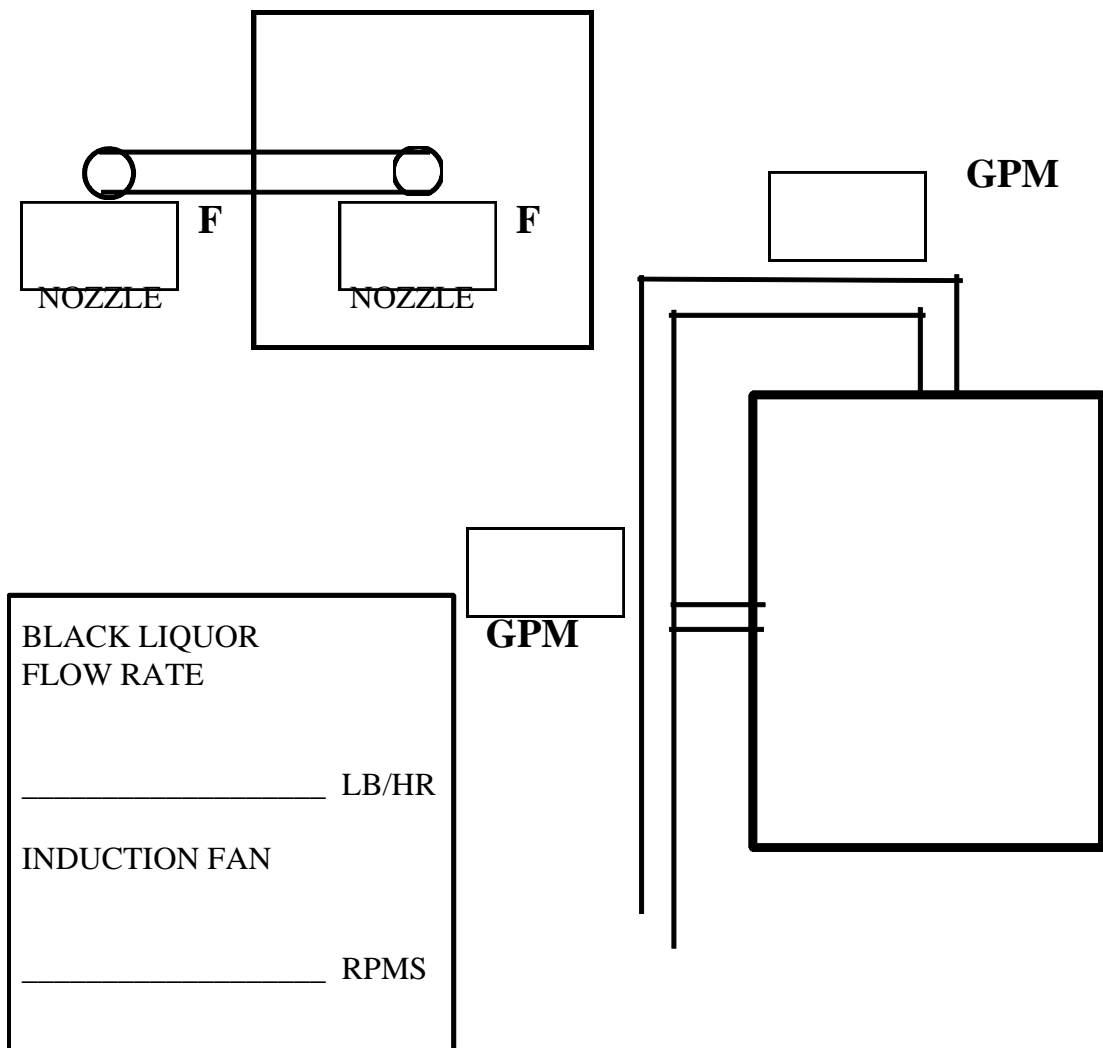
**APPENDIX G-3. EXAMPLE OF DATA FORM FOR WET
SCRUBBER (FRONT VIEW)**



APPENDIX G-4. EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN AND FRONT VIEW)



APPENDIX G-5. EXAMPLE OF DATA FORM FOR WET SCRUBBER (PLAN AND FRONT VIEW)



APPENDIX G-6. EXAMPLE OF DATA FORM FOR 8 NOZZLE WET SCRUBBER (PLAN VIEW)

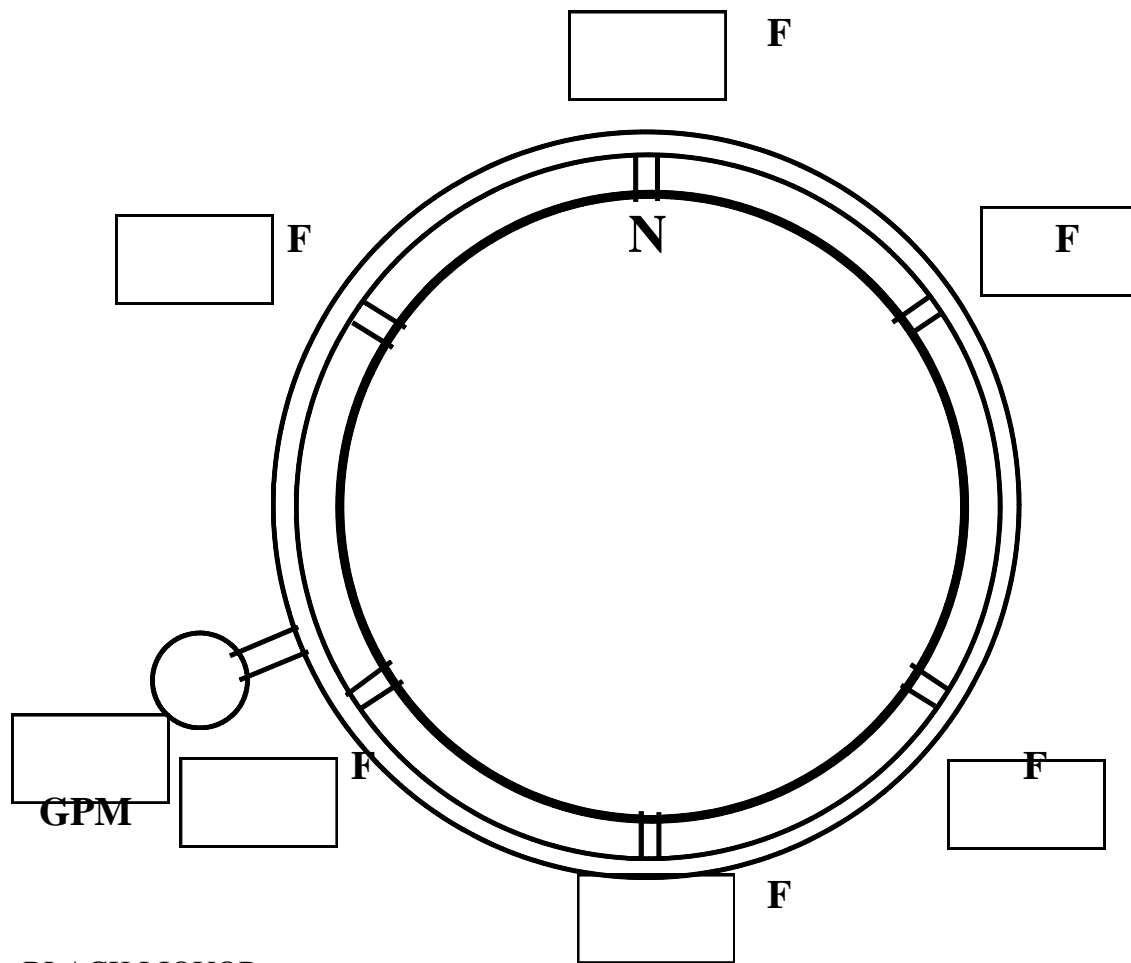
N

GPM

NOZZLE TEMPERATURE
(COLD, WARM OR HOT)

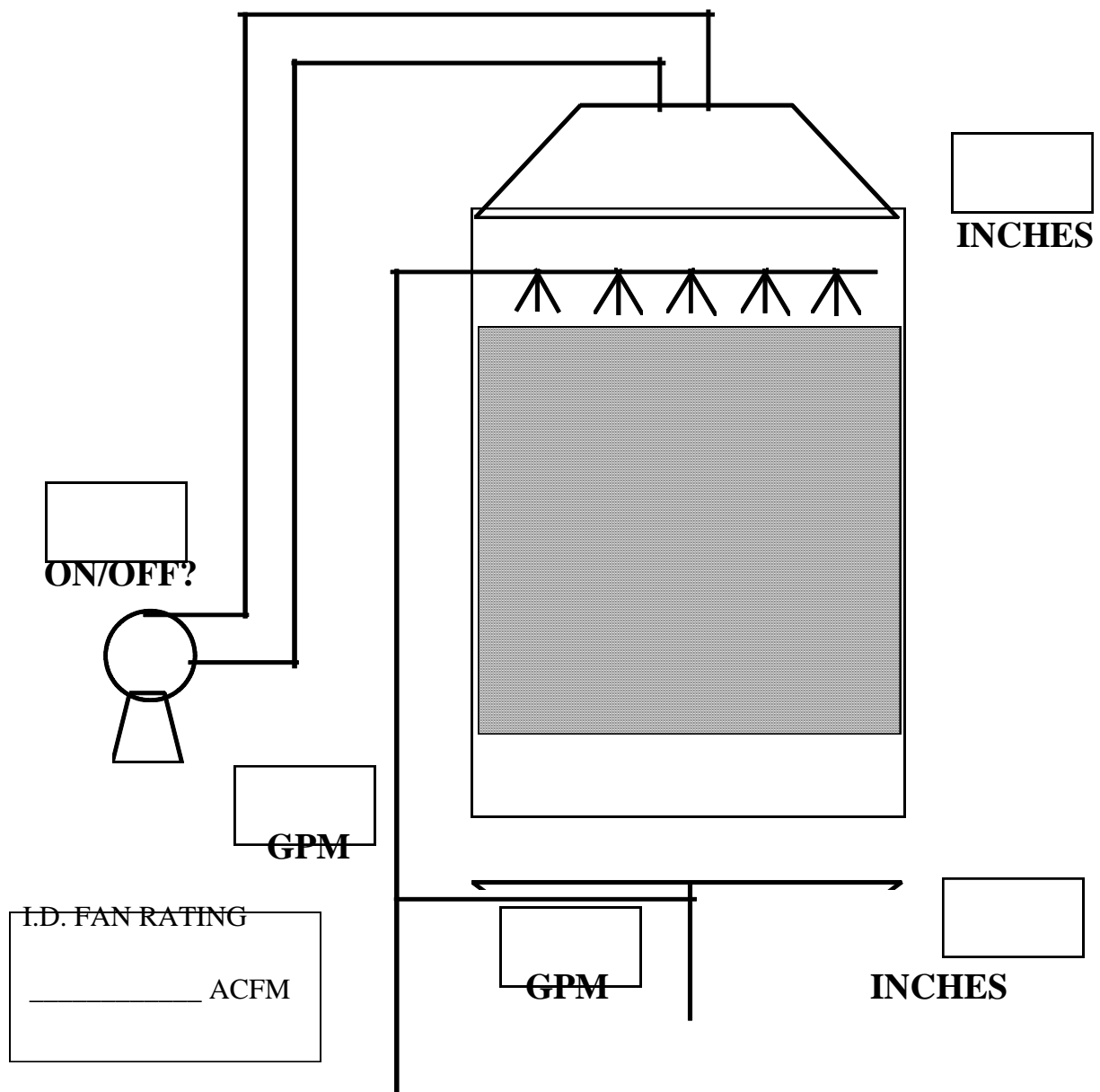
BLACK LIQUOR	
FIRING RATE _____	GPM
FIRING TEMPERATURE _____	F
PERCENT SOLIDS _____	%
LIQUOR DENSITY _____	LB/GAL

APPENDIX G-7. EXAMPLE OF DATA FORM FOR 6 NOZZLE WET SCRUBBER (PLAN VIEW)

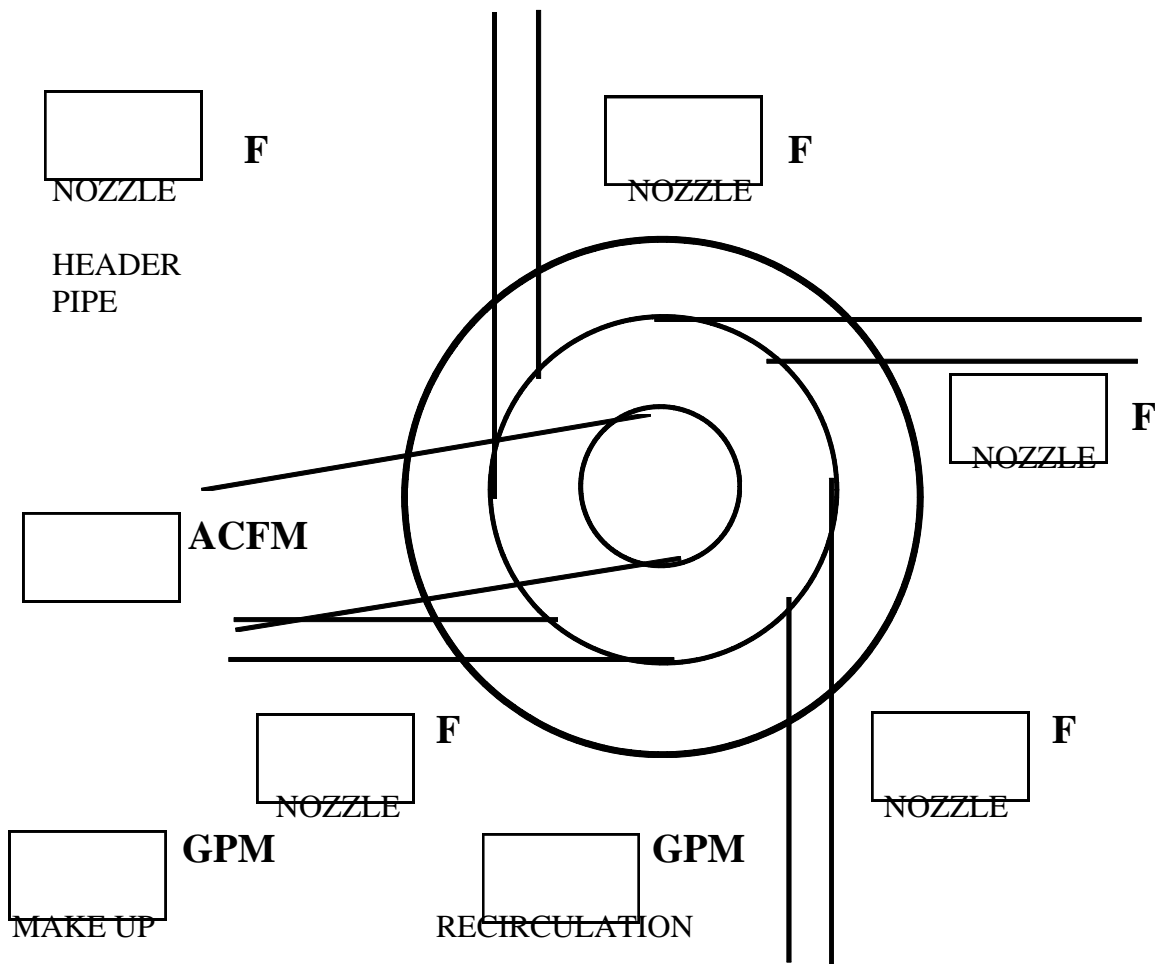


BLACK LIQUOR	
FIRING RATE _____	GPM
FIRING TEMPERATURE _____	F
PERCENT SOLIDS _____	%
LIQUOR DENSITY _____	LB/GAL

APPENDIX G-8. EXAMPLE OF DATA FORM PACKED TOWER WET SCRUBBER (FRONT VIEW)



APPENDIX G-9. EXAMPLE OF DATA FORM FOR VENTURI WET SCRUBBER (PLAN VIEW)



APPENDIX H-1. REGENERATIVE THERMAL OXIDIZERS

There are a number of issues regarding RTOs. For example, emissions containing significant amounts of moisture, particulate matter and other contaminants can cause the RTO and monitoring equipment to experience operational problems.

Likely operating parameters include chamber temperature and outlet air flow, static pressure at the inlet of the ID fan and isolation damper position.

An important consideration is the balance needed between high temperatures (that causes high NOx emissions) and low temperatures (that cause high CO emissions.)

Plugging and media failure are always a problem. For example, metal oxides (especially those of potassium and sodium) melt and fuse to the media. One monitoring parameter to consider in this regard is the pressure drop across the unit.

Another parameter to consider is the combustion temperature of each chamber, the average of them, the volumetric flow rate through it (or some other variable indicative of volumetric flow rate such as ID fan RPS, Amps or Watts, or inlet static pressure. Also important is the damper positions of the isolation dampers.

APPENDIX H-2. INSPECTING REGENERATIVE THERMAL OXIDIZERS

RTOs are oxidation technology devices that use two or more ceramic heat transfer beds that act as smaller heat exchangers and a thermal destruction (oxidation) chamber where the organics are oxidized. It can often recovery 90 to 95% of the heat generated by oxidation of the organics in the retention chamber. The combustion gases are passed through one of the heat transfer beds which consist of a ceramic or metallic structured (monolith) or random packing which becomes heated to near the combustion temperature of the process stream. The air flow is then changed to allow the process stream to flow through the heated matrix into the oxidation chamber. Hence, little additional heat is needed in the oxidation chamber to initiate thermal destruction. During this period, another heat transfer bed is being heated by combustion gases. Typically, the flow is changed every 4 to 5 minutes or is controlled by a thermal sensor. Oxidation temperatures are typically between 1,400 ° F and 2,000 ° F and inlet air flows can range from 100 scfm to 200,000 scfm.

RESIDENCE TIME IN COMBUSTION CHAMBER

Effective volume of combustion chamber (V_{OX}) _____ ft³
 Flow of process air at combustion temperature (Q_{OX}) _____ acfm

Use the following formula to calculate the residence time (T_{OX})

$T_{OX} = (V_{OX} * 60) / Q_{OX}$ _____ seconds

PRESSURE DROP

The monolith design allows lower pressure drops derived from the greater void fraction and its inherent laminar flow characteristics. Typically, pressure drop across a system is about 22 inches W.C. for a random based unit and 15 inches W.C. for a monolith unit. RTOs are designed to allow sufficient residence time in the oxidation chamber at a specified temperature to allow complete combustion.

BED VELOCITY

The typical bed velocity is between 200 and 250 fpm (70 ° F and 15 psi) with random packing or 300 to 350 fpm with structured packing. The range of heat transfer surface area is 160 ft² to 200 ft² per cubic foot. Gas velocities are typically 400 scfm / ft² or higher.

START-UP FUEL

For start-ups and providing supplemental energy to initiate and/or sustain combustion in the oxidation chamber, electric heating is used or fossil fuel is burned. The latter can be natural gas, LPG or fuel oil.

VOLUMETRIC FLOW RATE IN OXIDATION CHAMBER

During the source test, the volumetric flow rate in the stack (Q_S) is calculated. This, with the stack temperature (F_S) and the combustion temperature in the oxidation chamber (F_{OX}), can be used to calculate the volumetric flow rate in the oxidation chamber (Q_{OX}). The volumetric flow rate in the oxidation chamber is determined by the following equation:

$$Q_{OX} = (Q_S * (F_{OX} + 459.67)) / (F_S + 459.67)$$

where the measured temperatures are in degrees F. A similar equation can also be used to calculate a volumetric flow (entering the RTO) to be correlated with some measure of fan performance such as motor RPMs, amperes or kilowatts. In this way, volumetric flow rate entering the unit can (Q_{IN}) be estimated at any time. The volumetric flow into the unit at ambient temperature (F_{IN}) is

$$Q_{IN} = (Q_S * (F_{IN} + 459.67)) / (F_S + 459.67)$$

RESIDENCE TIME IN OXIDATION CHAMBER

During the source test, once the volumetric flow rate in the oxidation chamber (Q_{OX}) is calculated and since the volume (V_{OX}) of the oxidation chamber is known, the residence time can be calculated (in seconds) as follows:

$$T_{OX} = (V_{OX} * 60) / Q_{OX}$$

As the system is operating, there may be a build up of condensed organics in the cooler portion of the unit. Many units are designed to prevent this condensation or “backing out” processes, such as a purge system, for removing them.

Some systems have a “roughing filter” to remove larger sized material ahead of the heat transfer chambers. The pressure drop is monitored across the filter unit to indicate when it needs to be replaced.

To maintain the proper residence time in the oxidization chamber, the volumetric flow rate into the RTO is monitored and control by some method.

During the switching process between heat transfer chambers, some organics may not be destroyed prior to being exhausted out of the stack. Many units have provisions for preventing this.

Stack temperature can be monitored continuously to ensure that the heat transfer beds are functioning properly.

INITIAL PERFORMANCE TEST EVALUATION - RTO

Data

- Packing type (structured or random)
- Substrate type (ceramic, metallic, saddles, monolith, etc.)
- How often is substrate replaced?
- Volume of oxidation chamber (V_{OX})
- Number of heat transfer chambers
- Heat transfer chamber switching frequency
- Criteria switching (set frequency, thermal sensor, etc.)
- Design oxidation chamber combustion temperature
- Design residence time (seconds)
- Is residence time determined by flow rate or design data?
- How is flow into the RTO controlled?
- Volumetric flow rate at stack (F)
- Flue gas temperature in stack (F)
- Flue gas temperature at inlet to RTO (F)
- Measured volumetric flow rate at inlet to RTO (acfm), and/or
- Fan Motor Amperes (amperes), and/or
- Fan Motor Kilowatts (kilowatts), and/or
- Fan RPMs (rpms), and/orRPM reduction reading (%), and/or
- Other variable for volumetric flow rate
- Pressure drop across the RTO
- Pressure drop across the roughing filter
- Auxiliary fuel type (electric, natural gas, LPG, fuel oil)
- Is stack temperature measured?

Calculations

- Volumetric flow rate in oxidation chamber of RTO

$$\text{_____ acfm in stack} * (\text{_____ } ^\circ F_{OX} + 459.67)$$

$$(\text{_____ } ^\circ F_S + 459.76)$$

- Volumetric Flow Rate Surrogate

_____ acfm at inlet to RTO

_____ amperes, or, kilowatts, or, rpm, or %, or other

- Residence Time in Combustion Chamber

(_____ cubic feet of oxidization chamber * 60)

_____ calculated acfm in oxidation zone

APPENDIX I-1. SAMPLE CALCULATIONS FOR ELECTROSTATIC PRECIPITATORS

Example. An Electrostatic Precipitator at a pulp mill consists of two chambers (one designated by the mill as NORTH and the other designated as SOUTH). Each has three sections, designated "1, 2 and 3" for the inlet, middle and outlet, respectively. Each section is controlled by a separate Transformer-Rectifier Control. This particular unit is unusual in that the outlet sections have different collection plate dimensions than the inlet and mid sections. Each inlet and mid section has 17 collecting plates, each 25 feet high and 8 feet, 7.5 inches wide. Each outlet section has 17 plates, each 25 feet high and 8 feet 2 inches wide.

PLATE AREA

SectionNumber Designation	Height of Plates	Width Feet	Area Feet	Total Area of Plate	Total Area Square Feet
N1	17	25	8.625	215.625	6,900
N2	17	25	8.625	215.625	6,900
N3	17	25	8.167	204.167	6,533
S1	17	25	8.625	215.625	6,900
S2	17	25	8.625	215.625	6,900
S3	17	25	8.167	204.167	6,533
Total					40,666

VOLUMETRIC FLOW RATE

During the Initial Performance Test, the average Volumetric Flow Rates and flue gas temperatures during the three test runs were:

RUN #	QS	TS	TCD
1	58,094 acfm	341 °F	355 °F
2	57,500 acfm	352 °F	358 °F
3	55,750 acfm	351 °F	361 °F

VOLUMETRIC FLOW RATE AT THE INLET TO THE ESP

RUN#	STACK FLOW	TEMP RATIO	INLET FLOW
1	58,094 acfm	814.670 / 800.670	59,110 acfm
2	57,500 acfm	817.670 / 811.670	57,925 acfm
3	55,750 acfm	820.670 / 810.670	56,438 acfm

CALCULATION OF THE SCA

RUN#	PLATE AREA	1000s OF ACFM	SCA
1	40,666	59.110	688
2	40,666	57.925	702
3	40,666	56.438	721
AVERAGE			704

It can be concluded that the SCA of the ESP is about 700.

ESP ELECTRICAL DATA DURING IPT

	V	NORTH A	KV	SOUTH A
INLET				
PRIMARY	366	77	366	104
SECONDARY	60	296	63	201
MIDDLE				
PRIMARY	379	119	436	129
SECONDARY	53	646	56	584
OUTLET				
PRIMARY	419	169	413	124
SECONDARY	59	850	43	809

PRIMARY WATTS

	NORTH WATTS	SOUTH WATTS
INLET	28,182	38,064
MIDDLE	45,101	56,244
OUTLET	70,811	51,212

SECONDARY WATTS

	NORTH WATTS	SOUTH WATTS
INLET	17,760	12,663
MIDDLE	34,238	32,704
OUTLET	50,150	34,787

POWER FACTOR

	NORTH	SOUTH
INLET	0.630	0.333
MIDDLE	0.759	0.581
OUTLET	0.708	0.679

TOTAL SECONDARY WATTS

$$17,760 + 12,663 + 34,238 + 32,704 + 50,150 + 34,787 = 182,302 \text{ WATTS}$$

POWER DISTRIBUTION

	NORTH	SOUTH	TOTAL	SPLIT
	WATTS	WATTS	WATTS	
INLET	17,760	12,663	30,423	58.4 / 41.6
MIDDLE	34,238	32,704	66,942	51.1 / 48.9
OUTLET	50,150	34,787	84,937	59.0 / 41.0
TOTAL	102,148	80,154	182,302	56.0 / 44.0

POWER DENSITY

182,302 WATTS / 40,666 SQUARE FEET = 4.483 WATTS PER SQUARE FOOT

APPENDIX I

Data form filled out.							
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
0.630	28182	366	77	366	104	38064	0.333
% Split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% Split
58.4	17760	60	296	63	201	12663	41.6
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
0.759	45101	379	119	436	129	56244	0.581
% Split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% Split
51.1	34238	53	646	56	584	32704	48.9
Power Factor	Primary Watts	Primary Volts	Primary Amps	Primary Volts	Primary Amps	Primary Watts	Power Factor
0.708	70811	419	169	413	124	51212	0.679
% Split	Secondary Watts	Secondary Kilovolts	Secondary Milliamps	Secondary Kilovolts	Secondary Milliamps	Secondary Watts	% Split
59.0	50150	59	850	43	809	34787	41.0
Overall % Split	Channel Secondary Watts	Total Secondary Watts			Channel Secondary Watts	Overall % Split	
56.0	102148	182302			80154	44.0	
Total Plate Area (Square Feet)		Total Secondary Watts per Square Foot of Plate Area					
40666		4.483					

APPENDIX I-2. SAMPLE CALCULATIONS FOR WET SCRUBBERS

Example. During the Initial Performance Test, during three runs, scrubber data was as follows:

RUN #	VOLUMETRIC FLOW RATE ACFM	SCRUBBER LIQUID FLOW GPM	PRESSURE DIFFERENTIAL INCHES OF WATER
1	5,771	2,110	5.2
2	5,705	2,107	5.1
3	5,708	2,112	5.1

VOLUMETRIC FLOW RATES

During the Initial Performance Test, the average Volumetric Flow Rates and flue gas temperatures during the three test runs were:

RUN #	QS	TS	TCD
1	5,771 acfm	90 °F	250 °F
2	5,705 acfm	130 °F	251 °F
3	5,708 acfm	126 °F	250 °F

VOLUMETRIC FLOW RATE AT THE INLET TO THE SCRUBBER

RUN#	TEMP RATIO	INLET FLOW
1	709.670 / 549.670	7,451 acfm
2	710.670 / 589.670	6,876 acfm
3	709.670 / 585.670	6,917 acfm

LIQUIDTO GAS RATIO FOR THE SCRUBBER

RUN#	SCRUBBING LIQUID GPM	VOLUMETRIC GAS FLOW 1000s OF ACFM	LIQUID TO GAS RATIO
1	2,110	7.451	283
2	2,107	6.876	306
3	2,112	6.917	305
AVERAGE			298

It can be concluded that the Liquid to Gas Ratio is about 300.

APPENDIX I-3. SAMPLE CALCULATIONS FOR REGENERATIVE THERMAL OXIDIZERS

Example. With a combustion chamber size of 15 cubic feet, during the Initial Performance Test, the average Volumetric Flow Rates and flue gas temperatures during the three test runs were:

RUN #	QS	TS	TCD
1	3,001 acfm	550 °F	85 °F
2	3,215 acfm	547 °F	90 °F
3	3,750 acfm	602 °F	95 °F

VOLUMETRIC FLOW RATE AT THE INLET TO THE SCRUBBER

RUN#	TEMP RATIO	INLET FLOW
1	544.670 / 1,009.670	1,619 acfm
2	549.670 / 1,006.670	1,755 acfm
3	554.670 / 1,061.670	1,959 acfm

LIQUID

TO GAS RATIO FOR THE SCRUBBER

RUN#	COMBUSTION CHAMBER VOLUME FT ³	INLET RESIDENCE FLOW TIME ACFM SECONDS
1	15	1,619 0.56
2	15	1,755 0.51
3	15	1,959 0.46
AVERAGE		0.51

The average residence time is 0.51 seconds.