Summary Flow Diagrams of the Pulp and Paper MACT Standard
(40 CFR part 63, subpart S)

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U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

NOTE: The following eleven diagrams provide only a summary of the requirements of the standards and do not supersede the standards in any manner. Compliance determinations are based on the standards published in the Code of Federal Regulations.
Does this facility produce pulp, paper, or paperboard?

NO

Not subject to this rule.

YES

Is this facility a major source of HAP? (Does the facility emit more than 10 tons per year of a single HAP or more than 25 tons per year of aggregate HAPs?)

NO

Applicability and Compliance Schedule (see Figure 2)

Kraft, semi-chemical, and soda pulping system standards (see Figure 3)

Sulfite pulping system standards (see Figure 4)

Bleaching system standards (see Figure 5)

Kraft pulping condensate standards (see Figure 6)

Monitoring Requirements (see Figure 8)

Monitoring Parameters (see Figure 9)

Reporting and Recordkeeping Requirements (see Figure 10)

Reporting and Recordkeeping Requirements (Continued) (see Figure 11)

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FIGURE 2. APPLICABILITY AND COMPLIANCE SCHEDULE (§63.440)

KRAFT, SEMI-CHEMICAL, SODA, AND SULFITE PULPING MILLS

Existing Source Applicability
- Pulping and bleaching systems

New Source Applicability
- Pulping and bleaching systems constructed or reconstructed after December 17, 1993
- Additional pulping or bleaching lines constructed after December 17, 1993

MECHANICAL, NON-WOOD FIBER, AND SECONDARY FIBER PULPING MILLS

Existing Source Applicability
- Bleaching systems

New Source Applicability
- Bleaching systems constructed or reconstructed after March 8, 1996
- Additional bleaching lines constructed after March 8, 1996

New Sources Must Achieve Compliance Upon Startup or Within 60 Days After Promulgation of This Rule, Whichever is Later.

Existing Sources Must Achieve Compliance Within 3 Years After Promulgation of This Rule, With the Following Exceptions:

HVLC* Systems At Kraft Mills
- Compliance Within 8 Years After Promulgation of This Rule.
- Mill Must Provide and Update Compliance Milestones.

Bleaching Systems at Dissolving-Grade Kraft and Sulfite Mills
- Compliance Within 3 Years After the Promulgation of the Revised Effluent Limitation Guidelines.

Bleaching Systems in the Advanced Technology Incentives Program
- Compliance Within 6 Years After Promulgation of The NESHAP
- No "backsliding" provision in effect 60 days after promulgation (i.e., mill must not increase the application rate of chlorine of hypochlorite)
- Mill Must Provide and Update Compliance Milestones.

* High volume, low-concentration systems include knotters, screens, deckers, pulp washers, and oxygen delignification systems.

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**KRAFT PULPING SYSTEMS**

**Existing Sources**
- LVHC systems**
- HVLC systems
  - Knotter and screen systems with:
    - Knotter systems with emissions ≥ 0.05 kg***/Mg ODP and
      screen systems with emissions ≥ 0.1 kg***/Mg ODP
    - Knotter systems with emissions ≥ 0.15 kg***/Mg ODP
    - Knotter and screen systems with combined emissions
      ≥ 0.15 kg***/Mg ODP
    - Knotter and screen systems (emissions ≥ 0.15 kg***/Mg ODP)
    - Pulp washing systems
    - Decker systems that use any process water other than fresh
      water, papermaking system water, or process water with total
      HAP*** >400 ppmw
    - Oxygen delignification systems

**New Sources**
- Existing sources
- All knotter systems (HVLC system)
- All screen systems (HVLC system)
- All decker systems (HVLC system)
- Weak liquor storage tanks (HVLC system)

**LVHC SYSTEMS**

**Existing Sources**
- LVHC system**

**New Sources**
- LVHC system
- Pulp washing systems

**ROUTE VENTS TO A CLOSED-VENT COLLECTION SYSTEM**

- Negative pressure at each enclosure/hood opening
- No detectable leaks >500 ppmv***
  (positive pressure systems only)
- Bypass vapor lines:
  - Install flow indicator, or
  - Secure bypass line
- Visually inspect every 30 days
- Repair leaks as soon as practicable
  (begin repair within 5 days and
  complete within 15 days after
  identification)

**CONTROL OPTIONS**

Choose One of the Following:

- 98% Reduction by Weight***

- Introduce vent stream with primary fuel or into flame zone of a boiler, lime kiln, or recovery furnace.

- Route to a Thermal Oxidizer At One of the Following Conditions:
  - Minimum temperature of 1600°F and
    0.75 seconds residence time
  - 20 ppmv*** outlet concentration
    (corrected to 10% O₂)

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**notes:**

* Kraft pulping systems must also control pulping process condensates (see Figure 6).
** LVHC systems include digesters, turpentine recovery, evaporators, steam stripper systems, and any other equipment serving the same function as those previously mentioned.
*** All measurements as total HAP or methanol.

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FIGURE 4. PULPING SYSTEM STANDARDS FOR SULFITE PULPING MILLS (§63.443, §63.450)

SULFITE PULPING SYSTEMS

Existing Sources:
- Digester system vents
- Evaporator system vents
- Pulp washing systems

New Sources
- Existing Sources
- Weak liquor storage tank vents
- Strong liquor storage tank vents
- Acid condensate storage tank vents

Route Vents to a Closed-Vent Collection System
(see Figure 3)

<table>
<thead>
<tr>
<th>Calcium-based and Sodium-based Pulping Systems</th>
<th>Ammonium-based and Magnesium-based Pulping Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Options</td>
<td>Control Options</td>
</tr>
<tr>
<td>Choose One of the Following:</td>
<td>Choose One of the Following:</td>
</tr>
<tr>
<td>Outlet Emission Levels ≤0.44 kg*/Mg ODP</td>
<td>Outlet Emission Levels ≤1.1 kg*/Mg ODP</td>
</tr>
<tr>
<td>Remove 92% by Weight*</td>
<td>Remove 87% by Weight*</td>
</tr>
</tbody>
</table>

* All values measured as total HAP or Methanol. Outlet emission level and percent reduction requirements must account for HAP releases from vents, condensates, and wastewater from control devices used to reduce HAP emissions.
FIGURE 5. BLEACHING SYSTEM STANDARDS (§63.445)

BLEACHING SYSTEMS

Are chlorine or chlorinated compounds used?

NO

No Control Requirements

YES

KRAFT, SEMI-CHEMICAL, SODA, AND SULFITE PULPING MILLS

Existing and New Sources
• Bleaching stages that use chlorine or chlorinated compounds

CHLOROFORM CONTROL OPTIONS

Choose One of the Following:

1. Comply With the Revised Effluent Limitation Guidelines and Standards
2. Use No Chlorine or Hypochlorite In Any Bleaching Stage 99% Reduction by Weight*

MECHANICAL, NON-WOOD FIBER, AND SECONDARY FIBER PULPING MILLS

Existing and New Sources
• Bleaching stages that use chlorine or chlorine dioxide

CHLORINATED HAP CONTROL OPTIONS (excluding chloroform)

• Route vents to a closed-vent collection system (see Figure 3) and choose one of the following:

1. Outlet Concentration ≤10 ppmv*
2. Outlet Emission Levels ≤0.001 kg*/Mg ODP

* All values measured as total chlorinated HAP or chlorine.

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KRAFT PULPING PROCESS CONDENSATES

New and Existing Sources:
+ Digester system
+ Turpentine recovery system
+ Each weak liquor feed stage in the evaporator system
+ LVHC collection system
+ HVLC collection system

Convey condensates in a closed collection system meeting the requirements for individual drain systems as specified in Subpart RR (40 CFR 63.446(d)) until the condensates reach one of the treatment options.

CONTROL OPTIONS
Choose One of the Following:

CONTROL THE ENTIRE VOLUME OF CONDENSATES FROM ALL LISTED SOURCES

VOLUME REDUCTION OPTIONS
(Condensate Segregation)
Segregate condensate streams into low-HAP and high-HAP streams. Choose one of the following:

VOLUME REDUCTION OPTION 1:
High-HAP stream that contains at least 65 percent of the total HAP* mass from the digester, turpentine recovery, and evaporator systems.
Control the high-HAP stream along with condensates from the LVHC and HVLC collection systems.

VOLUME REDUCTION OPTION 2:
High-HAP stream that contains >3.6 kg*/Mg ODP (unbleached mills) or >5.5 kg*/Mg ODP (bleached mills) from all listed sources.
Control the high-HAP stream.

TREATMENT OPTIONS
Choose One of the Following:

RECYCLE
Route condensates to a controlled piece of process equipment meeting the pulping vent standards.

BIOTREATMENT
Remove 92% of total HAPs by weight in a biological treatment system.

STEAM STRIPPING
(or other control devices)**
Choose One of the Following:

** HAPs removed from pulping process condensates by steam stripping (or other control devices) must be controlled at levels required by the kraft pulping vent standards.

* All values measured as total HAP or Methanol.

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CLEAN CONDENSATE ALTERNATIVE (CCA)

- Alternative to kraft pulping system standards in Figure 3 (for individual vents or combination of vents)
- Concept--Reduction of HAP emissions through reduction of HAP concentration in process water
- Resulting HAP emission reductions can be used as partial or complete fulfillment of the emission reductions required by the kraft pulping system standards

SOURCES ELIGIBLE FOR INCLUSION IN THE CCA

- Pulping systems
- Bleaching systems
- Causticizing systems
- Papermaking systems

CALCULATE BASELINE EMISSIONS

Baseline emissions are to be measured after compliance has been achieved with:
- Kraft pulping process condensate standards, and
- Revised effluent limitation guidelines and standards in 40 CFR 430 subpart B

CALCULATE EMISSIONS REDUCTIONS ACHIEVED THROUGH THE CCA

Emissions Reductions Achieved Through the CCA =

- Baseline Emissions minus emission levels measured after the CCA has been implemented
- Excluding
  - emission reductions attributable to control technology required by local, State, or Federal agencies
  - control equipment installed prior to December 17, 1993

CALCULATE EMISSIONS REDUCTIONS EXPECTED THROUGH COMPLIANCE WITH THE KRAFT PULPING SYSTEM STANDARDS

Compliance through the CCA is Determined by Proving That:

Emission Reductions Achieved Through the CCA (kg total HAP/Mg ODP) ≥ Emission Reductions Expected Through Compliance With the Kraft Pulping System Standards (kg total HAP/Mg ODP)

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FIGURE 8. MONITORING REQUIREMENTS (§63.453)

INSTALL AND OPERATE:
Continuous Monitoring System (CMS)

ALLOWABLE OPERATING/EMISSION PARAMETERS
FOR SPECIFIED SOURCES AND CONTROLS
- Use named parameters in Figure 9 for specified sources and controls.
- Alternative parameters or processors to those specified are allowed only with EPA approval.

DETERMINING OPERATING/EMISSION PARAMETERS
FOR OTHER SOURCES AND CONTROLS
- Only for the sources and controls listed below:
  - Sulfite pulping vent controls,
  - Kraft condensate segregation techniques; and
  - Kraft clean condensate alternative controls.
- Establish potential parameters:
  - Monitor potential parameters during performance test; and
  - Supplement the performance test results with engineering assessment and manufacturer's recommendations.
- Provide the rationale and data to Administrator indicating that the chosen parameter(s) demonstrate compliance with the emission standard.

SETTING PARAMETER:
VALUE, AVERAGING TIME, AND MONITORING FREQUENCY
- Establish parameter value:
  - Continuous monitoring data collected during performance test, and
  - Supplement the performance test results with engineering assessment and manufacturer's recommendations.
- Provide rationale and data to Administrator indicating that the chosen parameter value demonstrates compliance with emission standard.

EXCEEDING THE MONITORING PARAMETER VALUES OR PROCEDURES
- Shall constitute a violation of the applicable emission standard, and
- Must be reported as excess emissions
- Except:
  - Biological treatment systems that are tested and comply with percent reduction standards
  - Steam strippers excess emissions must not exceed 10% of operating time including startup, shutdown, or malfunction, and
  - Kraft, soda, and semi-chemical vent controls must not exceed (excluding startup, shutdown, or malfunction):
    - 1% for LVHC systems controls
    - 4% for HVLC or combined LVHC and HVLC system controls

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| **PULPING SYSTEMS** | **Thermal Oxidizer**  
- For compliance with the 98 percent reduction option; measure, maintain, and record fire box temperature with a CMS*  
- For compliance with the 20 ppmv outlet option; measure, maintain, and record outlet HAP concentration with a CMS  
- For compliance with the 1600°F design temperature option; measure, maintain, and record fire box temperature with a CMS  
- No monitoring requirements for pulping vent system vents routed to a power boiler, lime kiln, or recovery furnace |
|-------------------|---------------------------------------------------------------|
| **BLEACHING SYSTEMS** | **Bleaching Vent Scrubbers**  
- Measure and record the following parameters using a CMS:  
  - pH or oxidation/reduction potential of scrubber effluent,  
  - gas scrubber inlet flowrate, and  
  - gas scrubber liquid influent flowrate  
  -or-  
  - Chlorine outlet concentration  
  Systems participating in the extended compliance time of the Effluent Incentives Program:  
- Monitor chlorine and hypochlorite application rates (kg/Mg ODP) during extended compliance period |
| **PULPING PROCESS CONDENSATES** | **Steam Strippers**  
- Measure and record the following parameters using a CMS:  
  - Process water feed rate,  
  - Steam feed rate, and  
  - Column feed temperature  
  -or-  
  - Outlet methanol concentration  
**Biological Treatment Systems**  
- Daily monitoring  
  - Outlet soluble BOD5  
  - Mixed liquor volatile suspended solids  
  - Horsepower of aerator unit(s)  
  - Inlet liquid flow  
  - Liquid temperature  
  - Collect and store inlet and outlet grab samples  
- Quarterly Monitoring  
  - Every 1st quarter: demonstrate percent reduction of total HAP  
  - Remaining quarters: percent reduction of total HAP (methanol can be measured if a relationship between total HAP and methanol reduction is established and maintained at levels as less than those measured during the 1st quarter) |
| **CLOSED VENT SYSTEMS** and CLOSED (Condensates) COLLECTION SYSTEMS | **Every 30 days:**  
- Visual inspection  
- Inspect bypass line valve or closure mechanism  
**Initially and Annually**  
- Demonstrate no detectable leaks at positive pressure portions  
- Demonstrate negative pressure at enclosure openings |

* CMS = Continuous Monitoring System
**FIGURE 10. RECORDKEEPING AND REPORTING REQUIREMENTS (§63.454, §63.455)**

<table>
<thead>
<tr>
<th>INITIAL NOTIFICATION REPORT</th>
<th>NOTIFICATION OF COMPLIANCE STATUS REPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing Major Sources</strong>: Within 1 year after becoming subject to rule</td>
<td>60 Days Following Compliance Demonstration</td>
</tr>
<tr>
<td><strong>New or Reconstructed Major Sources</strong>: No later than 120 days after initial startup</td>
<td>• Methods used to determine compliance.</td>
</tr>
<tr>
<td>• Name &amp; address of owner or operator.</td>
<td>• Results of performance tests and/or CMS performance evaluations.</td>
</tr>
<tr>
<td>• Address of the source.</td>
<td>• Methods to be used to determine continuous compliance.</td>
</tr>
<tr>
<td>• Identification of the rule and source’s compliance date.</td>
<td>• Type and quantity of HAP emitted.</td>
</tr>
<tr>
<td>• Description of operations, design capacity, and HAP emission points.</td>
<td>• Analysis demonstrating whether a major or area source.</td>
</tr>
<tr>
<td>• Statement of whether a major or area source.</td>
<td>• Description of control equipment and efficiencies.</td>
</tr>
<tr>
<td>• Notification of intent to construct or startup date for new or reconstructed sources.</td>
<td>• Statement as to whether source has complied with standard.</td>
</tr>
<tr>
<td>• Control strategy report (HVLC systems at kraft mills).</td>
<td>• Data, calculations, engineering assessments, and manufacturer’s recommendations used to determine operating parameter value.</td>
</tr>
<tr>
<td>• Control strategy report (bleaching systems participating in the Effluent Incentives Program)</td>
<td></td>
</tr>
</tbody>
</table>
**FIGURE 11. RECORDKEEPING AND REPORTING REQUIREMENTS (§63.454, §63.455)**

<table>
<thead>
<tr>
<th>PERIODIC REPORTS</th>
<th>REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUARTERLY (Excess Emissions)</td>
<td>Requirements specified in Subpart A</td>
</tr>
<tr>
<td></td>
<td>No additional requirements under Subpart S</td>
</tr>
<tr>
<td>SEMI-ANNUALLY (No Excess Emissions)</td>
<td>Requirements specified in subpart A</td>
</tr>
<tr>
<td></td>
<td>Mills participating in the Effluent Incentives Program must report daily application rates of chlorine and hypochlorite</td>
</tr>
<tr>
<td>BI-ANNUALLY</td>
<td>Mills with extended compliance schedules (some kraft pulping systems and for mills participating in the Effluent Incentives Program) must update control strategy reports</td>
</tr>
</tbody>
</table>

**RECORDKEEPING**

- Comply with recordkeeping requirements specified in Subpart A
- Mills with closed-vent systems and/or closed collection systems shall prepare and maintain a site-specific inspection plan
- Mills participating with the Effluent Incentives Program shall record daily average chlorine and hypochlorite application rates (kg/Mg ODP)
- Mills shall record all CMS parameters included in the monitoring requirements (see Figures 8 and 9)