United States Environmental Protection Agency
Region 10, Office of Air, Waste and Toxics
AWT-150
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

Permit Number: R10T5020101
Issued: 5/13/2015
Effective: 5/13/2015
Expiration: 8/13/2019
Replaces: R10T5020100
AFS Plant I.D. Number: 16-009-00018

# Title V Air Quality Operating Permit

## Permit Renewal #1, Administrative Amendment

In accordance with the provisions of Title V of the Clean Air Act (42 U.S.C. 7401 *et seq.*), 40 CFR Part 71 and other applicable rules and regulations,

## Stimson Lumber Company

is authorized to operate air emission units and to conduct other air pollutant emitting activities in accordance with the conditions listed in this permit. This source is authorized to operate in the following location:

| | |
|---|---|
| Location: | Coeur d'Alene Reservation<br>733 10th Street<br>Plummer, Idaho 83851<br>Latitude: 47.33ºN, Longitude: 116.89ºW |
| Responsible Official: | Matthew S. Frank<br>Plant Manager<br>Stimson Lumber Company<br>Plummer, Idaho 83851-0639<br>Phone: 208-686-9080, ext. 2222<br>Fax: 208-686-9089 |
| Company Contact: | Steven Petrin<br>Corporate E&H Manager<br>520 S.W. Yamhill, Suite 700<br>Portland, Oregon 97204<br>Phone: 503-306-4655<br>Email: spetrin@stimsonlumber.com |

The United States Environmental Protection Agency (EPA) has also developed a statement of basis that describes the bases for conditions contained in this permit.

/s/ 5/13/2015

Donald A. Dossett, P.E., Manager
Air Permits and Diesel Unit
Office of Air, Waste and Toxics
U.S. EPA, Region 10

Date

# Table of Contents

# 1. Source Information and Emission Units

The Stimson Lumber Company (Stimson or permittee) facility is a lumber mill that produces dry dimensional lumber. The emission units are listed in Table 1.

**Table 1: Emission Units (EU) & Control Devices**

| EU # | Emission Unit Description | Control Device[1] |
|---|---|---|
| EU-1 | Hog Fuel-Fired Boiler: Riley R-X-1, Serial No. 2771, (including ash handling fugitives); 70,000 lb/hr steam output capacity, 105 MMBtu/hr heat input capacity; manufactured 1951, installed in 1983 | Joy multiclone, Yanke wet scrubber |
| EU-2 | Lumber Drying Kilns: Indirectly heated; field-erected, annual capacity = 109,200 Mbdft | None |
| EU-3 | Sawmill: Includes log bucking and debarking, hog, bark conveying, log sawing, sawdust conveying, chipper, chip conveying and loading, unloading and storage of materials in sawdust and chip truck bins; annual capacity = 109,200 Mbdft of logs, or 393,000 dry tons of logs | Some activities are inside building |
| EU-4 | Planer Mill; includes planer shavings cyclone and the planer chipper cyclone; annual capacity 109,200 Mbdft/year | Some activities are inside building |
| EU-5 | Used Oil-Fired Heater: Clean Burn 4000, 280,000 Btu/hr. | None |
| EU-6 | Piles and handling; bark fuel pile, sawdust pile, shavings pile; drop onto pile, wind erosion of piles | None |
| EU-7 | Tanks: diesel (8000 gallon) and gasoline (200 gallon) fuel tanks, horizontal | Under cover |
| EU-8 | Plant Traffic: in log yard, on paved areas and in green lumber stacking area; involves front-end loaders and trucks | Work practices |

[1] The multiclone and scrubber are required to be used by this permit

# 2. Standard Terms and Conditions

2.1. Terms not otherwise defined in this permit have the meaning assigned to them in the referenced regulations. The language of the cited regulation takes precedence over paraphrasing except the text of terms specified pursuant to any of the following sections is directly enforceable: section 304(f)(4) of the Federal Clean Air Act (CAA), 40 CFR §§ 71.6(a)(3)(i)(B and C), 71.6(a)(3)(ii), and 71.6(b), or any other term specifically identified as directly enforceable.

**Compliance with the Permit**

2.2. The permittee must comply with all conditions of this Part 71 permit. All terms and conditions of this permit are enforceable by EPA and citizens under the Clean Air Act. Any permit noncompliance constitutes a violation of the Clean Air Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.
[40 CFR § 71.6(a)(6)(i)]

2.3. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
[40 CFR § 71.6(a)(6)(ii)]

**Permit Shield**

2.4. Compliance with the terms and conditions of this permit shall be deemed compliance with the applicable requirements specifically listed in this permit as of the date of permit issuance.
[40 CFR § 71.6(f)(1)]

2.5. Nothing in this permit shall alter or affect the following:

2.5.1. The provisions of section 303 of the Clean Air Act (emergency orders), including the authority of EPA under that section;

2.5.2. The liability of a permittee for any violation of applicable requirements prior to or at the time of permit issuance;

2.5.3. The applicable requirements of the acid rain program, consistent with section 408(a) of the Clean Air Act; or

2.5.4. The ability of EPA to obtain information under section 114 of the Clean Air Act.
[40 CFR § 71.6(f)(3)]

**Other Credible Evidence**

2.6. For the purpose of submitting compliance certifications in accordance with Condition 3.4.9 of this permit, or establishing whether or not a person has violated or is in violation of any requirement of this permit, nothing shall preclude the use, including the exclusive use, of any credible evidence or information, relevant to whether a source would have been in compliance with applicable requirements if the appropriate performance or compliance test or procedure had been performed.
[section 113(a) and 113(e)(1) of the CAA, 40 CFR §§ 51.212, 52.12, 52.33, 60.11(g), and 61.12]

**Emergency Provisions**

2.7. In addition to any emergency or upset provision contained in any applicable requirement, the permittee may seek to establish that noncompliance with a technology-based emission limitation under this permit was due to an emergency. To do so, the permittee shall demonstrate the affirmative defense of emergency through properly signed, contemporaneous operating logs, or other relevant evidence that:

2.7.1. An emergency occurred and that the permittee can identify the cause(s) of the emergency;

2.7.2. The permitted facility was at the time being properly operated;

2.7.3. During the period of the emergency the permittee took all reasonable steps to minimize levels of emissions that exceeded the emissions standards, or other requirements in this permit; and

2.7.4. The permittee submitted notice of the emergency to EPA within 2 working days of the time when emission limitations were exceeded due to the emergency. This notice must contain a description of the emergency, any steps taken to mitigate emissions, and corrective actions taken. This notice fulfills the requirements of Condition 3.48 of this permit, concerning prompt notification of deviations.
[40 CFR §§ 71.6(g)(2), (3) and (5)]

2.8. In any enforcement proceeding, the permittee attempting to establish the occurrence of an emergency has the burden of proof. [40 CFR § 71.6(g)(4)]

2.9. An “emergency” means any situation arising from sudden and reasonably unforeseeable events beyond the control of the source, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the source to exceed a technology-based emission limitation under the permit due to unavoidable increases in emissions attributable to the emergency. An emergency shall not include noncompliance to the extent caused by improperly designed equipment, lack of preventive maintenance, careless or improper operation, or operator error. [40 CFR § 71.6(g)(1)]

**Permit Actions**

2.10. This permit may be modified, revoked, reopened, and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition. [40 CFR § 71.6(a)(6)(iii)]

2.11. The permit may be reopened by EPA and the permit revised prior to expiration under any of the circumstances described in 40 CFR § 71.7(f). [40 CFR § 71.7(f)]

**Permit Expiration and Renewal**

2.12. This permit shall expire on the expiration date on page one of this permit or on an earlier date if the source is issued a Part 70 or Part 71 permit by a permitting authority under an EPA approved or delegated permit program. [40 CFR § 71.6(a)(11)]

2.13. Expiration of this permit terminates the permittee's right to operate unless a timely and complete permit renewal application has been submitted at least six months, but not more than 18 months, prior to the date of expiration of this permit. [40 CFR §§ 71.5(a)(1)(iii), 71.7(b) and 71.7(c)(1)(ii)]

2.14. If the permittee submits a timely and complete permit application for renewal, consistent with 40 CFR § 71.5(a)(2), but EPA has failed to issue or deny the renewal permit, then all the terms and conditions of the permit, including any permit shield granted pursuant to 40 CFR § 71.6(f) shall remain in effect until the renewal permit has been issued or denied. This permit shield shall cease to apply if, subsequent to the completeness determination, the permittee fails to submit by the deadline specified in writing by EPA any additional information identified as being needed to process the application. [40 CFR §§ 71.7(c)(3) and 71.7(b)]

**Off Permit Changes**

2.15. The permittee is allowed to make certain changes without a permit revision, provided that the following requirements are met:

2.15.1. Each change is not addressed or prohibited by this permit;

2.15.2. Each change meets all applicable requirements and does not violate any existing permit term or condition;

2.15.3. The changes are not changes subject to any requirement of 40 CFR Parts 72 through 78 or modifications under any provision of Title I of the Clean Air Act;

2.15.4. The permittee provides contemporaneous written notice to EPA of each change, except for changes that qualify as insignificant activities under 40 CFR § 71.5(c)(11), that describes each change, the date of the change, any change in emissions, pollutants emitted, and any applicable requirements that would apply as a result of the change;

2.15.5. The changes are not covered by a permit shield provided under 40 CFR § 71.6(f) and Conditions 2.4 and 2.5 of this permit; and

2.15.6. The permittee keeps a record describing all changes that result in emissions of any regulated air pollutant subject to any applicable requirement not otherwise regulated under this permit, and the emissions resulting from those changes. [40 CFR §71.6(a)(12)]

**Emissions Trading and Operational Flexibility**

2.16. The permittee is allowed to make a limited class of changes under section 502(b)(10) of the Clean Air Act within this permitted facility that contravene the specific terms of this permit without applying for a permit revision, provided:

2.16.1. The changes do not exceed the emissions allowable under this permit (whether expressed therein as a rate of emissions or in terms of total emissions);

2.16.2. The changes are not modifications under any provision of Title 1 of the Clean Air Act;

2.16.3. The changes do not violate applicable requirements;

2.16.4. The changes do not contravene federally enforceable permit terms and conditions that are monitoring (including test methods), recordkeeping, reporting, or compliance certification requirements;

2.16.5. The permittee sends a notice to EPA, at least 7 days in advance of any change made under this provision, that describes the change, when it will occur and any change in emissions and identifies any permit terms or conditions made inapplicable as a result of the change and the permittee attaches each notice to its copy this permit; and

2.16.6. The changes are not covered by a permit shield provided under 40 CFR § 71.6(f) and Conditions 2.4 and 2.5 of this permit.

[40 CFR § 71.6(a)(13)(i)]

2.17. No permit revision shall be required, under any approved economic incentives, marketable permits, emissions trading and other similar programs or processes for changes that are provided for in this permit. [40 CFR § 71.6(a)(8)]

**Severability**

2.18. The provisions of this permit are severable, and in the event of any challenge to any portion of this permit, or if any portion is held invalid, the remaining permit conditions shall remain valid and in force. [40 CFR §71.6(a)(5)]

**Property Rights**

2.19. This permit does not convey any property rights of any sort, or any exclusive privilege. [40 CFR §71.6(a)(6)(iv)]

# 3. General Requirements

**General Compliance Schedule**

3.1. For applicable requirements with which the source is in compliance, the permittee will continue to comply with such requirements. [40 CFR §§ 71.6(c)(3) and 71.5(c)(8)(iii)(A)]

3.2. For applicable requirements that will become effective during the permit term, the permittee shall meet such requirements on a timely basis. [40 CFR §§ 71.6(c)(3) and 71.5(c)(8)(iii)(B)]

**Inspection and Entry**

3.3. Upon presentation of credentials and other documents as may be required by law, the permittee shall allow EPA or an authorized representative to perform the following:

3.3.1. Enter upon the permittee's premises where a Part 71 source is located or emissions-related activity is conducted, or where records must be kept under the conditions of the permit;

3.3.2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

3.3.3. Inspect at reasonable times any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit; and

3.3.4. As authorized by the Clean Air Act, sample or monitor at reasonable times substances or parameters for the purpose of assuring compliance with the permit or applicable requirements.

[40 CFR § 71.6(c)(2)]

**Open Burning Restrictions**

3.4. Except as exempted in 40 CFR § 49.131(c), the permittee shall not openly burn, or allow the open burning of, the following materials:

3.4.1. Garbage;

3.4.2. Dead animals or parts of dead animals;

3.4.3. Junked motor vehicles or any materials resulting from a salvage operation;

3.4.4. Tires or rubber materials or products;

3.4.5. Plastics, plastic products, or styrofoam;

3.4.6. Asphalt or composition roofing, or any other asphaltic material or product;

3.4.7. Tar, tarpaper, petroleum products, or paints;

3.4.8. Paper, paper products, or cardboard other than what is necessary to start a fire or that is generated at single-family residences or residential buildings with four or fewer dwelling units and is burned at the residential site;

3.4.9. Lumber or timbers treated with preservatives;

3.4.10. Construction debris or demolition waste;

3.4.11. Pesticides, herbicides, fertilizers, or other chemicals;

3.4.12. Insulated wire;

3.4.13. Batteries;

3.4.14. Light bulbs;

3.4.15. Materials containing mercury (e.g., thermometers);

3.4.16. Asbestos or asbestos-containing materials;

3.4.17. Pathogenic wastes;

3.4.18. Hazardous wastes; or

3.4.19. Any material other than natural vegetation that normally emits dense smoke or noxious fumes when burned.

[40 CFR §§ 49.131(c) and (d)(1)]

3.5. Open burning shall be conducted as follows:

3.5.1. All materials to be openly burned shall be kept as dry as possible through the use of a cover or dry storage;

3.5.2. Before igniting a burn, noncombustibles shall be separated from the materials to be openly burned to the greatest extent practicable;

3.5.3. Natural or artificially induced draft shall be present, including the use of blowers or air curtain incinerators where practicable;

3.5.4. To the greatest extent practicable, materials to be openly burned shall be separated from the grass or peat layer; and

3.5.5. A fire shall not be allowed to smolder.

[40 CFR § 49.131(e)(1)]

3.6. Except for exempted fires set for cultural or traditional purposes, a person shall not initiate any open burning when:

3.6.1. The Regional Administrator has declared a burn ban; or

3.6.2. An air stagnation advisory has been issued or an air pollution alert, warning or emergency has been declared by the Regional Administrator.

[40 CFR §§ 49.131(d)(2), (d)(3) and (e)(2), and 49.137(c)(4)(i)]

3.7. Except for exempted fires set for cultural or traditional purposes, any person conducting open burning when such an advisory is issued or declaration is made shall either immediately extinguish the fire, or immediately withhold additional material such that the fire burns down.

[40 CFR §§ 49.131(e)(3) and 49.137(c)(4)(ii)]

3.8. Nothing in this section exempts or excuses any person from complying with applicable laws and ordinances of local fire departments and other governmental jurisdictions. [40 CFR § 49.131(d)(4)]

**Visible Emissions Limits**

3.9. Except as provided for in Conditions 3.10 and 3.11, the visible emissions from any air pollution source that emits, or could emit, particulate matter or other visible air pollutants shall not exceed 20% opacity, averaged over any consecutive six-minute period. Compliance with this emission limit is determined as follows:

3.9.1. Using EPA Reference Method 9 found in Appendix A of 40 CFR part 60; or

3.9.2. Alternatively, using a continuous opacity monitoring system that complies with Performance Specification 1 found in Appendix B of 40 CFR part 60.

[40 CFR §§ 49.124(d)(1) and (e)]

3.10. The requirements of Condition 3.9 do not apply to open burning, agricultural activities, forestry and silvicultural activities, non-commercial smoke houses, sweat houses or lodges, smudge pots, furnaces and boilers used exclusively to heat residential buildings with four or fewer dwelling units, or emissions from fuel combustion in mobile sources. [40 CFR § 49.124(c)]

3.11. Exceptions to the visible emission limit in Condition 3.9 include:

3.11.1. The visible emissions from an air pollution source may exceed the 20% opacity limit if the owner or operator of the air pollution source demonstrates to the Regional Administrator's satisfaction that the presence of uncombined water, such as steam, is the only reason for the failure of an air pollution source to meet the 20% opacity limit.

3.11.2. The visible emissions from an oil-fired boiler or solid fuel-fired boiler that continuously measures opacity with a continuous opacity monitoring system (COMS) may exceed the 20% opacity limit during start-up, soot blowing, and grate cleaning for a single period of up to 15 consecutive minutes in any eight consecutive hours, but must not exceed 60% opacity at any time.

[40 CFR §§ 49.124(d)(2) and (3)]

**Fugitive Particulate Matter Requirements and Recordkeeping**

3.12. Except as provided for in Condition 3.17, the permittee shall take all reasonable precautions to prevent fugitive particulate matter emissions and shall maintain and operate all pollutant-emitting activities to minimize fugitive particulate matter emissions. Reasonable precautions include, but are not limited to the following:

3.12.1. Use, where possible, of water or chemicals for control of dust in the demolition of buildings or structures, construction operations, grading of roads, or clearing of land;

3.12.2. Application of asphalt, oil (but not used oil), water, or other suitable chemicals on unpaved roads, materials stockpiles, and other surfaces that can create airborne dust;

3.12.3. Full or partial enclosure of materials stockpiles in cases where application of oil, water, or chemicals is not sufficient or appropriate to prevent particulate matter from becoming airborne;

3.12.4. Implementation of good housekeeping practices to avoid or minimize the accumulation of dusty materials that have the potential to become airborne, and the prompt cleanup of spilled or accumulated materials;

3.12.5. Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;

3.12.6. Adequate containment during sandblasting or other similar operations;

3.12.7. Covering, at all times when in motion, open bodied trucks transporting materials likely to become airborne; and

3.12.8. The prompt removal from paved streets of earth or other material that does or may become airborne.

[40 CFR §§ 49.126(d)(1) and (2)]

3.13. Once each calendar year, during typical operating conditions and meteorological conditions conducive to producing fugitive dust, the permittee shall survey the facility to determine the sources of fugitive particulate matter emissions. For new sources or new operations, a survey shall be conducted within 30 days after commencing operation.

3.13.1. The permittee shall record the results of the survey, including the date and time of the survey and identification of any sources of fugitive particulate matter emissions found; and

3.13.2. If sources of fugitive particulate matter emissions are present, the permittee shall determine the reasonable precautions that will be taken to prevent fugitive particulate matter emissions.

[40 CFR §§ 49.126(e)(1)(i) and (ii)]

3.14. The permittee shall prepare, and update as necessary following each survey, a written plan that specifies the reasonable precautions that will be taken and the procedures to be followed to prevent fugitive particulate matter emissions, including appropriate monitoring and recordkeeping.

3.14.1. For construction or demolition activities, a written plan shall be prepared prior to commencing construction or demolition.

[40 CFR §§ 49.126(e)(1)(iii) and (iv)]

3.15. The permittee shall implement the written plan, and maintain and operate all sources to minimize fugitive particulate matter emissions. [40 CFR §§ 49.126(e)(1)(iii) and (iv)]

3.16. Efforts to comply with this section cannot be used as a reason for not complying with other applicable laws and ordinances. [40 CFR § 49.126(e)(3)]

3.17. The requirements of Conditions 3.12 through 3.16 do not apply to open burning, agricultural activities, forestry and silvicultural activities, sweat houses or lodges, non-commercial smoke houses, or activities associated with single-family residences or residential buildings with four or fewer dwelling units.

[40 CFR § 49.126(c)]

**Other Work Practice Requirements and Recordkeeping**

3.18. The permittee shall comply with the requirements of the Chemical Accident Prevention Provisions at 40 CFR Part 68 no later than the latest of the following dates:

3.18.1. Three years after the date on which a regulated substance, present above the threshold quantity in a process, is first listed under 40 CFR § 68.130; or

3.18.2. The date on which a regulated substance is first present above a threshold quantity in a process.

[40 CFR § 68.10]

3.19. Except as provided for motor vehicle air conditioners (MVACs) in 40 CFR Part 82, Subpart B, the permittee shall comply with the stratospheric ozone and climate protection standards for recycling and emissions reduction pursuant to 40 CFR Part 82, Subpart F.

3.19.1. Persons opening appliances for maintenance, service, repair, or disposal must comply with the required practices pursuant to 40 CFR § 82.156.

3.19.2. Equipment used during the maintenance, service, repair, or disposal of appliances must comply with the standards for recycling and recovery equipment pursuant to 40 CFR § 82.158.

3.19.3. Persons performing maintenance, service, repair, or disposal of appliances must be certified by an approved technician certification program pursuant to 40 CFR § 82.161.

3.19.4. Persons disposing of small appliances, MVACs, and MVAC-like appliances must comply with recordkeeping requirements pursuant to 40 CFR § 82.166. ("MVAC-like appliance" is defined at 40 CFR § 82.152.)

3.19.5. Persons owning commercial or industrial process refrigeration equipment must comply with the leak repair requirements pursuant to 40 CFR § 82.156.

3.19.6. Owners/operators of appliances normally containing 50 or more pounds of refrigerant must keep records of refrigerant purchased and added to such appliances pursuant to 40 CFR § 82.166.

[40 CFR Part 82, Subpart F]

3.20. If the permittee performs a service on motor (fleet) vehicles when this service involves ozone-depleting substance refrigerant (or regulated substitute substance) in the MVAC, the permittee must comply with all the applicable requirements for stratospheric ozone and climate protection as specified in 40 CFR Part 82, Subpart B, Servicing of Motor Vehicle Air Conditioners. [40 CFR Part 82, Subpart B]

3.21. The permittee shall comply with 40 CFR Part 61, Subpart M for asbestos removal and disposal when conducting any renovation or demolition at the facility. [40 CFR Part 61, Subpart M]

**General Testing and Associated Recordkeeping and Reporting**

3.22. In addition to the specific testing requirements contained in the emission unit sections of this permit, the permittee shall comply with the generally applicable testing requirements in Conditions 3.23 through 3.30 whenever conducting a performance test required by this permit unless specifically stated otherwise in this permit. [40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.23. Test Notification. The permittee shall provide EPA at least 30 days prior notice of any performance test, except as otherwise specified in this permit, to afford EPA the opportunity to have an observer present. If after 30 days notice for an initially scheduled performance test, there is a delay in conducting the scheduled performance test, the permittee shall notify EPA as soon as possible of any delay in the original test date, either by providing at least 7 days prior notice of the rescheduled date of the performance test, or by arranging a rescheduled date with EPA by mutual agreement.

[40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.24. Test Plan. The permittee shall submit to EPA a source test plan 30 days prior to any required testing. The source test plan shall include and address the following elements:

3.24.1. Purpose and scope of testing;

3.24.2. Source description, including a description of the operating scenarios and mode of operation during testing and including fuel sampling and analysis procedures;

3.24.3. Schedule/dates of testing;

3.24.4. Process data to be collected during the test and reported with the results, including source-specific data identified in the emission unit sections of this permit;

3.24.5. Sampling and analysis procedures, specifically requesting approval for any proposed alternatives to the reference test methods, and addressing minimum test length (e.g., one hour, 8 hours, 24 hours, etc.) and minimum sample volume;

3.24.6. Sampling location description and compliance with the reference test methods;

3.24.7. Analysis procedures and laboratory identification;

3.24.8. Quality assurance plan;

3.24.9. Calibration procedures and frequency;

3.24.10. Sample recovery and field documentation;

3.24.11. Chain of custody procedures;

3.24.12. Quality assurance/quality control project flow chart;

3.24.13. Data processing and reporting;

3.24.14. Description of data handling and quality control procedures; and

3.24.15. Report content and timing.

[40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.25. Facilities for performing and observing the emission testing shall be provided that meet the requirements of 40 CFR 60.8(e) and Reference Method 1 (40 CFR Part 60, Appendix A).

[40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.26. Unless EPA determines in writing that other operating conditions are representative of normal operations or unless specified in the emission unit sections of this permit, the source shall be operated at a capacity of at least 90% but no more than 100% of maximum during all tests.

[40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.27. Only regular operating staff may adjust the processes or emission control devices during or within 2 hours prior to the start of a source test. Any operating adjustments made during a source test, that are a result of consultation during the tests with source testing personnel, equipment vendors, or consultants, may render the source test invalid. [40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.28. Each source test shall follow the reference test methods specified by this permit and consist of at least three (3) valid test runs.

3.28.1. If the reference test method yields measured pollutant concentration values at an oxygen concentration other than specified in the emission standard, the permittee shall correct the measured pollutant concentration to the oxygen concentration specified in the emission standard by using the following equation:

$$PC_X = PC_m \times \frac{(20.9-X)}{(20.9-Y)}$$

Where:
$PC_X$ = Pollutant concentration at X percent;
$PC_m$ = Pollutant concentration as measured;
X = The oxygen concentration specified in the standard; and
Y = The measured average volumetric oxygen concentration.
[40 CFR § 71.6(a)(3)(i)(B)]

3.28.2. Source test emission data shall be reported as the arithmetic average of all valid test runs and in the terms of any applicable emission limit, unless otherwise specified in the emission unit sections of this permit. [40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.29. Test Records. For the duration of each test run (unless otherwise specified), the permittee shall record the following information:

3.29.1. All data which is required to be monitored during the test in the emission unit sections of this permit; and

3.29.2. All continuous monitoring system data which is required to be routinely monitored in the emission unit sections of this permit for the emission unit being tested.
[40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

3.30. Test Reports. Emission test reports shall be submitted to EPA within 60 days of completing any emission test required by this permit along with items required to be recorded in Condition 3.29 above.
[40 CFR §§ 71.6(a)(3) and 71.6(c)(1)]

**General Recordkeeping**

3.31. Monitoring Records. The permittee shall keep records of required monitoring information that include the following:

3.31.1. The date, place, and time of sampling or measurements;

3.31.2. The date(s) analyses were performed;

3.31.3. The company or entity that performed the analyses;

3.31.4. The analytical techniques or methods used;

3.31.5. The results of such analyses; and,

3.31.6. The operating conditions as existing at the time of sampling or measurement.
[40 CFR § 71.6(a)(3)(ii)(A)]

3.32. Off-Permit Change Records. The permittee shall keep a record describing all off-permit changes allowed to be made under Condition 2.15 that result in emissions of any regulated air pollutant subject to any applicable requirement not otherwise regulated under this permit, and the emissions resulting from those changes. [40 CFR §71.6(a)(12)]

3.33. Open Burning Records. For any open burning allowed under Conditions 3.4 through 3.8, the permittee shall document the following:

3.33.1. The date that burning was initiated;

3.33.2. The duration of the burn;

3.33.3. The measures taken to comply with each provision of Condition 3.5; and

3.33.4. The measures taken to ensure that materials prohibited in Condition 3.4 were not burned.
[40 CFR § 71.6(a)(3)(i)(B)]

3.34. Fee Records. The permittee shall retain in accordance with the provisions of Condition 3.35 of this permit, all work sheets and other materials used to determine fee payments. Records shall be retained for five years following the year in which the emissions data is submitted. [40 CFR § 71.9(i)]

3.35. Records Retention. The permittee shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, report, or application. Support information includes all calibration and maintenance records, all original strip-chart recordings for continuous monitoring instrumentation, and copies of all reports required by this permit. [40 CFR §§ 71.6(a)(3)(ii)(B), 49.126(e)(1)(v) and 49.130(f)(2)]

**General Reporting**

3.36. Additional Information. The permittee shall furnish to EPA, within a reasonable time, any information that EPA may request in writing to determine whether cause exists for modifying, revoking, and reissuing, or terminating the permit, or to determine compliance with the permit. Upon request, the permittee shall also furnish to EPA copies of records that are required to be kept pursuant to the terms of the permit, including information claimed to be confidential. Information claimed to be confidential must be accompanied by a claim of confidentiality according to the provisions of 40 CFR Part 2, Subpart B. [40 CFR §§ 71.6(a)(6)(v) and 71.5(a)(3)]

3.37. Corrections. The permittee, upon becoming aware that any relevant facts were omitted or incorrect information was submitted in the permit application, shall promptly submit such supplementary facts or corrected information. [40 CFR § 71.5(b)]

3.38. Off-Permit Change Report. The permittee shall provide contemporaneous written notice to EPA of each off-permit change allowed to be made under Condition 2.15, except for changes that qualify as insignificant activities under 40 CFR § 71.5(c)(11). The written notice shall describe each change, the date of the change, any change in emissions, pollutants emitted, and any applicable requirements that would apply as a result of the change. [40 CFR §71.6(a)(12)]

3.39. Section 502(b)(10) Change Report. The permittee is required to send a notice to EPA at least 7 days in advance of any section 502(b)(10) change allowed to be made under Condition 2.16. The notice must describe the change, when it will occur and any change in emissions, and identify any permit terms or conditions made inapplicable as a result of the change. The permittee shall attach each notice to its copy this permit. [40 CFR § 71.6(a)(13)(i)(A)]

3.40. Address. Unless otherwise specified in this permit, any documents required to be submitted under this permit, including reports, test data, monitoring data, notifications, compliance certifications, fee calculation worksheets, and applications for renewals and permit modifications shall be submitted to the EPA address below. A copy of each document submitted to EPA that does not contain confidential business information shall be sent to the Tribal address below:

| Original documents go to EPA at: | Copies go to Tribe at: |
|---|---|
| Part 71 Air Quality Permits<br>U.S. EPA - Region 10, AWT-150<br>1200 Sixth Avenue, Suite 900<br>Seattle, WA 98101 | Air Quality Manager<br>Coeur d'Alene Tribe<br>P.O. Box 408<br>Plummer, Idaho 83851-0408 |

[40 CFR §§ 71.5(d), 71.6(c)(1) and 71.9(h)(2)]

**Part 71 Emission and Fee Reporting**

3.41. Part 71 Annual Emission Report. No later than the date specified in Condition 4.1 of each year, the permittee shall submit to EPA an annual report of actual emissions for the preceding calendar year. [40 CFR § 71.9(h)(1)]

3.41.1. "Actual emissions" means the actual rate of emissions in tons per year of any "regulated pollutant (for fee calculation)," as defined in 40 CFR § 71.2, emitted from a Part 71 source over the preceding calendar year. Actual emissions shall be calculated using each emissions unit's actual operating hours, production rates, in-place control equipment, and types of materials processed, stored, or combusted during the preceding calendar year. [40 CFR § 71.9(c)(6)]

3.41.2. Actual emissions shall be computed using methods required by the permit for determining compliance. [40 CFR § 71.9(h)(3)]

3.41.3. Actual emissions shall include fugitive emissions. [40 CFR § 71.9(c)(1)]

3.42. Part 71 Fee Calculation Worksheet. Based on the annual emission report required in Condition 3.41 and no later than the date specified in Condition 4.1 of each year, the permittee shall submit to EPA a fee calculation worksheet (blank forms provided by EPA) and a photocopy of each fee payment check (or other confirmation of actual fee paid). [40 CFR §§ 71.9(c)(1), 71.9(e)(1) and 71.9(h)(1)]

3.42.1. The annual emissions fee shall be calculated by multiplying the total tons of actual emissions of each "regulated pollutant (for fee calculation)," emitted from the source by the presumptive emission fee (in dollars/ton) in effect at the time of calculation. The presumptive emission fee is revised each calendar year and is available from EPA prior to the start of each calendar year. [40 CFR § 71.9(c)(1)]

3.42.2. The permittee shall exclude the following emissions from the calculation of fees:

3.42.2.1. The amount of actual emissions of each regulated pollutant (for fee calculation) that the source emits in excess of 4,000 tons per year;

3.42.2.2. Actual emissions of any regulated pollutant (for fee calculation) already included in the fee calculation; and

3.42.2.3. The insignificant quantities of actual emissions not required to be listed or calculated in a permit application pursuant to 40 CFR 71.5(c)(11). [40 CFR § 71.9(c)(5)]

3.43. Part 71 Annual Fee Payment. No later than the date specified in Condition 4.1 of each year, the permittee shall submit to EPA full payment of the annual permit fee based on the fee calculation worksheet required in Condition 3.42. [40 CFR §§ 71.9(a), 71.9(c)(1) and 71.9(h)(1)]

3.43.1. The fee payment and a completed fee filing form shall be sent to:

U.S.EPA
FOIA and Miscellaneous Payments
Cincinnati Finance Center
P. O. Box 979078
St Louis, MO 63197-9000

[40 CFR § 71.9(k)(2)]

3.43.2. The fee payment shall be in United States currency and shall be paid by money order, bank draft, certified check, corporate check, or electronic funds transfer payable to the order of the U.S. Environmental Protection Agency. [40 CFR § 71.9(k)(1)]

3.43.3. The permittee, when notified by EPA of additional amounts due, shall remit full payment within 30 days of receipt of an invoice from EPA. [40 CFR § 71.9(j)(2)]

3.43.4. If the permittee thinks an EPA assessed fee is in error and wishes to challenge such fee, the permittee shall provide a written explanation of the alleged error to EPA along with full payment of the EPA assessed fee. [40 CFR § 71.9(j)(3)]

3.43.5. Failure of the permittee to pay fees in a timely manner shall subject the permittee to assessment of penalties and interest in accordance with 40 CFR § 71.9(l). [40 CFR § 71.9(l)]

3.44. The annual emission report and fee calculation worksheet (and photocopy of each fee payment check), required in Conditions 3.41 and 3.42, shall be submitted to EPA at the address listed in Condition 3.40 of this permit.[1] [40 CFR § 71.9(k)(1)]

3.45. The annual emission report and fee calculation worksheet (and photocopy of each fee payment check), required in Conditions 3.41 and 3.42, shall be certified by a responsible official in accordance with Condition 3.50 of this permit. [40 CFR § 71.9(h)(2)]

**Annual Registration**

3.46. The permittee shall submit an annual registration report that consists of estimates of the total actual emissions from the air pollution source for the following air pollutants: PM, PM10, PM2.5, $SO_x$, $NO_x$, CO, VOC, lead and lead compounds, ammonia, fluorides (gaseous and particulate), sulfuric acid mist, hydrogen sulfide, total reduced sulfur (TRS), and reduced sulfur compounds, including all calculations for the estimates. Emissions shall be calculated using the actual operating hours, production rates, in-place control equipment, and types of materials processed, stored, or combusted during the preceding calendar year. [40 CFR §§ 49.138(e)(3)(xii), (e)(4) and (f)]

3.46.1. The emission estimates required by Condition 3.46 shall be based upon actual test data or, in the absence of such data, upon procedures acceptable to the Regional Administrator. Any emission estimates submitted to the Regional Administrator shall be verifiable using currently accepted engineering criteria. The following procedures are generally acceptable for estimating emissions from air pollution sources:

3.46.1.1. Source-specific emission tests;

3.46.1.2. Mass balance calculations;

3.46.1.3. Published, verifiable emission factors that are applicable to the source;

3.46.1.4. Other engineering calculations; or

3.46.1.5. Other procedures to estimate emissions specifically approved by the Regional Administrator.

[40 CFR §§ 49.138(e)(4) and (f)]

3.46.2. The annual registration report shall be submitted with the annual emission report and fee calculation worksheet required by Conditions 3.41 and 3.42 of this permit. The permittee may submit a single combined report provided that the combined report clearly identifies which emissions are the basis for the annual registration report, the part 71 annual emission report, and the part 71 fee calculation worksheet. All registration information and reports shall be submitted on forms provided by the Regional Administrator. [40 CFR §§ 49.138(d) and (f)]

**Periodic and Deviation Reporting**

3.47. Semi-Annual Monitoring Report. The permittee shall submit to EPA reports of any required monitoring for each six month reporting period from July 1 to December 31 and from January 1 to June 30. All reports shall be submitted to EPA and shall be postmarked by the 45th day following the end of the

[1]The permittee should note that an annual emissions report, required at the same time as the fee calculation worksheet by 40 CFR § 71.9(h), has been incorporated into the fee calculation worksheet.

reporting period. All instances of deviations from permit requirements must be clearly identified in such reports. All required reports must be certified by a responsible official consistent with Condition 3.50.

[40 CFR § 71.6(a)(3)(iii)(A)]

3.48. Deviation Report. The permittee shall promptly report to EPA, by telephone or facsimile, deviations from permit conditions, including those attributable to upset conditions as defined in this permit, the probable cause of such deviations, and any corrective actions or preventive measures taken. The report shall be made using the following numbers:

Telephone: (206) 553-1331
Facsimile: (206) 553-0110
Attn: Part 71 Deviation Report

[40 CFR § 71.6(a)(3)(iii)(B)]

3.48.1. For the purposes of Conditions 3.47 and 3.48, deviation means any situation in which an emissions unit fails to meet a permit term or condition. A deviation is not always a violation. A deviation can be determined by observation or through review of data obtained from any testing, monitoring, or record keeping required by this permit. For a situation lasting more than 24 hours, each 24-hour period is considered a separate deviation. Included in the meaning of deviation are any of the following:

3.48.1.1. A situation where emissions exceed an emission limitation or standard;

3.48.1.2. A situation where process or emissions control device parameter values indicate that an emission limitation or standard has not been met;

3.48.1.3. A situation in which observations or data collected demonstrate noncompliance with an emission limitation or standard or any work practice or operating condition required by the permit (including indicators of compliance revealed through parameter monitoring);

3.48.1.4. A situation in which any testing, monitoring, recordkeeping or reporting required by this permit is not performed or not performed as required;

3.48.1.5. A situation in which an exceedance or an excursion, as defined in 40 CFR Part 64, occurs; and

3.48.1.6. Failure to comply with a permit term that requires submittal of a report.

[40 CFR § 71.6(a)(3)(iii)(C)]

3.48.2. For the purpose of Condition 3.48 of the permit, prompt is defined as any definition of prompt or a specific time frame for reporting deviations provided in an underlying applicable requirement as identified in this permit. Where the underlying applicable requirement fails to address the time frame for reporting deviations, reports of deviations will be submitted based on the following schedule:

3.48.2.1. For emissions of a hazardous air pollutant or a toxic air pollutant (as identified in the applicable regulation) that continue for more than an hour in excess of permit requirements, the report must be made within 24 hours of the occurrence;

3.48.2.2. For emissions of any regulated pollutant excluding those listed in Condition 3.48.2.1 above, that continue for more than two hours in excess of permit requirements, the report must be made within 48 hours of the occurrence; or

3.48.2.3. For all other deviations from permit requirements, the report shall be submitted with the semi-annual monitoring report required in Condition 3.47.

[40 CFR § 71.6(a)(3)(iii)(B)]

3.48.3. Within 10 working days of the occurrence of a deviation as provided in Condition 3.48.2.1 or 3.48.2.2 above, the permittee shall also submit a written notice, which shall include a narrative description of the deviation and updated information as listed in Condition 3.48, to EPA, certified consistent with Condition 3.50 of this permit.

[40 CFR §§ 71.6(a)(3)(i)(B) and (iii)(B)]

**Annual Compliance Certification**

3.49. The permittee shall submit to EPA a certification of compliance with permit terms and conditions, including emission limitations, standards, or work practices, postmarked by February 28 of each year and covering the permit or permits in effect during the previous calendar year. The compliance certification shall be certified as to truth, accuracy, and completeness by a responsible official consistent with Condition 3.50 of this permit. [40 CFR § 71.6(c)(5)]

3.49.1. The annual compliance certification shall include the following:

3.49.1.1. The identification of each permit term or condition that is the basis of the certification;

3.49.1.2. The identification of the method(s) or other means used by the permittee for determining the compliance status with each term and condition during the certification period. Such methods and other means shall include, at a minimum, the methods and means required in this permit. If necessary, the permittee also shall identify any other material information that must be included in the certification to comply with section 113(c)(2) of the Clean Air Act, which prohibits knowingly making a false certification or omitting material information; and

3.49.1.3. The status of compliance with each term and condition of the permit for the period covered by the certification, including whether compliance during the period was continuous or intermittent. The certification shall be based on the method or means designated above. The certification shall identify each deviation and take it into account in the compliance certification. The certification shall also identify as possible exceptions to compliance any periods during which compliance is required and in which an excursion or exceedance as defined under 40 CFR Part 64 occurred.

[40 CFR § 71.6(c)(5)(iii)]

**Document Certification**

3.50. Any document required to be submitted under this permit shall be certified by a responsible official as to truth, accuracy, and completeness. Such certifications shall state that based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete. [40 CFR §§ 71.5(d), 71.6(c)(1) and 71.9(h)(2)]

**Permit Renewal**

3.51. The permittee shall submit a timely and complete application for permit renewal at least six months, but not more than 18 months, prior to the date of expiration of this permit.

[40 CFR §§ 71.5(a)(1)(iii), 71.7(b) and 71.7(c)(1)(ii)]

3.52. The application for renewal shall include the current permit number, a description of permit revisions and off-permit changes that occurred during the permit term and were not incorporated into the permit during the permit term, any applicable requirements that were promulgated and not incorporated into the permit during the permit term, and other information required by the application form.

[40 CFR §§ 71.5(a)(2) and 71.5(c)(5)]

# 4. Facility-Specific Requirements

**Fees and Emission Reports Due Date**

4.1. Unless otherwise specified, fees and emission reports required by this permit are due annually on April 1. [40 CFR §§ 71.9(a) and 71.9(h)]

**Fuel Sulfur Limits**

4.2. The permittee shall not sell, distribute, use, or make available for use any solid fuel that contains more than 2.0 percent sulfur by weight. [40 CFR § 49.130(d)(7)]

4.2.1. Compliance with the sulfur limit is determined using ASTM method E775-87(2004). [40 CFR § 49.130(e)(3)]

4.3. The permittee shall not sell, distribute, use, or make available for use any used oil that contains more than 2.0 percent sulfur by weight. [40 CFR § 49.130(d)(4)]

4.3.1. Compliance with the sulfur limit is determined using ASTM methods D2880-03, D4294-03, D6021-96(2001). [40 CFR § 49.130(e)(1)]

**Fuel Sulfur Monitoring and Recordkeeping**

4.4. The permittee shall keep records showing that only wood is combusted in the boiler. [40 CFR § 49.130(f)(1)(iii)]

4.5. The permittee shall obtain, record, and keep records of the percent sulfur by weight from the vendor for each delivery of liquid fuel. If the vendor is unable to provide this information (or there is no vendor), then obtain a representative grab sample for each delivery (or from the used oil tank at least at the beginning of each heating season) and test the sample using the reference method in Condition 4.3.1. [40 CFR § 49.130(f)(1)(i) and 40 CFR § 71.6(a)(3)(i)(B)]

**Visible and Fugitive Emission Monitoring and Recordkeeping**

4.6. Except as provided for in Condition 4.13, once each quarter, the permittee shall visually survey each emission unit and any other pollutant emitting activity for the presence of visible emissions or fugitive emissions of particulate matter.

4.6.1. The observer conducting the visual survey must be trained and knowledgeable regarding the effects of background contrast, ambient lighting, observer position relative to lighting and wind, and the presence of uncombined water on the visibility of emissions (see 40 CFR part 60, Appendix A, Method 22).

4.6.2. For the surveys, the observer shall select a position that enables a clear view of the emission point to be surveyed that is at least 15 feet from the emission point and where the sunlight is not shining directly in the observer's eyes.

4.6.3. The observer shall observe emissions from each potential emission point for at least 15 seconds.

4.6.4. Any visible emissions or fugitive emissions of particulate matter other than uncombined water shall be recorded as a positive reading associated with the emission unit or pollutant emitting activity.

4.6.5. Surveys shall be conducted while the facility is operating, and during daylight hours. [40 CFR § 71.6(a)(3)(i)(B)]

4.7. If the observation conducted under Condition 4.6 identifies any visible emissions or fugitive emissions of particulate matter, the permittee shall:

4.7.1. Immediately upon conclusion of the visual observation in Condition 4.6, investigate the source and reason for the presence of visible emissions or fugitive emissions; and

4.7.2. As soon as practicable, take appropriate corrective action.

[40 CFR § 71.6(a)(3)(i)(B)]

4.8. If the corrective actions undertaken pursuant to Condition 4.7.2 do not eliminate the visible or fugitive emissions, the permittee shall within 24 hours of the initial survey conduct a visible emissions observation of the emission point in question, for thirty minutes, using the procedures specified in Condition 3.9.1. [40 CFR § 71.6(a)(3)(i)(B)]

4.9. If any of the visible emissions observations required in Condition 4.8 or 4.10 indicate visible emissions greater than 20% opacity, the permittee shall conduct daily visible emissions observations, for thirty minutes, of the emission point in question until two consecutive daily observations indicate visible emissions of 20% opacity or less. [40 CFR § 71.6(a)(3)(i)(B)]

4.10. If the Method 9 visible emissions observation required in Condition 4.8, or if two consecutive daily observations required by Condition 4.9 indicate visible emissions of 20% opacity or less, the permittee shall conduct weekly visible emissions observations of the emission point for three additional weeks.

[40 CFR § 71.6(a)(3)(i)(B)]

4.11. The permittee shall maintain records of the following:

4.11.1. Details of each visual survey or visible emissions observation, including date, time, observer and results for each emission unit and any other pollutant emitting activity;

4.11.2. Date, time and type of any investigation conducted pursuant to Condition 4.7.1;

4.11.3. Findings of the investigation, including the reasons for the presence of visible emissions or fugitive emissions of particulate matter;

4.11.4. Date, time and type of corrective actions taken pursuant to Condition 4.7.2;

4.11.5. Results of any Method 9 visible emissions observations conducted on the source of visible or fugitive emissions, and pursuant to Conditions 4.8 through 4.10.

[40 CFR § 71.6(a)(3)(i)(B)]

4.12. Any observation of visible emissions in excess of Condition 3.9 is a deviation and subject to the provisions of Conditions 3.47 and 3.48. [40 CFR § 71.6(a)(3)(i)(B)]

4.13. The requirements of Conditions 4.6 through 4.12 shall not apply to emissions from boiler EU-1.

[40 CFR § 71.6(a)(3)(i)(B)]

**Facility-Wide HAP Emission Limits and Work Practice Requirements**

4.14. HAP emissions from this facility shall not exceed 24 tons per year as determined on a rolling 12-month basis by calculating the emissions (tons) for each month and adding the emissions (tons) for the previous eleven months. Monthly HAP emissions (tons) shall be determined by multiplying appropriate emission factors (lb/unit) by the recorded monthly operation/production rates (units/month) and dividing by 2000 lb/ton.

4.14.1. Hydrogen chloride emission factors shall be based on the most recent fuel sampling results.

[Permit No. R10NT501000]

4.15. Emissions of any single HAP from this facility shall not exceed 9 tons per year as determined on a rolling 12-month basis by calculating the emissions (tons) for each month and adding the emissions (tons) for the previous eleven months. Monthly emissions of any single HAP (tons) shall be determined by multiplying appropriate emission factors (lb/unit) by the recorded monthly operation/production rates (units/month) and dividing by 2000 lb/ton.

4.15.1. Hydrogen chloride emission factors shall be based on the most recent fuel sampling results. [Permit No. R10NT501000]

**Facility-Wide HAP Monitoring and Recordkeeping Requirements**

4.16. The permittee shall obtain, record, and keep records of the percent (by weight) chloride in the used oil from the vendor for each batch of fuel. If the vendor is unable to provide this information, the permittee shall obtain a representative grab sample for each batch and analyze the sample using the procedures in ASTM 4057 and ASTM 808. For used oil generated on site, the permittee shall obtain a representative grab sample from the storage tank once per year and analyze the sample using the procedures in ASTM 4057 and ASTM 808.

4.16.1. The permittee shall determine a hydrogen chloride emission factor (lb/Mgal) for the heater using the information collected in Condition 4.16. [40 CFR § 71.6(a)(3)(i)(B) and (C), 71.6(a)(3)(ii) and 71.6(c)(1)]

4.17. Each month, the permittee shall calculate and record facility-wide monthly and rolling 12-month total emissions (tons) for all HAP-emitting activities at the facility. [Permit No. R10NT501000]

4.18. Prior to the first fuel analysis being conducted as required in Condition 5.5.3, the permittee shall use 1.7 mmBtu/Mlbsteam to calculate the monthly heat input to boiler EU-1 for use in emission calculations. [40 CFR § 71.6(a)(3)(i)(B) and (C), 71.6(a)(3)(ii) and 71.6(c)(1)]

4.19. The permittee shall track and record the operations and production for each HAP-emitting activity at the facility, such that facility-wide HAP emissions can be calculated on a monthly and 12-month basis. [Permit No. R10NT501000]

4.20. The permittee shall maintain records of emission calculations and parameters used to calculate emissions for at least five years. [Permit No. R10NT501000]

**Facility-Wide HAP Reporting Requirements**

4.21. Once each year, on or before April 1, the permittee shall, along with the annual registration required in Condition 3.46, submit to EPA a report containing the twelve monthly rolling 12-month emissions calculations for the previous calendar year.

4.21.1. The report shall contain a description of all emissions estimating methods used, including emission factors and their sources, assumptions made and production data. [Permit No. R10NT501000]

**NESHAP Subpart JJJJJJ Work Practice and Emission Reduction Measures**

4.22. NESHAP Subpart JJJJJJ Boiler EU-1 Performance Tune-up. The permittee shall conduct a performance tune-up of boiler EU-1 no later than March 21, 2014, and every 2 years thereafter subject to the following: [40 CFR §§ 63.11196(a)(1), 63.11201(b), 63.11210(c), 63.11223(a) through (c) and Table 2 to JJJJJJ of Part 63]

4.22.1. Each performance tune-up shall be conducted no more than 25 months after the previous tune-up. [40 CFR § 63.11223(b)]

4.22.2. If boiler EU-1 is not operating on the required date for a tune-up, the tune-up shall be conducted within 30 days of startup. [40 CFR § 63.11223(b)(7)]

4.22.3. Conduct the tune-up while combusting biomass. [40 CFR § 63.11223(a)]

4.22.4. Inspect the system controlling the air-to-fuel ratio and ensure that it is correctly calibrated and functioning properly. The inspection may be delayed until the next scheduled boiler shutdown, not to exceed 36 months from the previous inspection. [40 CFR § 63.11223(b)(3)]

4.22.5. Optimize total emissions of CO. This optimization shall be consistent with the manufacturer's specifications, if available, and with any $NO_X$ requirement to which boiler EU-1 is subject. [40 CFR §§ 63.11223(b)(4)]

4.23. NESHAP Subpart JJJJJJ Energy Assessment for Boiler EU-1 and Its Energy Use Systems. The permittee shall satisfy Condition 4.23.1 or 4.23.2 no later than March 21, 2014: [40 CFR § 63.11196(a)(3), 63.11201(b), 63.11210(c) and Table 2 to Subpart JJJJJJ of Part 63]

4.23.1. Have a one-time energy assessment performed or amended in accordance with Condition 4.24 and as follows: [40 CFR § 63.11201(b) and Table 2 to Subpart JJJJJJ of Part 63]

4.23.1.1. The energy assessment (and in the case of an amendment; the underlying assessment) shall be completed on or after January 1, 2008. [40 CFR § 63.11201(b) and Table 2 to Subpart JJJJJJ of Part 63]

4.23.1.2. An energy assessment performed after February 1, 2013 shall be conducted by a qualified energy assessor. [Table 2 to Subpart JJJJJJ of Part 63]

4.23.2. Operate under an energy management program compatible with ISO 50001 that includes boiler EU-1. [40 CFR § 63.11201(b) and Table 2 to Subpart JJJJJJ of Part 63]

4.24. NESHAP Subpart JJJJJJ One-Time Energy Assessment Requirements for Boiler EU-1 and Its Energy Use Systems. If the permittee elects to have a one-time energy assessment performed or amended to comply with Condition 4.23, the assessment (or amended assessment) shall include the following: [40 CFR § 63.11201(b), 40 CFR § 63.11237 and Table 2 to Subpart JJJJJJ of Part 63]

4.24.1. An on-site evaluation up to 24 technical labor hours in duration (but may be longer at the discretion of the permittee) that includes the following: [40 CFR § 63.11237]

4.24.1.1. A visual inspection of boiler EU-1 boiler system;

4.24.1.2. An evaluation of operating characteristics of the boiler EU-1 boiler system, specifications of energy use systems, operating and maintenance procedures, and unusual operating constraints;

4.24.1.3. An inventory of major energy use systems consuming energy from boiler EU-1 and which are under control of the permittee;

4.24.1.4. A review of available architectural and engineering plans, facility operating and maintenance procedures and logs, and fuel usage; [Table 2 to Subpart JJJJJJ of Part 63]

4.24.2. A list of major energy conservation measures that are within the permittee's control; [Table 2 to Subpart JJJJJJ of Part 63]

4.24.3. A list of the energy savings potential of the energy conservation measures identified, and [Table 2 to Subpart JJJJJJ of Part 63]

4.24.4. A comprehensive report detailing the ways to improve efficiency, the cost of specific improvements, benefits, and the time frame for recouping those investments. [Table 2 to Subpart JJJJJJ of Part 63]

4.25. NESHAP Subpart JJJJJJ Boiler EU-1 General Duty Requirement. At all times, the permittee must operate and maintain boiler EU-1, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. The general duty to minimize emissions does not require the permittee to make any further efforts to reduce emissions if levels required by this standard have been achieved. Determination of whether such operation and maintenance procedures are being used will be based on information available to EPA that may include, but is not limited to, monitoring results, review of operation and

maintenance procedures, review of operation and maintenance records, and inspection of the source. [40 CFR § 63.11205(a)]

**NESHAP Subpart JJJJJJ Monitoring and Recordkeeping Requirements**

4.26. NESHAP Subpart JJJJJJ Boiler EU-1 Performance Tune-up Monitoring. The permittee shall measure and record the concentration of CO in parts per million, by volume, and $O_2$ in volume percent, in boiler EU-1's effluent stream before and after the performance tune-up conducted to satisfy Condition 4.22. Measurements may be either on a dry or wet basis, as long as it is the same basis before and after the performance tune-up is performed. Measurements may be taken using a portable CO analyzer. [40 CFR § 63.11223(b)(5)]

4.27. NESHAP Subpart JJJJJJ Recordkeeping for Compliance – Boiler EU-1 and Its Energy Use Systems. The permittee shall maintain the following records: [40 CFR § 63.11225(c)]

4.27.1. A copy of each notification and report submitted to comply with NESHAP Subpart JJJJJJ and all documentation supporting any Initial Notification or Notification of Compliance Status submitted to EPA. [40 CFR §§ 63.10(b)(2)(xiv) and 63.11225(c)(1)]

4.27.2. Records identifying boiler EU-1, the date of tune-up, the procedures followed for tune-up, and the manufacturer's specifications to which boiler EU-1 was tuned. [40 CFR § 63.11225(c)(2)(i)]

4.27.3. A copy of the energy assessment report for boiler EU-1 and its energy use systems. [40 CFR § 63.11225(c)(2)(iii)]

4.28. NESHAP Subpart JJJJJJ Boiler EU-1 Recordkeeping for General Duty Requirement. The permittee shall maintain the following records: [40 CFR § 63.11225(c)]

4.28.1. Records of the occurrence and duration of each malfunction of boiler EU-1, or of the associated air pollution control and monitoring equipment. [40 CFR § 63.11225(c)(4)]

4.28.2. Records of actions taken during periods of malfunction to minimize emissions in accordance with Condition 4.25, including corrective actions to restore the malfunctioning boiler, air pollution control, or monitoring equipment to its normal or usual manner of operation. [40 CFR § 63.11225(c)(5)]

4.29. NESHAP Subpart JJJJJJ Boiler EU-1 Recordkeeping for Use of Non-Hazardous Secondary Materials as Fuels. The permittee shall maintain the following records:

4.29.1. If boiler EU-1 combusts non-hazardous secondary materials that have been determined not to be a solid waste pursuant to 40 CFR § 241.3(b)(1), the permittee shall keep a record which documents how the secondary material meets each of the legitimacy criteria under 40 CFR § 241.3(d)(1).

4.29.2. If boiler EU-1combusts a fuel that has been processed from a discarded non-hazardous secondary material pursuant to 40 CFR § 241.3(b)(4), the permittee shall keep records as to how the operations that produced the fuel satisfies the definition of processing in 40 CFR § 241.2 and each of the legitimacy criteria in 40 CFR § 241.3(d)(1).

4.29.3. If boiler EU-1 combusts a fuel that received a non-waste determination pursuant to the petition process submitted under 40 CFR § 241.3(c), the permittee shall keep a record that documents how the fuel satisfies the requirements of the petition process.

4.29.4. If boiler EU-1 combusts non-hazardous secondary materials as fuel per 40 CFR §241.4, the permittee shall keep records documenting that the material is a listed non-waste under 40 CFR § 241.4(a). [40 CFR § 63.11225(c)(2)(ii)]

**NESHAP Subpart JJJJJJ Reporting Requirements**

4.30. NESHAP Subpart JJJJJJ Boiler EU-1 Performance Tune-up Reporting. Maintain on-site and submit to EPA as part of the semiannual report satisfying Condition 3.47 the following information for each performance tune-up conducted to satisfy Condition 4.22:
[40 CFR §§ 63.11223(b)(6) and 71.6(a)(3)(iii)(A)]

4.30.1. The concentration of CO in boiler EU-1's effluent stream in parts per million, by volume, and $O_2$ in volume percent, measured at high fire or typical operating load, before and after the tune-up of the boiler. [40 CFR §§ 63.11223(b)(6)(i)]

4.30.2. A description of any corrective action taken as a part of the tune-up of boiler EU-1.
[40 CFR §§ 63.11223(b)(6)(ii)]

4.31. NESHAP Subpart JJJJJJ Initial Notification Requirement. The permittee shall submit an Initial Notification to EPA no later than January 20, 2014, and the notification shall provide the following information: [40 CFR §§ 63.9(b), 63.11225(a)(2), 63.11235 and Table 8 to NESHAP JJJJJJ of Part 63 ]

4.31.1. The name and address of the owner or operator; [40 CFR § 63.9(b)(2)(i)]

4.31.2. The address (i.e., physical location) of the affected source; [40 CFR § 63.9(b)(2)(ii)]

4.31.3. An identification of the relevant standard, or other requirement, that is the basis of the notification and the source's compliance date; [40 CFR § 63.9(b)(2)(iii)]

4.31.4. A brief description of the nature, size, design, and method of operation of the source and an identification of the types of emission points within the affected source subject to the relevant standard and types of hazardous air pollutants emitted; and [40 CFR § 63.9(b)(2)(iv)]

4.31.5. A statement of whether the affected source is a major source or an area source.
[40 CFR §§ 63.9(b)(2)(v)]

4.32. NESHAP Subpart JJJJJJ Notification of Compliance Status. The permittee shall submit a Notification of Compliance Status to EPA no later than July 19, 2014, and the notification shall be signed by the permittee's responsible official certifying its accuracy and attesting to whether the source has complied with NESHAP JJJJJJ. The notification shall provide the following information:
[40 CFR §§ 63.9(h)(1), 63.11214(b) and (c), and 63.11225(a)(4)]

4.32.1. The methods that were used to determine compliance; [40 CFR § 63.9(h)(2)(i)(A)]

4.32.2. The methods that will be used for determining continuing compliance, including a description of monitoring and reporting requirements and test methods; [40 CFR § 63.9(h)(2)(i)(C)]

4.32.3. A statement by the permittee as to whether boiler EU-1 has complied with NESHAP Subpart JJJJJJ or other requirements. [40 CFR § 63.9(h)(2)(i)(G)]

4.32.4. The statement, "This facility complies with the requirements in 40 CFR § 63.11214 to conduct an initial tune-up of boiler EU-1." [40 CFR § 63.11225(a)(4)(ii)]

4.32.5. The statement, "This facility has had an energy assessment performed according to § 63.11214(c)." [40 CFR § 63.11225(a)(4)(iii)]

4.32.6. The statement, "No secondary materials that are solid waste were combusted in boiler EU-1."
[40 CFR § 63.11225(a)(4)(v)]

4.33. NESHAP Subpart JJJJJJ Annual Compliance Certification Report. Each year, the permittee shall prepare by March 1 and submit to EPA by March 15 an Annual Compliance Certification Report for the previous calendar year. The report shall be signed by the permittee's responsible official and provide the following information: [40 CFR § 63.11225(b)]

4.33.1. Company name and address. [40 CFR §63.11225(b)(1)]

4.33.2. Statement by a responsible official, with the official's name, title, phone number, email address and signature, certifying the truth, accuracy and completeness of the notification and a statement of whether the source has complied with all the relevant standards and other requirements of NESHAP Subpart JJJJJJ. [40 CFR §63.11225(b)(2)]

4.33.3. The statement, "This facility complies with the requirements in 40 CFR § 63.11223 to conduct a biennial tune-up of boiler EU-1." [40 CFR §63.11225(b)(2)(i)]

4.33.4. The statement, "No secondary materials that are solid waste were combusted in boiler EU-1." [40 CFR §63.11225(b)(2)(i)(ii)]

4.33.5. A description of any deviations from the applicable requirements during the previous calendar year, the time periods during which the deviations occurred, and the corrective actions taken. [40 CFR § 63.11225(b)(3)]

4.34. NESHAP Subpart JJJJJJ Boiler EU-1 Notification of Combustion of Solid Waste. The permittee shall provide 30 days prior notice to EPA of the date upon which combusting of solid waste will commence or recommence in boiler EU-1. The notification shall identify the following: [40 CFR § 63.11225(f)]

4.34.1. The name of the owner or operator of boiler EU-1, the location of boiler EU-1, identification of boiler EU-1 as a boiler that will commence combusting solid waste, and the date of the notice. [40 CFR § 63.11225(f)(1)]

4.34.2. The currently applicable subcategory listed at 40 CFR § 63.11200. [40 CFR § 63.11225(f)(2)]

4.34.3. The date on which the permittee became subject to the currently applicable emission limits. [40 CFR § 63.11225(f)(3)]

4.34.4. The date upon which the permittee will commence combusting solid waste**.** [40 CFR § 63.11225(f)(4)]

4.35. NESHAP Subpart JJJJJJ Boiler EU-1 Notification of Fuel Switch, Physical Change or Permit Limit. The permittee shall provide notice to EPA if the permittee switched fuels or made a physical change to boiler EU-1 and the fuel switch or change resulted in (a) the applicability of a different subcategory of NESHAP JJJJJJ listed at 40 CFR § 63.11200, (b) boiler EU-1 becoming subject to NESHAP Subpart JJJJJJ, or (c) boiler EU-1 switching out of NESHAP Subpart JJJJJJ due to a change to 100 percent natural gas. Notice shall also be provided if EPA issues a permit limit to the permittee that results in the permittee being subject to NESHAP Subpart JJJJJJ. Notice shall be provided within 30 days of the change, and the notification shall identify the following: [40 CFR § 63.11225(g)]

4.35.1. The name of the owner or operator of boiler EU-1, the location of boiler EU-1, identification of boiler EU-1 as a boiler that has switched fuels, was physically changed, or took a permit limit, and the date of the notice. [40 CFR § 63.11225(g)(1)]

4.35.2. The date upon which the fuel switch, physical change, or permit limit occurred. [40 CFR § 63.11225(g)(2)]

**Monitoring for PSD Modifications to the Facility**

4.36. Where there is a reasonable possibility (as defined in 40 CFR § 52.21(r)(6)(vi)) that a project (other than projects at a source with a PAL) that is not a part of a major modification may result in a significant emissions increase of any regulated NSR pollutant and the permittee elects to use the method specified in 40 CFR § 52.21(b)(41)(ii)(a) through (c) for calculating projected actual emissions, the permittee shall perform the following.

4.36.1. Before beginning actual construction of the project, document and maintain a record of the following information.

4.36.1.1. A description of the project.

4.36.1.2. Identification of the emissions unit(s) whose emissions of a regulated NSR pollutant could be affected by the project.

4.36.1.3. A description of the applicability test used to determine that the project is not a major modification for any regulated NSR pollutant, including the baseline actual emissions, the projected actual emissions, the amount of emissions excluded under 40 CFR § 52.21(b)(41)(ii)(c) and an explanation for why such amount was excluded, and any netting calculations, if applicable.

4.36.2. Monitor the emission of any regulated NSR pollutant that could increase as a result of the project and that is emitted by any emissions unit identified in Condition 4.36.1.2; and calculate and maintain a record of the annual emissions, in tons per year on a calendar year basis, for a period of 5 years following resumption of regular operations after the change, or for a period of 10 years following resumption of regular operations after the change if the project increases the design capacity or potential to emit of that regulated NSR pollutant at such emissions unit.

[40 CFR § 52.21(r)(6)]

**Reporting for PSD Modifications to the Facility**

4.37. If monitoring and recordkeeping is required in Condition 4.36.2, the permittee shall report to EPA when the annual emissions, in tons per year, from the project identified in Condition 4.36.1.1 exceed the baseline actual emissions as documented and maintained pursuant to Condition 4.36.1.3 by a significant amount (as defined in 40 CFR § 52.21(b)(23)) for that regulated NSR pollutant , and when such emissions differ from the preconstruction projection as documented and maintained pursuant to Condition 4.36.1.3. Such report shall be submitted to EPA within 60 days after the end of such year. The report shall contain the following.

4.37.1. The name, address and telephone number of the major stationary source.

4.37.2. The annual emissions as calculated pursuant to Condition 4.36.2.

4.37.3. Any other information that the owner or operator wishes to include in the report (e.g., an explanation as to why the emissions differ from the preconstruction projection).

[40 CFR § 52.21(r)(6)]

# 5. Unit-Specific Requirements – EU-1 (Hog Fuel-Fired Boiler)

**EU-1 Emission Limits and Work Practice Requirements**

5.1. FARR Particulate Matter Limit. Particulate matter emissions from the boiler stack shall not exceed an average of 0.46 grams per dry standard cubic meter (0.2 grains per dry standard cubic foot), corrected to seven percent oxygen, during any three-hour period.

5.1.1. Compliance with the particulate matter limit is determined using EPA Reference Method 5 (see 40 CFR part 60, Appendix A). [40 CFR §§ 49.125(d)(2) and (e)]

5.2. FARR Sulfur Dioxide Emission Limit. Sulfur dioxide emissions from the boiler stack shall not exceed an average of 500 parts per million by volume, on a dry basis and corrected to seven percent oxygen, during any three-hour period.

5.2.1. Compliance with the $SO_2$ limit is determined using EPA Reference Methods 6, 6A, 6B, and 6C as specified in the applicability section of each method (see 40 CFR part 60, appendix A) or, alternatively, a continuous emission monitoring system that complies with Performance Specification 2 found in Appendix B of 40 CFR Part 60.

[40 CFR §§ 49.129(d)(1) and (e)]

5.3. At all times that the boiler operates, the boiler exhaust shall be directed to the multiclone and wet scrubber. [40 CFR §§ 49.124(d)(1), 49.125(d)(2) and 71.6(a)(1)]

5.4. The multiclone and wet scrubber shall be maintained in good operating condition and shall be operated at all times that the boiler is operational. [40 CFR §§ 49.124(d)(1), 49.125(d)(2) and 71.6(a)(1)]

**EU-1 Testing Requirements**

5.5. Particulate Matter Test. Between six and twelve months prior to expiration of this permit, the permittee shall measure particulate matter emissions from the boiler stack using the test method specified in Condition 5.1.1.

5.5.1. During each source test run, the permittee shall measure the visible emissions from the boiler stack for the duration of each particulate matter test run using the procedures specified in Condition 3.9.1.

5.5.2. During each source test run, the permittee shall record the values (and time recorded) of the parameters specified in Condition 5.9. For monitoring devices that do not have continuous recording devices, the recorded values must consist of no fewer than 3 values recorded per test run.

5.5.3. During each source test run, the permittee shall collect composite fuel samples. The permittee shall estimate and record the percentages of bark, species of wood and material less than 1/8 inch in each composite fuel sample. The permittee shall determine and record the boiler fuel-heat-input-to-steam-output ratio (mmBtu/mlbsteam) using the procedures specified in Appendix B to this permit. Prior to the first fuel analysis being conducted, the permittee shall use 1.7 mmBtu/Mlb steam to calculate the monthly heat input to the boiler for emission calculations.

[40 CFR § 71.6(a)(3)(i)(B)]

5.6. Periodic Particulate Matter Test. The permittee shall measure particulate matter emissions from the boiler stack using the procedures specified in Condition 5.5 as follows:

| **If testing required in Condition 5.5 results in measured particulate matter emissions …** | **Additional particulate matter testing shall be conducted …** |
|---|---|
| ≥ 90% of the emission limit in Condition 5.1 | Once per calendar year, between December 1 and March 31 |
| ≥ 75% but < 90% of the emission limit in Condition 5.1 | Once per two calendar years, between December 1 and March 31 |
| < 75% of the emission limit in Condition 5.1 | Once per four calendar years, between December 1 and March 31 |

[40 CFR § 71.6(a)(3)(i)(B)]

5.7. Carbon Monoxide and Nitrogen Oxides Test. Within 180 days after issuance of this permit, the permittee shall measure carbon monoxide and nitrogen oxides emissions from the boiler stack using the following test methods:

| **Pollutant** | **Test Method** |
|---|---|
| Carbon Monoxide | EPA Reference Method 10 (see 40 CFR part 60, Appendix A) |
| Nitrogen Oxides | EPA Reference Method 7, 7a, 7b or 7c (see 40 CFR part 60, Appendix A) |

5.7.1. During each source test run, the permittee shall record the values (and time recorded) of the parameters specified in Condition 5.9. For monitoring devices that do not have continuous recording devices, the recorded values must consist of no fewer than 3 values recorded per test run.

5.7.2. During each source test run, the permittee shall collect composite fuel samples. The permittee shall estimate and record the percentages of bark, species of wood and material less than 1/8 inch in each composite fuel sample. The permittee shall determine and record the boiler fuel-heat-input-to-steam-output ratio (mmBtu/mlbsteam) using the procedures specified in Appendix B to this permit.

[40 CFR § 71.6(a)(3)(i)(B)]

**EU-1 Monitoring and Recordkeeping Requirements**

5.8. Periodic Visible Emission Monitoring. The permittee shall measure visible emissions from the boiler stack within three months after this permit is issued for one hour using the procedures specified in Condition 3.9.1 and subsequently as specified in the following table.

| **If the most recent visible emission measurement results in measured opacity of …** | **Additional visible emissions measurements shall be conducted …** |
|---|---|
| One or more 6-minute average > 20% opacity | Once per day, until two consecutive daily measurements are ≤ 20% |
| One or more 6-minute average ≥ 10% opacity | Once per month, with consecutive tests at least 10 days apart, until three consecutive monthly measurements are < 10% |
| All 6-minute averages < 10% opacity | Once per calendar quarter, with consecutive tests at least 30 days apart |

[40 CFR §§ 71.6(a)(3)(i)(B) and (C), 71.6(a)(3)(ii), 71.6(c)(1), 64.6(c), 64.3(b)(4)]

5.9. The permittee shall install, calibrate, operate and maintain equipment necessary to measure and record:

5.9.1. Steam production (lb/hr) - continuous measurement/display, recorded at least once per hour with at least 90% monthly data capture;

5.9.2. Steam pressure (psig) - continuous measurement/display, recorded at least once per month;

5.9.3. Boiler excess oxygen downstream of the combustion chamber (%) - continuous measurement/display, recorded at least once per day with at least 90% monthly data capture;

5.9.4. Pressure drop across the multiclone (inches of water) - continuous measurement/display, recorded at least once per month;

5.9.5. Pressure drop across the scrubber (inches of water) – continuous measurement/display, recorded at least once per day with at least 90% monthly data capture; and

5.9.6. Water flow to the scrubber (gallons per minute) – continuous measurement/display, recorded at least once per day with at least 90% monthly data capture.

[40 CFR §§ 71.6(a)(3)(i)(B) and (C), 71.6(a)(3)(ii), 71.6(c)(1), 64.6(c), 64.3(b)(4)]

5.10. The permittee shall ensure that the monitoring equipment required by Conditions 5.8 and 5.9 meet the following performance, operational and maintenance criteria:

5.10.1. Measurement locations that provide for obtaining data that are representative of the emissions or parameters being monitored. [40 CFR 64.3(b)(1)]

5.10.2. Quality assurance and control practices, considering manufacturer recommendations, that are adequate to ensure the continuing validity of the data. [40 CFR 64.3(b)(3)]

5.10.3. Maintaining necessary parts for routine repairs of the monitoring equipment. [40 CFR § 64.7(b)]

5.10.4. Except for, as applicable, monitoring malfunctions, associated repairs, and required quality assurance or control activities (including, as applicable, calibration checks and required zero and span adjustments), continuous operation of the monitoring equipment (or collecting data at all required intervals) at all times that the pollutant-specific emissions unit is operating. Data recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities shall not be used for purposes of this part, including data averages and calculations, or fulfilling a minimum data availability requirement, if applicable. The owner or operator shall use all the data collected during all other periods in assessing the operation of the control device and associated control system. A monitoring malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring to provide valid data. Monitoring failures that are caused in part by poor maintenance or careless operation are not malfunctions. [40 CFR § 64.7(c)]

5.10.5. An excursion is defined as scrubber pressure drop less than 3.0 inches of water, scrubber water flow rate less than 30 gallons per minute or scrubber stack opacity greater than 10%. [40 CFR § 64.1 and 64.6(c)(2)]

5.10.6. An exceedance is defined as any measured emission of PM which exceeds an emission limit specified in Condition 3.9 or 5.1. [40 CFR § 64.1 and 64.6(c)(2)]

5.11. Upon detecting an excursion or exceedance, the permittee shall restore operation of the pollutant-specific emissions unit (including the control device and associated capture system) to its normal or usual manner of operation as expeditiously as practicable in accordance with good air pollution control practices for minimizing emissions. The response shall include minimizing the period of any startup, shutdown or malfunction and taking any necessary corrective actions to restore normal operation and prevent the likely recurrence of the cause of an excursion or exceedance (other than those caused by excused startup or shutdown conditions). Such actions may include initial inspection and evaluation, recording that operations returned to normal without operator action (such as through response by a computerized distribution control system), or any necessary follow-up actions to return operation to within the indicator range, designated condition, or below the applicable emission limitation or standard, as applicable. [40 CFR § 64.7(d)(1)]

5.12. The permittee shall develop and implement a quality improvement plan (QIP) in accordance with 40 CFR § 64.8 if EPA Region 10 determines, pursuant to 40 CFR § 64.7(d)(2), that the permittee has not used acceptable procedures in response to an excursion or exceedance. [40 CFR §§ 64.7(d)(2) and 64.8(a)]

5.13. If the permittee identifies a failure to achieve compliance with an emission limitation or standard for which the approved monitoring did not provide an indication of an excursion or exceedance while providing valid data, or the results of compliance or performance testing document a need to modify the existing indicator ranges or designated conditions, the permittee shall promptly notify the permitting authority and, if necessary, submit a proposed modification to the permit to address the necessary monitoring changes. Such a modification may include, but is not limited to, reestablishing indicator ranges or designated conditions, modifying the frequency of conducting monitoring and collecting data, or the monitoring of additional parameters. [40 CFR § 64.7(e)]

5.14. The recordkeeping requirements of Condition 3.35 shall apply to monitoring conducted to satisfy Conditions 5.8 through 5.13. The permittee shall maintain records of monitoring data, monitor performance data, corrective actions taken, any written quality improvement plan required pursuant to 40 CFR § 64.8 and any activities undertaken to implement a quality improvement plan, and other supporting information required to be maintained under this part (such as data used to document the adequacy of monitoring, or records of monitoring maintenance or corrective actions). Instead of paper

records, the permittee may maintain records on alternative media, such as microfilm, computer files, magnetic tape disks, or microfiche, provided that the use of such alternative media allows for expeditious inspection and review, and does not conflict with other applicable recordkeeping requirements. [40 CFR § 64.9(b)]

5.15. The permittee shall sample and analyze the wood fuel for chloride content no less frequently than quarterly to determine a hydrogen chloride emission factor (lb/MMBtu).

5.15.1. Sampling and analysis procedures to determine chloride content in the wood fuel shall follow the procedures specified in 40 CFR § 63.7521 as described in Appendix A to this permit. The results of the analyses shall be used to determine a hydrogen chloride emission factor (lb/MMBtu) for the boiler as specified in 40 CFR § 63.7521 as described in Appendix A to this permit.

[Permit No. R10NT501000 and 40 CFR § 71.6(c)(1)]

**EU-1 Reporting Requirements**

5.16. The reports required by Condition 3.47 and 3.48 shall include the following:

5.16.1. Summary information on the number, duration and cause (including unknown cause, if applicable) of excursions and exceedances, as applicable, and the corrective actions taken;

5.16.2. Summary information on the number, duration and cause (including unknown cause, if applicable) for monitor downtime incidents (other than downtime associated with zero and span or other daily calibration checks, if applicable); and

5.16.3. A description of the actions taken to implement a QIP during the reporting period as specified in § 64.8. Upon completion of a QIP, the owner or operator shall include in the next summary report documentation that the implementation of the plan has been completed and reduced the likelihood of similar levels of excursions or exceedances occurring.

[40 CFR § 64.9(a)(2)]

5.17. The report required by Condition 3.47 shall include copies of all laboratory results relied upon to calculate HCl emission factors and shall list the sampling and analytical methods employed.

[40 CFR §§ 71.6(a)(3)(i)(B) and (C), 71.6(a)(3)(ii) and 71.6(c)(1)]

# 6. Unit-Specific Requirements – EU-2 (Lumber Drying Kilns)

**EU-2 Emission Limits and Work Practice Requirements**

6.1. Particulate matter emissions from the stack(s) of this emission unit shall not exceed an average of 0.23 grams per dry standard cubic meter (0.1 grains per dry standard cubic foot) during any three-hour period.

6.1.1. Compliance with the particulate matter limit is determined using EPA Reference Method 5 (see 40 CFR part 60, Appendix A).

[40 CFR §§ 49.125(d)(3) and (e)]

**EU-2 Monitoring and Recordkeeping Requirements**

6.2. The permittee shall determine the monthly volume of lumber dried (bf/month) in the lumber kilns according to species of lumber and maximum drying temperature of each batch.

6.2.1. For each kiln charge, track the species and volume of lumber dried (bf) and the maximum dry bulb temperature (ºF) of heated air entering the lumber stack.

[40 CFR §§ 71.6(a)(3)(i)(B) and (C), 71.6(a)(3)(ii) and 71.6(c)(1)]

# 7. Unit-Specific Requirements – EU-3 (Sawmill)

**EU-3 Emission Limits and Work Practice Requirements**

7.1. Particulate matter emissions from the stack(s) of this emission unit shall not exceed an average of 0.23 grams per dry standard cubic meter (0.1 grains per dry standard cubic foot) during any three-hour period.

7.1.1. Compliance with the particulate matter limit is determined using EPA Reference Method 5 (see 40 CFR part 60, Appendix A).

[40 CFR §§ 49.125(d)(3) and (e)]

# 8. Unit-Specific Requirements – EU-4 (Planer Mill)

**EU-4 Emission Limits and Work Practice Requirements**

8.1. Particulate matter emissions from the stack(s) of this emission unit shall not exceed an average of 0.23 grams per dry standard cubic meter (0.1 grains per dry standard cubic foot) during any three-hour period.

8.1.1. Compliance with the particulate matter limit is determined using EPA Reference Method 5 (see 40 CFR part 60, Appendix A).

[40 CFR §§ 49.125(d)(3) and (e)]

# 9. Unit-Specific Requirements – EU-5 (Used Oil-Fired Heater)

**EU-5 Emission Limits and Work Practice Requirements**

9.1. Particulate matter emissions from the stack of this emission unit shall not exceed an average of 0.23 grams per dry standard cubic meter (0.1 grains per dry standard cubic foot), corrected to seven percent oxygen, during any three-hour period.

9.1.1. Compliance with the particulate matter limit is determined using EPA Reference Method 5 (see 40 CFR part 60, appendix A).

[40 CFR §§ 49.125(d)(1) and (e)]

9.2. Sulfur dioxide emissions from the stack of this emission unit shall not exceed an average of 500 parts per million by volume, on a dry basis and corrected to seven percent oxygen, during any three-hour period.

9.2.1. Compliance with the $SO_2$ limit is determined using EPA Reference Methods 6, 6A, 6B, and 6C as specified in the applicability section of each method (see 40 CFR part 60, appendix A) or, alternatively, a continuous emission monitoring system that complies with Performance Specification 2 found in Appendix B of 40 CFR Part 60.

[40 CFR §§ 49.129(d)(1) and (e)]

**EU-5 Monitoring and Recordkeeping Requirements**

9.3. The first time each calendar year that the used oil-fired heater is operated for 4 or more consecutive daylight hours, the permittee shall conduct a visible emissions observation of the heater stack, for one hour, using the procedures specified in Condition 3.9.1.

9.4. The permittee shall record the number of hours that the heater operates.

[40 CFR § 71.6(a)(3)(i)(B)]

# Appendix A: HCl Emission Factor Procedure for Hogged Fuel

**Last Revised December 2013**

1. Sample Fuel
   - Take 3 composite samples (composed of three approximately 2-pound individual samples) using 40 CFR 63.7521(c); all samples shall be collected at a location that most accurately represents the fuel being burned; if not sampling during a stack test, individual belt or screw feeder samples, described in 40 CFR 63.7521(c)(1)(ii), shall be separated by a 30 minute period

2. Homogenize Sample
   - Subdivide and homogenize each composite sample using 40 CFR 63.7521(d) until sample passes 0.5 mm screen; approximately 50 grams of sample are needed for each moisture analysis, 1 gram of sample is needed for each oxygen bomb, and 2 grams of sample are needed for ash analysis

3. Determine Moisture Content
   - Determine moisture content (%, wet basis) of three composite samples using ASTM E871-82R06; time analysis such that samples used for moisture analysis represents moisture content of samples introduced to oxygen bomb; do not average the three sample results

4. Prepare Sample for Heat Content and Chlorine Content Analysis
   - Prepare three composite samples using SW-846-5050; this sample preparation can be performed simultaneously with heat content analysis (ASTM E711); alternatively, ASTM E776-87R04 can be used in place of both SW-846-5050 and SW-846-9056/9056A; do not combine composite samples before or after sample preparation

5. Determine Heat Content (aka Gross Calorific Value or High Heat Value)
   - Determine gross calorific value (Btu/lb, wet basis) of three composite samples using ASTM E711-87R04; do not average the three sample results
   - Convert GCV results to be on a dry basis:
     (GCV, wet basis) / (1 - %moisture) = (GCV, dry basis)

6. Determine Chlorine Content
   - Analyze bomb combustate for each composite sample for Cl (mg/L, wet basis) using SW-846-9056 or SW-846-9056A (alternatively, use ASTM E776-87R04 in place of SW-846-5050 and SW-846-9056/9056A)
   - Convert Cl mg/L (wet basis) to Cl ug/g (wet basis) using SW-846-5050 (eq. 1)

7. Determine Average HCl Emission Factor
   - Convert Cl (ug/g, wet basis) to HCl (lb/mmBtu, dry basis) for each composite sample:
     (Cl ug/g, wet basis) / (1 -%moisture) x (36.5 g HCl / 35.5 g Cl) / ($1x10^6$ ug/g) / (GCV Btu/lb, dry basis) x ($1x10^6$ Btu/mmBtu) = (HCl lb/mmBtu)
   - Determine HCl emission factor (HCl lb/mmBtu) by averaging the HCl results from the three composite samples.

8. Adjust for Controls and Other Documented Increases and Decreases to the Emission Factor
   - Apply reductions to the emission factor such as documented control efficiency or limited HCl conversion of fuel chlorine in the boiler.

# Appendix B: Boiler Fuel-Heat-Input-To-Steam-Output Ratio

**Last Revised September 2013**

1. During each emission test run:
   - Measure average stack gas flow (dscfm) using Reference Method 2
   - Measure average steam flow rate (mlbsteam/hr) using boiler monitoring equipment

2. Sample Fuel
   - Take 3 composite samples (composed of three approximately 2-pound individual samples) using 63.7521(c); all samples shall be collected at a location that most accurately represents the fuel being burned; if not sampling during a stack test, individual belt or screw feeder samples, described in 63.7521(c)(1)(ii), shall be separated by a 30 minute period

3. Homogenize Fuel Sample
   - Subdivide and homogenize each composite sample using 63.7521(d) until sample passes 0.5 mm screen

4. Determine Fuel Moisture
   - Determine moisture content (%, wet basis) of three composite samples using ASTM E871-82R06; time analysis such that samples used for moisture analysis represents moisture content of samples introduced to oxygen bomb; do not average the three sample results
   - For converting heat content or ultimate analysis % to dry basis, use the following:
     - (value, wet basis) / (1 - %moisture) = (value, dry basis)

5. Determine Fuel Heat Content (aka Gross Calorific Value or High Heat Value)
   - Determine gross calorific value (Btu/lb, wet basis) for each composite sample using ASTM E711-87R04; do not average the three sample results; convert GCV results to be on dry basis

6. Perform Ultimate Analysis (for each composite sample)
   - Determine ash content (%, dry basis) using ASTM D1102-84R07
   - Determine C (%, wet basis) using ASTM E777-87R04; convert to dry basis
   - Determine H (%, wet basis) using ASTME777-87R04; convert to dry basis
   - Determine N (%, wet basis) using ASTM E778-87R04; convert to dry basis
   - Determine S (%, wet basis) using ASTM E775-87R04; convert to dry basis
   - Calculate O (%, dry basis) using ash, C, H, N and S results (%, dry basis) and ASTM E870-82R06

7. Calculate Hogged Fuel F-Factor (for each composite sample)
   - Calculate F-factor (dscf/mmBtu) using results from ultimate analysis (dry basis) and GCV (dry basis) using equation 19-13 in 40 CFR 60 App A, RM19

8. Calculate Conversion Factor
   - Determine fuel heat input rate (mmBtu/hr) using average stack flow rate and percent oxygen (dry) for each run and F-factor for each composite sample:
     (dscf/min) ((20.9 - $\%O_2$)/20.9) x (60 min/hr) / (dscf/mmBtu) = (mmBtu/hr)
   - Determine input/output ratios (mmBtu/mlbsteam) by dividing the fuel heat input rate (mmBtu/hr) for each composite by the steam flow rate (mlbsteam/hr) for each run
   - Average the input/output ratio (mmBtu/mlbsteam) for the three samples/runs

United States Environmental Protection Agency
Region 10, Office of Air, Waste and Toxics
AWT-150
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

Permit Number: R10T5020101
Issued: 5/13/2015
Effective: 5/13/2015
Expiration: 8/13/2019
Replaces: R10T5020100
AFS Plant I.D. Number: 16-009-00018

# Statement of Basis

## Title V Air Quality Operating Permit
## Permit Renewal #1, Administrative Amendment

Permit Writer: Doug Hardesty

## Stimson Lumber Company

(formerly Plummer Forest Products, Inc.)
Coeur d'Alene Reservation
Plummer, Idaho

### Purpose of Permit and Statement of Basis

Title 40 Code of Federal Regulations Part 71 establishes a comprehensive air quality operating permit program under the authority of Title V of the 1990 amendments to the federal Clean Air Act. The air quality operating permit is an enforceable compilation of all of the applicable air pollution requirements that apply to an existing affected air emissions source. The permit is developed via a public process, may contain additional new requirements to improve monitoring of existing requirements, and contains procedural and prohibitory requirements related to the permit program itself. The permit is valid for 5 years and may be renewed.

This document, the statement of basis, summarizes the legal and factual basis for the permit conditions in the air quality operating permit to be issued to Stimson Lumber Company (referred to herein as Stimson, facility, source, or permittee). Unlike the air quality operating permit, this document is not legally enforceable. This statement of basis summarizes the emitting processes at the facility, air emissions, permitting and compliance history, the statutory or regulatory provisions that relate to the subject facility, and the steps taken to provide opportunities for public review of the permit. The permittee is obligated to follow the terms of the permit. Any errors or omissions in the summaries provided here do not excuse the permittee from the requirements of the permit.

The permit was administratively amended to change the name of the responsible official on May 13, 2015.

# Table of Contents

# 1. EPA Authority to Issue Title V Permits

On July 1, 1996, EPA adopted regulations (see 61 Federal Register (FR) 34202) codified at 40 Code of Federal Regulations (CFR) Part 71 setting forth the procedures and terms under which the Agency would administer a federal operating permit program. These regulations were updated on February 19, 1999 (64 FR 8247) to incorporate EPA's approach for issuing federal operating permits to affected stationary sources in Indian Country.

As described in 40 CFR 71.4(a), EPA will implement a Part 71 program in areas where a state, local, or Tribal agency has not developed an approved Part 70 program. Unlike states, Indian Tribes are not required to develop operating permit programs, though EPA encourages Tribes to do so. See, for example, Indian Tribes: Air Quality Planning and Management (63 FR 7253, February 12, 1998) (also known as the "Tribal Authority Rule"). Therefore, within Indian Country, EPA will administer and enforce a Part 71 federal operating permit program for stationary sources until the governing Indian Tribe receives EPA's approval to administer its own operating permit program.

# 2. Facility Information

## 2.1 Location

The Stimson facility is located south of Plummer, Idaho, and west of Highway 95. The facility is within the boundaries of Benewah County and the Coeur d'Alene Indian Reservation and is in Indian Country as defined in 40 CFR Part 71.

## 2.2 Coeur d'Alene Reservation

The Coeur d'Alene Reservation was established by Executive Order in 1873. By a series of treaty agreements, the reservation was reduced to its present size of approximately 345,000 acres. The reservation is considered to be Indian Country, as defined in 40 CFR Part 71. The Tribe is organized under a Constitution approved by the Bureau of Indian Affairs. The Constitution provides for a seven-member tribal council to serve as the governing body of the Tribe.

Tribal Contact: Les Higgins
Air Quality Manager
Coeur d'Alene Tribe
P.O. Box 408, 109 Lolo Street
Plummer, Idaho 83851-0408
Phone: (208) 686-8101; Fax: (208) 686-8302
Email: lhiggins@scdtribe-nsn.gov

## 2.3 Facility Description

The facility is owned by the Tribe, but is operated by Stimson Lumber Company under a leasing arrangement.

The primary operation at the facility is the production of dimensional lumber from raw logs. The Stimson facility has debarkers and saws, kilns for drying lumber, a planer, a wood chipper, a bark hog, various storage bins and a hog fuel-fired boiler (to supply steam to the kilns). The site includes a log yard, shops, offices, and open and covered storage areas. There are no chemical wood preservative or gluing operations. Logs are received and stored in the log yard. The process of cutting the logs into lumber includes debarking, sawing, chipping, kiln drying, planing, and packaging for shipping.

The byproducts of lumber manufacturing are sawdust, wood chips, planer shavings, and hog fuel. These byproducts may be burned in the hog fuel (wood-waste) boilers or stored in bins until the material is sold and transferred off-site. The hog fuel boiler is used to provide steam to generate electricity and for the

drying of rough green lumber in the drying kilns. Prior to steam use in the kilns, the steam is used to produce electricity in a steam turbine-powered 5-megawatt capacity generator. The electricity produced is primarily used on-site, but is also sold to the regional power grid.

SIC Code(s): 2421 Sawmills and Planing Mills, General (primary)

4911 Electric Services, Electric Power Generation

Note that while two SIC codes are listed, the sawmill and planing mill SIC code of 2421 is considered the primary code. Since most of the electrical power generated (SIC code 4911) onsite is used for powering the facility, these activities are considered to be support activities to the sawmill.

The air pollution emission units and control devices that exist at the facility are listed in Table 1 below by emission unit identification number (EU ID #). None of the emission units vent through a stack shared with another emission unit. Installation dates for each emission unit are listed because they are important in determining applicability of federal PSD, NSPS and MACT standards (see further discussion in Section 4). Capacities are listed for several emission units based on the best information available from the applicant. The capacity of the kilns is based on applicant statements that the kilns together can produce 109.2 mmbf/yr. The control devices that are required by rule or this permit are so noted.

**Table 1 - Emission Units (EU) & Control Devices**

| EU # | Emission Unit Description | Control Device[1] |
|---|---|---|
| EU-1 | Hog Fuel-Fired Boiler: Riley R-X-1, Serial No. 2771, (including ash handling fugitives); 70,000 lb/hr steam output capacity, 105 MMBtu/hr heat input capacity; manufactured 1951, installed in 1983 | Joy multiclone, Yanke wet scrubber |
| EU-2 | Lumber Drying Kilns: Indirectly heated; field-erected, annual capacity = 109,200 Mbdft | None |
| EU-3 | Sawmill: Includes log bucking and debarking, hog, bark conveying, log sawing, sawdust conveying, chipper, chip conveying and loading, unloading and storage of materials in sawdust and chip truck bins; annual capacity = 109,200 Mbdft of logs, or 393,000 dry tons of logs | Some activities are inside building |
| EU-4 | Planer Mill; includes planer shavings cyclone and the planer chipper cyclone; annual capacity 109,200 Mbdft/year | Some activities are inside building |
| EU-5 | Used Oil-Fired Heater: Clean Burn 4000, 280,000 Btu/hr. | None |
| EU-6 | Piles and handling; bark fuel pile, sawdust pile, shavings pile; drop onto pile, wind erosion of piles | None |
| EU-7 | Tanks: diesel (8000 gallon) and gasoline (200 gallon) fuel tanks, horizontal | Under cover |
| EU-8 | Plant Traffic: in log yard, on paved areas and in green lumber stacking area; involves front-end loaders and trucks | Work practices |

[1] The multiclone and scrubber are required to be used by this permit

An emission unit or activity qualifies as an insignificant emission unit (IEU) if it is an activity type listed in 40 CFR 71.5(c)(11)(i) or emits less than 2 tons per year of any regulated air pollutant excluding HAPs [40 CFR 71.5(c)(11)(ii)(A)] and less than 1000 pounds per year of any HAP or the de minimus HAP level established under Section 112(g), whichever is lower [40 CFR 71.5(c)(11)(ii)(B)]. There are no emission units being treated as IEUs in the Title V permit.

## 2.4 Local Air Quality and Attainment Status

Northern Idaho, including the Coeur d'Alene Indian Reservation, either attains the national ambient air quality standards for all criteria pollutants or is unclassifiable. An area is unclassifiable when there is insufficient monitoring data. The only monitoring data for the Coeur d'Alene Reservation is based on PM10 and PM2.5 monitors which are operated nearby, in Plummer, just NE of the facility. Data from these monitors indicates both daily and annual averages below the standards for particulate.

## 2.5 Permitting, Construction and Compliance History

The subject facility was built in the 1960's as a planer mill only. The sawmill was added in the 1970's. In October 1983, the Riley boiler and electrical generator were added. The sawmill was operated by Pacific Crown and the co-generation plant (i.e. boiler and electrical generator) were operated by Wood Power.

In August 1982, Wood Power had applied to the Idaho Department of Health and Welfare (IDHW) for a Permit to Construct (Idaho Department of Environmental Quality (IDEQ) was previously a Division of IDHW). On September 29, 1982, Wood Power received a two-page Permit to Construct.

In 1995, the Pacific Crown facility was sold to ITT Rayonier. On August 16, 1996, Rayonier submitted a Permit to Construct application to IDHW to replace three direct contact kilns with three non-contact lumber drying kilns. This would allow the facility to dry all of their lumber instead of selling green lumber. IDHW issued the facility a Director's Exemption instead of a Permit to Construct.

It is EPA's position that unless EPA has explicitly approved a program as applying in Indian Country, State or local regulations are not effective within the boundaries of that Indian Country land for purposes of complying with the Clean Air Act. See Federal Operating Permits Program Final Rule, 64 FR 8247, 8254 (February 19, 1999). This would include permits issued under State or local regulations. EPA therefore does not consider any permits issued by Idaho to Stimson or its predecessors to be federally enforceable or to establish applicable requirements for purposes of the Clean Air Act. There are no existing PSD permits issued to Stimson.

In 1997, the co-generation plant was also sold to ITT Rayonier. The sawmill burned down in 1998, but the planer mill continued to operate. On September 21, 1999, the entire facility was sold to the Coeur d'Alene Tribe, and in May 2000, Plummer Forest Products leased the facility from the Tribe. After rebuilding the sawmill with mostly new equipment, the sawmill started up in June 2001. The co-generation equipment was started up in September 2001. For about four months (June through September 2001), temporary power generators were used to supply power to the sawmill. The temporary power generators were removed in October 2001. An oil-fired package boiler (originally built in 1973) was installed in April 2002, but rarely operated before being removed.

The initial Title V permit for this plant was issued to Plummer Forest Products on May 17, 2006. The plant was leased to Stimson Lumber Company on May 31, 2006. The permit and statement of basis were administratively amended to address the change in permittee. The company name, responsible official, contact information and introductory paragraphs on the front page of the permit and statement of basis were revised. Issuance dates were also changed, as well as the footers on the permit, statement of basis and appendices to the statement of basis. No other changes were made.

In 2007, Stimson applied for and was issued a non-Title V permit that established limits on hazardous air pollutants such that the company could be treated as a minor source for hazardous air pollutant purposes. Compliance with these limits allows Stimson to avoid two MACT standards that only apply to major sources of hazardous air pollutants. The requirements in the non-Title V permit are considered applicable requirements and have been included in this Title V permit.

In July 2009, Stimson notified EPA that they planned on replacing the scrubber on the boiler with an identical unit. After realizing that the new scrubber operated differently than the former scrubber, in early 2010, Stimson applied for a significant modification of their permit to revise the scrubber parameter range

required in the permit. Stimson was having trouble operating the new scrubber within the required scrubber parameter range in the original permit. Stimson has been working on the issue since then, trying to decide what an appropriate range should be and whether there are operational issues with the scrubber.

Even though EPA sent Stimson a reminder letter, Stimson's application to renew their Title V permit missed the December 16, 2010, deadline. In June 2011, Stimson and EPA signed an Administrative Order on Consent which addressed the late application and adjusted the scrubber parameters ranges in the permit. Also in June 2011, EPA agreed to a Consent Agreement and Final Order addressing the late application.

Stimson has continued to struggle to meet the scrubber parameter ranges. Additional source testing was performed in the fall of 2012. Stimson submitted a new CAM plan to set new scrubber parameter ranges on March 11, 2013. Those new ranges are incorporated into the new Title V permit.

EPA inspected the facility on various occasions during the prior permit term. There are no other current compliance actions.

A chronological summary of permit activities for Stimson follows:

| | |
|---|---|
| May 17, 2006 | EPA issues Stimson's initial Title V permit. |
| November 9, 2006 | EPA administratively amends the permit to name Stimson the permittee. |
| September 28, 2007 | EPA issues Stimson's Non-Title V permit with HAP limits. |
| February 24, 2010 | Stimson submits an application for a significant modification to their permit to revise the scrubber parameters ranges. |
| December 16, 2010 | Stimson's renewal application was due to EPA. |
| January 1, 2011 | EPA receives Stimson's renewal Title V permit application. |
| June 16, 2011 | Stimson's initial Title V permit expired. |
| December 5, 2011 | Stimson submitted an off-permit notice that they were adding a new saw line (a fencing product) to the sawmill. |
| Thru June, 2013 | Additional information is submitted as requested. |
| August 1, 2013 | Pre-draft permit is sent to Stimson and Coeur d'Alene Tribe for initial review. |
| August 20, 2013 | Beginning of public comment period for draft permit. |
| September 20, 2013 | End of public comment period for draft permit. |
| August 13, 2014 | Final renewal permit issued. |
| May 13, 2015 | Administrative amendment issued to change responsible official. |

# 3. Emission Inventory

## 3.1 Emission Inventory Basics

An emission inventory generally reflects either the "actual" or "potential" emissions from a source. Actual emissions generally represent a specific period of time and are based on actual operation and controls. Potential emissions, referred to as potential to emit (PTE), generally represent the maximum capacity of a source to emit a pollutant under its physical and operational design, taking into

consideration regulatory restrictions, but only required control devices. PTE is often used to determine applicability to several EPA programs, including Title V, PSD and Section 112 (MACT).

Emissions can be broken into two categories: point and fugitive. Fugitive emissions are those which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening. Examples of fugitive emissions are roads, piles that are not normally enclosed, wind blown dust from open areas, and those activities that are normally performed outside buildings. Point sources of emissions include any emissions that are not fugitive.

The equation below represents the general technique for estimating emissions (in tons per year) from each emission unit at the facility. Emissions are calculated by multiplying an emission factor by an operational parameter. To estimate actual emission, the permittee will need to track the actual operational rates. Note that emission factors may be improved over time. For those estimation techniques that require substantial site-specific parameter tracking, such as piles and roads, emissions associated with a defined operational rate can be estimated to establish a set ratio that can be used to multiply by the actual operational rate in future years, significantly simplifying the annual inventory effort. All of the techniques and site-specific parameters and assumptions should be reviewed each year before estimating emissions to be sure they remain appropriate.

$$E = EF \times OP \times K$$

Where:

E = pollutant emissions in tons/year
EF = emission factor (see Appendix A)
OP = operational rate (or capacity for PTE)
K = 1 ton/2000 lbs for conversion from pounds per year to tons per year

## 3.2 Potential to Emit (PTE)

EPA reviewed and revised Stimson's emission inventory (for PTE) and has documented the facility PTE in Appendix A. Where appropriate, EPA revised the emission estimates using the latest emission factors to more accurately reflect the emissions from the facility. A summary of Stimson's PTE is presented in Table 2. Note that while fugitive emissions are included in Table 2, fugitive emissions are not always used to determine program applicability as explained in more detail in Section 4.1 of this statement of basis.

The PTE estimates for the facility generally assume all units operate 8760 hours per year. Potential particulate matter emissions consider the multiclone and scrubber as required control devices because it is assumed that the control devices are necessary for the boilers to comply with the particulate matter and opacity limits. The permit assures this assumption by requiring that the boiler be vented to the control devices at all times.

Emission factors for the boilers are based on heat input (fuel) to the boiler. Because steam production records are used to calculate boiler heat input (firing rate) for the purpose of the emission inventory, the conversion factor applied to convert steam production to heat input must be based on the latest site specific boiler testing/sampling data or a default efficiency factor that is acceptable to EPA. Appendix A to the permit explains the procedures for developing a boiler input-to-output ratio.

**Table 2 - Facility Potential to Emit[1]**

| | PTE in tons per year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Pollutant[2]** | **EU-1** | **EU-2** | **EU-3** | **EU-4** | **EU-5** | **EU-6** | **EU-7** | **EU-8** | **Facility Total** |
| CO | 184 | | | | <1 | | | | 184 |
| Pb | <1 | | | | <1 | | | | <1 |
| NOx | 189 | | | | <1 | | | | 189 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PM | 161 | 3 | 26 | 10 | <1 | <1 | | 196 | 395 |
| PM10 | 169 | 3 | 15 | 7 | <1 | <1 | | 56 | 249 |
| PM2.5 | 169 | 3 | 8 | 4 | <1 | <1 | | 28 | 211 |
| SO2 | 32 | | | | 3 | | | | 34 |
| VOC | 10.6 | 93 | | | <1 | | <1 | | 103 |
| GHG[3] | 97,187 | | | | 200 | | | | 97,388 |
| Plant-wide Total HAP[4] | | | | | | | | | 24 |
| Plant-wide Single HAP[4] | | | | | | | | | 9 |

[1] Fugitive emissions are included in this table but may not always be used in applicability determinations (see Section 4.1)

[2] CO = carbon monoxide; Pb = lead; NOx = oxides of nitrogen; PM = particulate matter; PM10 = particulate matter with diameter 10 microns or less; PM2.5 = particulate matter with diameter 2.5 microns or less; SO2 = sulfur dioxide; VOC = volatile organic compounds; HAP = hazardous air pollutants [see Clean Air Act, Section 112(b)]; GHG = greenhouse gases; plant-wide total HAP = all HAPs totaled; plant-wide single HAP = highest individual HAP

[3] The DC Circuit Court of Appeals on July 12, 2013 vacated EPA regulations that delayed until July 21, 2014 consideration of $CO_2$ emissions resulting from biomass combustion in determining PSD and Title V applicability pursuant to 40 CFR 52.21(b)(49)(ii)(a) and 40 CFR 71.2 definition of "subject to regulation." See explanation for exemption provided by EPA at 76 FR 43490. See DC Circuit Court of Appeals July 12, 2013 ruling vacating the exemption at http://www.cadc.uscourts.gov/internet/opinions.nsf/F523FF1F29C06ECA85257BA6005397B5/$file/11-1101-1446222.pdf

[4] HAP PTE is capped by plant-wide emission limits created in a Non-Title V permit

Stimson is expected to use the emission factors and calculation methods presented in Appendix A unless Stimson demonstrates that a more appropriate emission factor or calculation method should be used (e.g., results of more recent source testing or sampling, revised emission factors published in AP-42 or etc.). It is important to emphasize that to the extent Stimson relies on any type of emission control technique to estimate emissions used to determine annual fees, or the applicability of a regulatory program, use of the technique must be fully documented and verifiable.

# 4. Regulatory Analysis and Permit Content

EPA is required by 40 CFR Part 71 to include in this Title V permit all emission limitations and standards that apply to the facility, including operational, monitoring, testing, recordkeeping and reporting requirements necessary to assure compliance. This section explains which air quality regulations apply to this facility and how those requirements are addressed in the permit.

Located within Indian Country, the facility is subject to federal air quality regulations, but is not subject to state air quality regulations. EPA does not consider any permits issued by Idaho for this facility to be applicable requirements. The facility could be subject to tribal air quality regulations; however, the Coeur d'Alene Tribe has not gone through the process of obtaining authorization to be treated in the same manner as states under 40 CFR §§ 49.6 and 49.7 (Tribal Authority Rule) and obtaining approval of air quality regulations as a "Tribal Implementation Plan." Therefore, Tribal air quality regulations, if any, are not federally enforceable and do not meet the definition of "applicable requirement" under 40 CFR Part 71. As such, there are no Tribal air quality regulations in this Title V permit.

EPA relied on information provided in the permittee's Title V permit application and on supplementary information provided by the permittee to determine the requirements that are applicable to the planer mill. Future modifications to the mill could result in additional requirements applying.

## 4.1 Federal Air Quality Requirements

Title V Operating Permit Program - Title V of the Clean Air Act and the implementing regulation found in 40 CFR part 71 require major sources (as well as a selection of non-major sources) of air pollution to obtain operating permits and form the legal bases for this permit. A source is major if it has the potential to emit 100 tons per year or more of any Title V pollutant, 25 tons per year or more of hazardous air pollutants (totaled) or 10 tons per year or more of any single hazardous air pollutant (see 40 CFR 71.2). This facility is a major source subject to Title V because it has the potential to emit more than 100 tons

per year of CO, NOx, PM10, PM2.5, SO2 and VOC not counting fugitive emissions (see Table 2 and Appendix A). While PM emissions also exceed 100 tons per year, EPA does not consider PM a regulated pollutant for Title V applicability purposes.

The Title V operating permit serves as a comprehensive compilation of the air quality requirements that are applicable to a source. The permit also must assure compliance, so source-specific testing, monitoring, recordkeeping and reporting have been added where EPA believes it is necessary, as explained in Section 4.3 (Permit Conditions) of this Statement of Basis below.

Compliance Assurance Monitoring (CAM) - CAM applies to emission units that are subject to an emission limit with a pre-control potential to emit emissions equal to or greater than the major source threshold defined in Title V (generally, 100 tons per year) and that use a control device to comply with the limit (see 40 CFR Part 64). All units that meet the CAM applicability criteria must be in compliance with CAM at permit renewal and may also be required to submit a CAM plan if a significant change is made to the unit prior to renewal. The multiclone and scrubber that control particulate matter emissions from the boilers are the only control devices at the planer mill. Based on the emission inventory in Appendix A, pre-control PM emissions from each boiler are greater than 100 tons per year; therefore, the boiler controls are subject to CAM. Post control potential to emit PM, PM10 and PM2.5 are greater than 100 tpy, so the boiler is considered a large pollutant-specific emission unit. In the previous Title V permit, the emission inventory indicated that the source was not a large PSEU, so CAM was not addressed then.

Prevention of Significant Deterioration (PSD) - Under the PSD pre-construction permitting program found in Part C of the Clean Air Act and 40 CFR 52.21, no “major stationary source” or “major modification” to a major stationary source can begin actual construction without first obtaining a PSD permit. The PSD program has been changed over the years, but in general, a major stationary source for purposes of the PSD program is a source with a PTE of more than 250 tons per year of any PSD pollutant. A modification is major if it results in emission increases that equal or exceed the defined significance levels. Historical reviews of potential PSD projects are difficult due to the lack of specific details about the sources, their emissions and the various applicability requirements in previous PSD programs.

Based on the information available today, EPA is not aware of any modifications that would have been subject to PSD. EPA is not aware of any other modifications to the facility and does not draw any conclusions regarding compliance with past permitting requirements for this facility. Therefore, no permit shield is implied or explicit for past new source review or PSD requirements.

New Source Performance Standards (NSPS) - Four NSPS subparts may apply to boilers (steam generating units) and heaters: 40 CFR 60, Subparts D (Fossil-Fuel-Fired Steam Generators), Da (Electric Utility Steam Generating Units), Db (Industrial-Commercial-Institutional Steam Generating Units) and Dc (Small Industrial-Commercial-Institutional Steam Generating Units). Subparts D and Da do not apply because the boiler’s heat input capacity is only 105 mmBtu/hr, much less than the applicability thresholds of 250 mmBtu/hr for D and Da. Subpart Db and Dc do not apply because the boiler was manufactured in 1953, well before the 1984 and 1989 applicability dates, respectively, and there is no information that indicates that the boilers were modified or reconstructed after the applicability dates. None of the subparts apply to the heater because it is much smaller (less than 1 mmBtu/hr heat input capacity) than the size thresholds for the requirements.

There is an above-ground 8,000 gallon (30.3 cubic meter) diesel storage tank and a 200 gallon gasoline tank used to fuel vehicles at the facility. Three NSPS subparts may apply to the fuel storage tanks: 40 CFR 60, Subparts K (Storage Vessels “Commenced” from 6/12/73 to 5/18/78), Ka (Storage Vessels “Commenced” from 5/19/78 to 7/22/84) and Kb (Storage Vessels “Commenced” after 7/23/84). While it is not clear when the fuel tanks were installed, reconstructed or modified, Subparts K and Ka only apply to tanks larger than 40,000 gallons and Subpart Kb only applies to tanks larger than 75 cubic meters (20,000 gallons), so the tanks are not subject to NSPS.

Subpart A of 40 CFR Part 60 applies only if a source category-specific subpart applies. There are no other NSPS subparts that apply to the type of emissions units at the facility.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - Three NESHAP (MACT) Subparts may apply to the facility: 40 CFR 63, Subpart DDDD (Plywood and Composite Wood Products), DDDDD (Industrial, Commercial, and Institutional Boilers and Process Heaters) and JJJJJJ (Industrial, Commercial, and Institutional Boilers for Area Sources). Lumber kilns are included in Subpart DDDD source category and hog fuel-fired boilers are included in Subparts DDDDD and JJJJJJ. Subparts DDDD and DDDDD only apply to sources that were major for HAP on the first compliance date of the MACT. The compliance date for Subpart DDDD is October 1, 2007, and for Subpart DDDDD is January 31, 2016. Stimson applied for a Non-Title V operating permit to limit plant-wide HAP emissions below the major source thresholds of 10 and 25 tons per year. EPA issued the Non-Title V permit September 27, 2007, so the facility is no longer considered a major source of HAP (based on PTE). The facility, therefore, is not subject to Subparts DDDD or DDDDD. As an area source with a wood waste-fired boiler, the facility is subject to Subpart JJJJJJ; that subpart is included in this permit. There are no other NESHAP subparts that apply to the types of emission units at the facility.

Section 111(d) and Section 129 Regulations - There are no CAA, Section 111(d) or 129 regulations that apply to the type of emission units at the facility. Hog fuel (wood waste) combustion in the boilers is not considered solid waste or municipal waste combustion or incineration.

Federal Air Rules for Reservations (FARR) - On April 8, 2005, EPA promulgated a Federal Implementation Plan (FIP) for Reservations in Idaho, Oregon and Washington. This FIP is commonly referred to as the FARR. EPA published the FARR rules that generally apply to Indian Reservations in EPA Region 10 in 40 CFR 49.121 to 49.139. The FARR rules that specifically apply on the Coeur d'Alene Reservation are codified at 40 CFR 49.9921 to 49.9950. Those FARR requirements that apply to the permittee and have been included in the permit are discussed in Section 4.3 of this document, including the requirements created in a Non-Title V permit issued per 40 CFR 49.139. Several requirements of the FARR that are in effect on the Coeur d'Alene Reservation do not apply to the facility. Table 3 lists the FARR requirements that do not apply to the permittee and explains why.

**Table 3 – Inapplicable FARR Requirements**

| Citation | Description | Reason Inapplicable |
|---|---|---|
| 49.125(d)(1) | Limits particulate matter emissions from combustors except wood-fired boilers and exempts furnaces used exclusively for space heating with a rated heat input capacity of less than 400,000 Btu/hr. | The wood-fired boiler is excepted because it burns only wood. The heater is exempted because it is smaller than 400,000 Btu/hr. |
| 49.127 | Rules that apply to wood waste burners (wigwam burners). | No wigwam burners exist. |
| 49.128 | Rules that apply to wood veneer, plywood, particleboard and hardboard manufacturing. | None of these products are produced at the facility. |
| 49.129(d)(2) | Limits SO2 from "process source stacks." | None of the "processes" at the facility emit SO2. |
| 49.130(d)(1-3), (5-6) and (8) | Limits amount of sulfur in fuel oil, non-used oil liquid, coal and gaseous fuels. | None of these fuels are burned at the facility. Wood waste and used oil are limited in other section of this rule. |

| | | |
|---|---|---|
| 49.130(f)(1)(ii) | Additional requirements that apply to gaseous fuels. | No gaseous fuels are burned at the facility. |
| 49.135 | Restricts emissions determined to be detrimental to human health or welfare. | Actual requirements will result from EPA's determination and subsequent permits or orders that address an issue. |

Acid Rain Program - Title IV of the CAA created a SO2 and NOx reduction program found in 40 CFR Part 72. The program applies to any facility that includes one or more "affected units" that produce power. The hogged fuel-fired boiler is not a "unit" as defined in 40 CFR 72.2 because it does not combust fossil fuels. The used oil-fired heater is not large enough to be subject to the acid rain program in Part 72.

## 4.2 Other Federal Requirements

Endangered Species Act (ESA) - Under this act, EPA is obligated to consider the impact that a federal project may have on listed species or critical habitats. It is EPA's conclusion that the issuance of this Title V permit will not affect a listed specie or critical habitat because it does not authorize new emissions units, increase existing emission limits or impose any new work practice requirements. Therefore, no additional analysis and no additional requirements will be added to this permit for ESA reasons. EPA's no-effect determination concludes EPA's obligations under Section 7 of the ESA. For more information about EPA's obligations, see the Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act, published by the FWS and NMFS (March 1998, Figure 1).

National Environmental Policy Act (NEPA) - Under Section 793(c) of the Energy Supply and Environmental Coordination Act of 1974, no action taken under the Clean Air Act shall be deemed a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. This permit is an action taken under regulations implementing the Clean Air Act and is therefore exempt from NEPA.

National Historic Preservation Act (NHPA) - As noted earlier, the issuance of this Title V permit does not authorize new emissions units, increase existing emission limits or impose any new work practice requirements. No changes to the facility are expected as a result of this permit action. Consequently, no adverse effects are expected, and further review under NHPA is not indicated.

Environmental Justice (EJ) Policy - Under Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* signed on February 11, 1994, EPA is directed, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. This permit action does not allow new or additional emissions and therefore impacts. As a result, there is no information available that indicates that there are disproportionately high and adverse impacts to a minority or low-income population.

## 4.3 Permit Conditions

This Title V operating permit compiles all of the applicable requirements that apply to the permittee. Additional monitoring, recordkeeping and reporting requirements have been created where needed so the permit assures compliance with all of the applicable requirements. Each permit condition in the permit is explained below. The permit is organized into the following ten sections:

Permit Section 1: Source Information and Emission Units
Permit Section 2: Standard Terms and Conditions
Permit Section 3: General Requirements

Permit Section 4: Facility-Specific Requirements
Permit Section 5: Unit-Specific Requirements - EU-1 (Hog Fuel-fired Boiler)
Permit Section 6: Unit-Specific Requirements - EU-2 (Lumber Drying Kiln)
Permit Section 7: Unit-Specific Requirements - EU-3 (Sawmill)
Permit Section 8: Unit-Specific Requirements - EU-4 (Planer Mill)
Permit Section 9: Unit-Specific Requirements - EU-5 (Used Oil-Fired Heater)

**Permit Section 1 - Source Information and Emission Units**

This permit section contains a brief description of the facility and a list of emission units. A more detailed description of the facility can be found in Section 2 of this Statement of Basis.

**Permit Section 2 - Standard Terms and Conditions**

This permit section includes generic compliance terms that are required in all Title V permits, but are not subject to the annual compliance certification requirements found in Permit Condition 3.49.

Permit Condition 2.1 explains that the language in the underlying regulations takes precedence over paraphrased language in the permit. Some applicable requirements are paraphrased in the permit with the intention of clarifying the requirement, but with no intention of changing the underlying meaning of the requirement. Where there is a difference between the language in a permit and an underlying regulation, the wording in the underlying regulation should be used to interpret and implement the requirement. This permit condition also notes some underlying authorities that may have been used to create additional requirements in this permit.

Permit Conditions 2.4 and 2.5 address a general permit shield which states that compliance with the permit is deemed compliance with the applicable requirements listed in the permit. The permittee is responsible for complying with any applicable requirements that exist but have not been included in the permit. The permittee did not request a specific permit shield for any specific requirement excluded from this permit and none is being granted.

Permit Conditions 2.12 through 2.14 address the expiration of the permit and the ramifications if the permittee does or does not renew their permit. It is important to note that, if the permittee does not submit a complete and timely renewal application, the permittee's right to operate is terminated. The expiration date of the permit is listed on the top right-hand corner of the front page of the permit. Specific requirements regarding permit renewal are in Permit Conditions 3.51 and 3.52.

Permit Conditions 2.15 through 2.17 address options for making certain physical and operational changes in the facility that do not require a permit modification. If the permittee uses any of these options, they must comply with the applicable recordkeeping requirement found in Permit Condition 3.32 and reporting requirements found in Permit Conditions 3.38 and 3.39.

**Permit Section 3 - General Requirements**

This permit section includes conditions that are required in all Title V permits. In some cases, facility-specific testing, monitoring, recordkeeping and reporting requirements for these permit conditions might be found in Section 4 of the permit because those requirements can vary from permit to permit. Unless otherwise specified, emission units are subject to the general requirements in Section 3 of the permit as well as the facility-specific and unit-specific requirements in Sections 4 and 5 of the permit.

Permit Conditions 3.1 and 3.2 are general compliance schedule requirements. Because the permittee submitted their permit renewal application late, they are out of compliance with Title V until the permit is issued. Because EPA is not aware of any other non-compliance at the time of permit issuance, there is no issue-specific compliance schedule in Section 4 of the permit.

Permit Condition 3.3 requires the permittee to allow EPA-authorized representatives access to the facility and required records.

Permit Conditions 3.4 through 3.8 restrict open burning wherever the FARR applies including at industrial facilities. If the permittee performs any open burning, recordkeeping requirements specific to open burning found in Permit Condition 3.33 will apply.

Permit Conditions 3.9 through 3.11 limit visible emissions, require the use of either Reference Method 9 or a continuous opacity monitoring system (COMS) for determining compliance with the limit and provide exception to the rule. Reference Method 9 includes specific guidance for reading opacity when there is a wet plume (both attached and detached and directs the observer to take readings excluding the portion of the plume that includes uncombined water (droplets). In the vast majority of cases, the likelihood of exceeding the 20% opacity limit due to the presence of uncombined water is very low because an experienced observer would know that he/she should not read that portion of the plume. However, there are meteorological conditions that can prevent uncombined water (droplets) from completely evaporating in a plume (e.g., 100% relative humidity and a saturated plume). The provision in Permit Condition 3.11 addresses that situation. Currently, this facility does not use (and is not required to use) continuous opacity monitoring systems (COMS) to monitor visible emissions.

Because testing, monitoring, recordkeeping and reporting for assuring compliance with the visible emission limit can change based on the emission unit in question, the testing, monitoring, recordkeeping and reporting requirements are contained in the facility-specific requirements in Section 4 of the permit, or in each emission unit-specific section, as appropriate. The general monitoring, recordkeeping and reporting for this requirement is the periodic visible emissions survey (plant walkthrough) specified in Permit Conditions 4.6 through 4.13.

Permit Conditions 3.12 through 3.17 restrict fugitive particulate matter emissions and require a plan be created to assure the use of reasonable precautions to prevent fugitive emissions. The plan is based on a survey of the facility and is updated annually. This annual survey can be accomplished simultaneously with the periodic visible emission survey requirement in Permit Condition 4.6 through 4.13, as long as both requirements are fully complied with.

Permit Condition 3.18 addresses requirements in the Chemical Accident Prevention Program found in 40 CFR Part 68. This program requires sources that use or store regulated substances above a certain threshold to develop plans to prevent accidental releases. Based on information in their application, there are no regulated substances above the threshold quantities in this rule at this facility; therefore, the facility is not currently subject to the requirement to develop and submit a risk management plan. However, this requirement is included in the permit as an applicable requirement because the permittee has an ongoing responsibility to submit a risk management plan if a listed substance exists at the facility in quantities over the threshold amount, or if the quantity of any regulated substance ever increases above the threshold quantity. Including this term in the permit minimizes the need to reopen the permit if the facility becomes subject to the requirement to submit a risk management plan.

Permit Conditions 3.19 and 3.20 address the Stratospheric Ozone and Climate Protection Program found in 40 CFR Part 82. This program requires sources that handle regulated materials to meet certain procedural and certification requirements. There may be equipment at the facility that uses or contains chlorofluorocarbons (CFCs) or other materials regulated under this program. All air conditioning and refrigeration units must be maintained by certified individuals if they contain regulated materials.

Permit Condition 3.21 addresses asbestos demolition or renovation activity found in 40 CFR Part 61, Subpart M (NESHAP). This program requires sources that handle asbestos-containing materials to follow specific procedures. If the permittee conducts any demolition or renovation activity at their planer mill, they must assure that the project is in compliance with the federal rules governing asbestos, including the requirement to conduct an inspection for the presence of asbestos. This requirement is in the permit to address any demolition or renovation activity that may occur at the facility.

Permit Conditions 3.22 through 3.30 specify the procedures that must be followed whenever the permit

requires emissions testing or sampling in an emission unit-specific section of the permit. If there is a conflict between these permit conditions and an emission unit-specific permit condition, the unit-specific permit condition should be followed. Concentration-based emission limits required to be corrected to a specific oxygen concentration in the flue gas often do not contain a protocol to convert measured concentrations to specified oxygen levels. Permit Condition 3.28 provides a protocol for such a conversion.

Permit Condition 3.31 describes general recordkeeping that has been added to the permit using Part 71 authority to assure that there is good documentation for any monitoring that the permittee performs.

Permit Condition 3.32 describes recordkeeping requirements that apply only if the permittee makes off-permit changes. Certain off-permit changes are allowed in Permit Condition 2.15.

Permit Condition 3.33 describe recordkeeping requirements that apply if the permittee performs open burning. The open burning recordkeeping was added using Part 71 authority. Open burning is restricted in Permit Conditions 3.4 through 3.8.

Permit Condition 3.34 includes recordkeeping that applies to fee records including the duration that the records must be maintained. The duration is consistent with that required by Title V (see Permit Condition 3.35).

Permit Condition 3.35 sets the duration that records must be maintained. Both Title V and FARR records must be maintained for 5 years. These two requirements have been combined (streamlined) into one permit condition. If there is ever a conflict between these requirements and a more restrictive emission unit-specific permit condition, the specific permit condition should be followed.

Permit Conditions 3.36 and 3.37 require the permittee to submit or correct submitted information when requested by EPA and as needed. The permittee has an ongoing obligation to assure that all data in its Title V application is correct and to notify EPA of any errors or omissions.

Permit Conditions 3.38 and 3.39 describe reporting requirements that apply only if the permittee makes off-permit changes (Permit Condition 3.38) or section 502(b)(10) changes (Permit Condition 3.39). Certain off-permit changes are allowed in Permit Condition 2.15. Section 502(b)(10) changes are allowed in Permit Conditions 2.16.

Permit Condition 3.40 includes the address for submittals to EPA Region 10. All reports and notices, except for fee payments (see Permit Condition 3.43), should be sent to this address. Copies of each document sent to EPA should be sent to the Tribal Air Quality Coordinator.

Permit Conditions 3.41 through 3.45 require submittal of an annual emission inventory (of actual emissions) and payment of fees for Part 71 purposes. These requirements refer to Permit Condition 4.1 for the actual due date by which fees and emissions must be submitted each year. The per-ton fee rate varies each year; the permittee should contact EPA to obtain the current rate. The submittal of the emission inventory is timed to coincide with the payment of fees because annual Title V fees are based on actual emissions generated during the previous calendar year. Appendix A to this statement of basis documents the methods, techniques, and assumptions that EPA believes provide the most accurate basis for estimating actual emissions for this facility. As explained in Section 3.2 of this statement of basis, the emission estimation techniques listed in this statement of basis should be used to calculate the annual emissions inventory, unless the permittee has other information showing why another technique more accurately represents emissions. Also note that the actual emission estimates differ from the facility's PTE because actual emissions are calculated based on actual operations, not maximum operational capacity.

Note that the FARR emission inventory required in Permit Condition 3.46 to be reported at the same time can be combined with the Part 71 emission inventory as long as it is clear which emissions inventory is for which purpose, because the pollutant lists for each emission inventory are slightly different.

Permit Condition 3.46 requires submittal of an annual emission inventory (of actual emissions) for FARR registration purposes. Appendix A to this statement of basis documents the methods, techniques, and assumptions that EPA believes provide the most accurate basis for estimating actual emissions for this facility. As explained in Section 3.2 of this statement of basis, the emission estimation techniques listed in this statement of basis should be used to calculate the annual emissions inventory, unless the permittee has other information showing why another technique more accurately represents emissions. Also note that the actual emission estimates differ from the facility's PTE because actual emission are calculated based on actual operations, not maximum operational capacity.

Note that the FARR emission inventory is required to be submitted at the same time as the Part 71 fees and emission inventory required in Permit Conditions 3.41 through 3.45. The Part 71 and FARR emission inventories can be combined as long as it is clear which emissions inventory is for which purpose, because the pollutant lists for each emission inventory are slightly different.

Permit Conditions 3.47 and 3.48 require semi-annual monitoring reports and prompt deviation reports. Determinations of deviations, continuous or intermittent compliance status, or violations of the permit are not limited to the testing or monitoring methods required by the underlying regulations or this permit. Failure to meet any permit term or permit condition, including emission standards, is considered a deviation. Other credible evidence (including any evidence admissible under the federal rules of evidence) must be considered by the source and EPA in such determinations. The timing for reporting deviations, as well as other data collected, depends on the circumstances, as explained in these permit conditions.

Permit Condition 3.49 requires an annual compliance certification. The permittee must certify compliance with the permit conditions in sections 3 through 11. The permittee does not need to annually certify compliance with the provisions in permit sections 1 or 2. Consistent with Permit Condition 2.6, however, if a permittee is aware of any information that indicates noncompliance, that information must be included in the annual compliance certification. In a year when the permit is renewed or revised, the permittee must address each permit for the time that permit was in effect. Note that the deadline for the annual compliance certification was changed from January 30 to February 28 in an effort by EPA to make all of the Title V permits consistent. Forms for the annual compliance certifications may be obtained on the internet at http://www.epa.gov/air/oaqps/permits/p71forms.html.

Permit Condition 3.50 requires the permittee to certify the truth, accuracy and completeness of all documents (notices, reports, data, and etc) submitted to EPA. The certification must be signed by a responsible official as defined in 40 CFR 71.2. CFI's responsible official is listed on the first page of the permit. The permittee should request an administrative amendment of the permit if the responsible official for the facility changes.

Permit Conditions 3.51 through 3.52 require the permittee to submit an application for renewal and describe some of the information that must be included in the application. As explained in Permit Conditions 2.12 through 2.14, failure to submit a complete application on time terminates the permittee's right to operate. The expiration date of the permit is listed on the top right-hand corner of the front page of the permit.

**Permit Section 4 - Facility-Specific Requirements**

This permit section includes applicable requirements and related testing, monitoring, recordkeeping and reporting that apply either to multiple emission units or on a facility-specific basis. Unless otherwise specified, emission units are subject to the facility-specific requirements in Section 4 of the permit as well as the general and unit-specific requirements in Sections 3 and 5 of the permit.

Permit Condition 4.1 lists the due date for the annual fees and emission reports required in Permit Conditions 3.41 through 3.46.

Permit Condition 4.2 and 4.4 limit the sulfur content of the solid fuel burned in any combustion device and specifies the method for determining compliance. The facility burns only wood waste in the boiler. The underlying rule allows the permittee to simply keep records showing that only wood waste is burned because the naturally occurring sulfur content of wood waste is normally much less than the limit of 2% by weight. Wood waste at the facility was measured to contain 0.09% sulfur by weight.

Permit Conditions 4.3 and 4.5 limit the sulfur content of the used oil fuel burned in any combustion device and require recordkeeping or sampling to document compliance. The facility burns used oil only in the heater.

Permit Conditions 4.6 through 4.13 require a quarterly survey (also called a plant walkthrough) for visible and fugitive emissions as well as specific follow-up steps (investigation, corrective action, RM9 observation and additional recordkeeping and reporting) if visible or fugitive emissions are observed. If observed visible or fugitive emissions can not be eliminated within 24 hours, a tiered sequence of RM9 opacity observations must be performed. Observations of visible or fugitive emissions during a survey are not considered deviations; however, any resulting RM9 readings above 20% opacity are considered permit deviations pursuant to Permit Conditions 3.47 and 3.48. The annual fugitive particulate matter survey required in Permit Condition 3.13 can be accomplished simultaneously with a quarterly survey required in this permit condition as long as both requirements are fully complied with. This permit condition serves as the general periodic monitoring for several fugitive and particulate matter limits found in the permit. This requirement applies to emission sources that normally do not exhibit visible or fugitive emissions. If the permittee prefers a specific periodic monitoring approach for any emission sources subject to this requirement, the permittee can propose a new approach as a permit modification (see the boiler periodic monitoring in Permit Conditions 5.7 to 5.14 for examples).

Permit Conditions 4.14 and 4.15 limit HAP emissions to below the major source thresholds of 10 tons per year for any individual HAP and 25 tons per year for all HAP totaled. These limits, often called synthetic minor limits, were originally created in the 2006 Title V permit as 9.5 and 24.5 tons per year. The 2007 Non-Title V permit issued to Stimson lowered the limits to what they are today: 9 tons per year for a single HAP and 24 tons per year for all HAPs totaled. The facility will be treated as a minor source for NESHAP/MACT reasons as long as it complies with the limits. Because the limits are facility-wide, compliance with the limits will be determined based on actual emission estimates using actual production data and current emission factors. The term “average” was removed from the original limit because that was written in error – there is no way to average a 12 month rolling total. In Permit Conditions 4.14.1 and 4.15.1, the second sentence was removed because chloride sampling now exists.

The lumber kiln emission factors currently recommended were developed primarily through testing performed in a laboratory because lumber kilns are very difficult and expensive to test in the field. If there ever is a question regarding the representativeness of the kiln emission factors, it may be possible to test lumber from this specific planer mill in a “lab scale” kiln.

Permit Condition 4.16 requires the chloride content of the used oil be determined and used to calculate an emission factor for the heater. The chloride content of used oil can vary a lot, so it is important to confirm it to ensure more accurate emission tracking.

Permit Conditions 4.17 through 4.19 describe the recordkeeping and calculations required to confirm compliance with the HAP limits. Recommended emission factors for the boilers are presented in Appendix A as lb/mmBtu. Stimson plans to track steam production. Stimson will need to convert the steam output (lb/hr) to heat input (mmBtu/hr) using a conversion factor based on testing performed in 2005 (see the required sampling and analysis in Permit Condition 5.5.3) – Permit Condition 4.18 was added for that reason.

Permit Condition 4.20 requires chloride data to be kept for 5 years, consistent with the Non-Title V permit and the Part 71 data maintenance requirements.

Permit Condition 4.21 requires the permittee to report actual HAP emissions with their annual FARR emission report and sets the deadline for reporting. This allows all of the emission reporting to be done simultaneously for the facility.

Permit Conditions 4.22 – 4.25. The facility combusts in boiler EU-1 only material satisfying the definition of biomass as that term is defined at 40 CFR § 63.11237. Biomass means any biomass-based solid fuel that is not a solid waste. This includes, but is not limited to, wood residue and wood products (e.g., trees, tree stumps, tree limbs, bark, lumber, sawdust, sander dust, chips, scraps, slabs, millings, and shavings); animal manure, including litter and other bedding materials; vegetative agricultural and silvicultural materials, such as logging residues (slash), nut and grain hulls and chaff ( e.g., almond, walnut, peanut, rice, and wheat), bagasse, orchard prunings, corn stalks, coffee bean hulls and grounds. This definition of biomass is not intended to suggest that these materials are or are not solid waste as that term is defined at 40 CFR § 241.2. Because boiler EU-1 combusts only biomass, it is in the NESHAP Subpart JJJJJJ biomass subcategory of boilers pursuant to 40 CFR § 63.11200(b). It is with this in mind that EPA Region 10 created permit terms reflecting NESHAP Subpart JJJJJJ requirements.

Permit Condition 4.22. Existing biomass boilers are subject to periodic tune-up management practices for PM (surrogate for urban metal HAP) and CO (surrogate for urban organic HAP) based upon finding that periodic tune-ups represent generally available control technology (GACT), (78 FR 7489, February 1, 2013). An oxygen trim system, according to 40 CFR §63.11237, is a system of monitors that is used to maintain excess air at the desired level in a combustion device. Boiler EU-1 does not employ an oxygen trim system, so it is required to undergo a tune-up once every 2 years rather than every 5 years for boilers employing said system. The NESHAP Subpart JJJJJJ tune-up requirements at 40 CFR § 63.11223(b)(1) and (2) related to inspection of burner and flame pattern do not apply to boiler EU-1 because the boiler does not employ any burners. Burners are typically employed to combust gas and liquid fuels along with pulverized coal. In contrast, the facility employs a solid fuel feed system to introduce biomass into boiler EU-1.

Permit Conditions 4.23 and 4.24. Existing biomass boilers are subject to a beyond-the-floor control technology or GACT requirement to conduct an energy assessment, (76 FR 15573, March 21, 2011). This length of time may be extended at the discretion of the source. EPA has not established a minimum value for the amount of time necessary to conduct on-site technical labor.

The requirement to evaluate systems to identify energy savings opportunities extends to the boiler system and any energy use system (under the control of the source) that accounts for at least 20 percent of the boiler's energy (e.g., steam, hot water, or electricity). See definition of energy assessment at 40 CFR § 63.11237. The energy use systems serving as the basis for the percent of affected boiler energy production may be segmented by production area or energy use area as most logical and applicable to the source. The term boiler system, as defined in 40 CFR § 63.11237 means the boiler and associated components, such as, feedwater systems, combustion air systems, fuel systems, blowdown systems, combustion control systems, steam systems, and condensate return systems, directly connected to and serving the energy use systems. Similarly, the term energy use system includes any of the following systems located at the Clean Air Action Section 112 stationary source that use energy provided by the boiler: (a) process heating; compressed air systems; machine drive (motor, pumps, fans); process cooling; facility heating, ventilation, and air conditioning systems; hot water systems; building envelop; and lighting; or (b) other systems that use steam, hot water, process heat, or electricity, provided by the boiler. Energy use systems are only those systems using energy clearly produced by the boiler either (a) directly as steam or process heat, or (b) through an associated steam turbine generator in the form of electricity. The steam produced by boiler EU-1 is delivered to a steam turbine generator and the lumber kilns. The steam turbine generator, in turn, provides electricity to power the plant.

A source operating under an energy management program compatible with ISO 50001 is not required to conduct an energy assessment. An energy management program, as defined at 40 CFR § 63.11237, means a program that includes a set of practices and procedures designed to manage energy use that are demonstrated by the facility's energy policies, a facility energy manager and other staffing responsibilities, energy performance measurement and tracking methods, and energy saving goal, action plans, operating procedures, internal reporting requirements, and periodic review intervals used at the facility. Facilities may establish their program through energy management systems compatible with ISO 50001.

Permit Condition 4.25. The following sentence appears in Condition 4.25, "The general duty to minimize emissions does not require the permittee to make any further efforts to reduce emissions if levels required by this standard have been achieved." Because boiler EU-1 is not subject to an emission limitation, there is no "level" to which emissions can be reduced. Achieving compliance with general duty to minimize emissions goes beyond complying with tune-up and energy assessment requirements of Conditions 4.22 through 4.24. Compliance with this requirement will be determined, in part, based upon inspection of records created and maintained by the permittee to comply with 40 CFR §§ 63.10(b)(2)(iii), 63.11223(b)(6) and 63.11225(c)(4) and (5).

Permit Conditions 4.26 – 4.29. The facility is required to conduct monitoring and maintain records to document compliance with GACT work practice standards and emission reduction measures. The facility is also required to document that when it combusts biomass that is considered a non-hazardous secondary material as that term is defined at 40 CFR § 241.2, that it is combusting a fuel and not a solid waste.[1]

Permit Condition 4.26. The requirement to measure and record boiler EU-1 exhaust stack CO concentration is satisfied if measurements are taken before and after the performance tune-up. It is not necessary to take measurements between interim tasks in the tune-up process.

Permit Condition 4.27. Should the permittee choose to operate in accordance with an energy management program so as to comply with Condition 4.23.2, Condition 4.27 requires Stimson to, among other things, maintain records that document their energy management program and how it is compatible with ISO 50001.

Permit Condition 4.29. The following background about the different biomass streams combusted in boiler EU-1 provides some context for Condition 4.29. A majority of the biomass combusted in boiler EU-1 is hogged bark. This bark is generated on-site by the de-barking of logs prior to further processing into lumber. This clean cellulosic biomass is considered a traditional fuel as those terms are defined at 40 CFR § 241.2.

Permit Conditions 4.29.1 and 4.29.2. These permit conditions refer to legitimacy criteria that must be satisfied in order to consider non-hazardous secondary material to be a fuel.

Permit Condition 4.29.2. This permit condition refers to the term processing, and that term has the meaning given to it by EPA at 40 CFR § 241.2. Processing means any operations that transform discarded non-hazardous secondary material into a non-waste fuel or non-waste ingredient product. Processing includes, but is not limited to, operations necessary to: Remove or destroy contaminants; significantly improve the fuel characteristics of the material, e.g., sizing or drying the material in combination with other operations; chemically improve the as-fired energy content; or improve the ingredient characteristics. Minimal operations that result only in modifying the size of the material by shredding do not constitute processing for purposes of this definition.

[1] When EPA refers to secondary materials in this context, EPA means any material that is not the primary product of a manufacturing or commercial process, and can include post-consumer material, off-specification commercial chemical products or manufacturing chemical intermediates, post-industrial material, and scrap. A non-hazardous secondary material is a secondary material that, when discarded, would not be identified as a hazardous waste under 40 CFR § 261.

Permit Condition 4.29.3. This permit condition refers to a petition process whereby the Regional Administrator may grant a non-waste determination that a non-hazardous secondary material that is used as a fuel, which is not managed within the control of the generator, is not discarded and is not a solid waste when combusted pursuant to 40 CFR § 241.3(c).

Permit Condition 4.29.4. The facility does not combust any of the materials that EPA has listed as non-waste under 40 CFR § 241.4(a). The current list of EPA-designated non-waste materials are as follows:

- Scrap tires that are not discarded and are managed under the oversight of established tire collection programs, including tires removed from vehicles and off-specification tires;
- Resinated wood;
- Coal refuse that has been recovered from legacy piles and processed in the same manner as currently-generated coal refuse; and
- Dewatered pulp and paper sludges that are not discarded and are generated and burned on-site by pulp and paper mills that burn a significant portion of such materials where such dewatered residuals are managed in a manner that preserves the meaningful heating value of the materials.

Permit Condition 4.30. The underlying NESHAP Subpart JJJJJJ requirement at 40 CFR §63.11223(b)(6) requires the permittee to track certain tune-up related information and to submit it to the EPA if requested by the Administrator. EPA is taking this opportunity to require the permittee to submit certain tune-up related information as part of notification of compliance status and annual compliance certification. The requirement in 40 CFR § 63.11223(b)(6)(iii) to track the type and amount of fuel used over the 12 months prior to the tune-up would have appeared as an element of Permit Condition 4.30, but the requirement does not apply to boiler EU-1 because it combusts only biomass. It is not physically capable of using any other type of fuel listed at 40 CFR § 63.11200.

Permit Condition 4.33. EPA is utilizing its discretion, as granted through 40 CFR § 63.11225(b), to require the permittee to submit a NESHAP Subpart JJJJJJ compliance certification report to EPA each year by March 15 for the previous year's operations. EPA is unable to require this report be submitted by February 28 as part of the annual compliance certification report required by Condition 3.49 because the underlying NESHAP Subpart JJJJJJ reporting provision specifies a submittal date no sooner than March 15.

Permit Conditions 4.36 and 4.37. The PSD regulation applicability test for modifications was changed in December 2002. The rule change resulted in a new applicable requirement for PSD major sources. Since the facility is a PSD major source, this term is included in the operating permit. In summary, when the permittee considers a plant modification project to be exempt from PSD via the method specified in 40 CFR § 52.21(b)(41)(ii)(a-c) and there is a reasonable possibility that there will be a significant emissions increase resulting from the project, then the permittee must fulfill specified requirements related to documentation, monitoring, and notification. This term will be relevant only when the permittee is contemplating making physical or operational changes to the facility. In those instances it is strongly recommended that the permittee contact EPA to discuss their plans and verify their assumptions.

**Permit Section 5 - Unit-Specific Requirements - EU-1 (Hog Fuel-fired Boiler)**

Permit Condition 5.1 limits the particulate matter (PM) emissions from the boiler to 0.2 gr/dscf at 7% O2 and describes the emission testing method for determining compliance.

Permit Condition 5.2 limits the sulfur dioxide (SO2) emissions from the boiler and describes the emission testing methods for determining compliance. As the boiler only uses wood waste as fuel, SO2 emissions are expected to be well below the emission limit.

Permit Condition 5.3 requires the boiler exhaust to be vented to the multiclone and scrubber at all times. While there is no testing to confirm it, it can be assumed that both control devices are needed for the

boiler to comply with the particulate matter and visible emission limits. This requirement ensures the emission control device is used and will be considered when estimating PTE for the boiler.

Permit Condition 5.4 requires the boiler control devices to be maintained. Consistent with the requirement to ensure boiler emissions are controlled at all times, this requires ensures the control device is operating correctly and hopefully that the boiler stays in compliance with the particulate matter and visible emission limits.

Permit Conditions 5.5 and 5.6 require measurement of particulate matter emissions. Given that past test results have well below the emission limit, the next test must be performed just prior to the expiration of this permit. The schedule for additional testing after that depends on the results of that next test. During each test, visible emissions must be measured and all required periodic and compliance assurance monitoring required by the permit must be recorded. A new heat-input-to-steam-output ratio must be developed during each particulate matter test. The ratio is used to convert tracked steam production into heat input for calculating boiler emissions. Testing is required to be performed during winter months to hopefully capture worst-case emissions due to wetter fuel and higher steam demand. Because the permittee prefers to measure and track steam output rather than fuel input, during each emission test a ratio of heat input to steam output must be determined using procedures found in Appendix B to the permit. The ratio is then used to convert measured steam flows (mlb/hr) to heat input (mmBtu/hr) which can be applied to emission factors that are normally in terms of heat input (lb/mmBtu). The general emission testing requirements in Permit Conditions 3.22 through 3.30 apply to all emissions testing; except, periodic visible emission testing is only required to meet 3.27 (emission unit operation), 3.29 (records during tests) and 3.30 (test reports) of the general requirements as well as the recordkeeping required in Condition 5.5.2 (note that all particulate matter testing must follow all of Condition 5.5).

Permit condition 5.7 requires measurement of carbon monoxide and nitrogen oxides emissions. Given that the potential to emit emissions are based on 2005 CO and NOx test data, it is appropriate to confirm the emission with an additional test. The test must be performed within 180 days of permit issuance. CO and NOx testing should be done at the same time because CO and NOx emissions are affected inversely by certain operating and fuel conditions. Monitoring required by the permit must be recorded during the test. A new heat-input-to-steam-output ratio must be calculated using the test data.

Permit condition 5.8 requires routine visible emission monitoring to satisfy compliance assurance monitoring for the visible emission limit and provides additional indication of compliance with the particulate matter limit. The frequency for each observation depends on the results of the previous observation.

Permit Condition 5.9 requires ongoing monitoring of boiler operations, multiclone pressure drop, scrubber pressure drop and scrubber water flow to comply with CAM. Each of the parameters are required to be monitored (measured with a gauge indicator) continuously; however, the frequency of data recording varies. Because the permittee will base actual emissions on steam production, the permit requires continuous recording of the pounds of steam produced. Steam pressure, required to be recorded once per month, provides an indication of potential changes in boiler duty and allows an estimation of steam heat content. Boiler excess oxygen, required to be recorded once per hour, provides an indication of boiler performance with the concern that much lower oxygen levels may lead to incomplete combustion and much higher oxygen levels could cause the combustion chamber to be too cool. Pressure drop across the multiclone is generally related to control device performance (plugging or corrosion); but, is often only adequate for indicating significant changes in performance. The boiler oxygen and multiclone pressure drop readings can be useful for trouble-shooting performance problems and for tracking equipment condition trends. Scrubber pressure drop and water flow are considered more real-time indicators of scrubber performance. The permit includes a 90% data capture requirement for recordkeeping on a hourly or daily schedule – that is at least 90% percent of the data required to be measured and recorded each hour or day must be measured and recorded to comply with the permit. Data

capture of less than 90% for steam production, boiler excess oxygen, scrubber pressure drop or scrubber water flow is a permit deviation. This provides relief for the more stringent monitoring/recording schedules during a given month; whereas, steam pressure and multiclone pressure drop must be recorded at least once each month to comply with the data capture requirement.

Permit Condition 5.10 requires the performance, operational and maintenance criteria from Part 64 that applies to the monitoring equipment required in Permit Condition 5.8. Excursion thresholds, specifically defined for Stimson's boiler and control equipment, are based on emission testing that showed a good margin of compliance with the particulate matter limits while operating at those levels. Opacity was recorded as zero during the same emission testing, so the threshold for an excursion has been set well below the opacity limit of 20%.

Permit Condition 5.11 specifies what Part 64 requires the permittee to do when an excursion occurs.

Permit Condition 5.12 simply states EPA's option to require a quality improvement plan (QIP); this condition becomes a requirement only in the event EPA informs the permittee that a QIP is required.

Permit Condition 5.13 serves as a safeguard against incorrectly set excursion/exceedance thresholds by requiring the redefinition of the thresholds as needed.

Permit Condition 5.14 requires, consistent with Permit Condition 3.35, the maintenance of all records and supporting information.

Permit Condition 5.15 requires quarterly wood waste fuel sampling to determine the chloride content of the wood so a hydrogen chloride emission factor can be developed and used for reporting emissions. The hogged fuel sampling and chloride analytical procedures are specified in Appendix A to the permit. While the Non-Title V permit in which the sampling/analytical procedure was first required allows the permittee to request an alternative, that option has not been transferred to the Title V permit because it is EPA's policy that the methods required be specified in the permit. The permit must be revised to incorporate any alternative that is approved. Since the draft permit was made available for comment, EPA has decided that there is good evidence that most of the chlorine in the fuel does not convert to HCl. The emission inventory now reflects a 15% conversion rate (before any collection by the wet scrubber). Appendix A to the permit has been revised to allow the application of this reduction to the HCl emission factor based on fuel sampling. Stimson will still be required to sample their fuel for chlorine content because some of the past value sampled were the highest chlorine contents in the region.

Permit Condition 5.16 requires reporting from Part 64 to be combined with the Part 71 semi-annual and deviation reports required in Permit Conditions 3.47 and 3.48.

Permit Condition 5.17 requires fuel chloride analytical data to be included in the Part 71 semi-annual monitoring report required in 3.47.

**Permit Section 6 - Unit-Specific Requirements - EU-2 (Lumber Drying Kilns)**

Permit Conditions 6.1 limits particulate matter emissions and describes the test method for determining compliance. The visible and fugitive emission monitoring required in Permit Conditions 4.4 through 4.10 will serve as the periodic monitoring to assure compliance for this unit.

Permit Condition 6.2 requires periodic monitoring and recordkeeping that will assure compliance with the hazardous air pollutant emission limits.

**Permit Section 7 - Unit-Specific Requirements - EU-3 (Sawmill)**

Permit Condition 7.1 limits particulate matter emissions and describes the test method for determining compliance. No unit-specific testing or monitoring is required. The visible and fugitive emission monitoring required in Permit Conditions 4.6 through 4.12 will serve as the periodic monitoring to assure compliance for this unit.

**Permit Section 8 - Unit-Specific Requirements - EU-4 (Planer Mill)**

Permit Condition 8.1 limits particulate matter emissions and describes the test method for determining compliance. No unit-specific testing or monitoring is required. The visible and fugitive emission monitoring required in Permit Conditions 4.6 through 4.12 will serve as the periodic monitoring to assure compliance for this unit.

**Permit Section 9 - Unit-Specific Requirements - EU-5 (Used Oil-Fired Heater)**

Permit Condition 9.1 limits particulate matter emissions and describes the test method for determining compliance. No unit-specific testing or monitoring is required. The visible and fugitive emission monitoring required in Permit Conditions 4.6 through 4.12 will serve as the periodic monitoring to assure compliance for this unit.

Permit Condition 9.2 limits sulfur dioxide emissions and specifies the test method for determining compliance. The monitoring required in Permit Condition 4.5 to demonstrate compliance with the fuel sulfur content limit can also be used to indicate compliance with this stack concentration limit through calculations if needed, because the fuel sulfur content limit is expected to be more stringent than this limit.

Permit Condition 9.3 requires periodic visible emission monitoring for heater to assure compliance with the facility-wide visible emission limit.

Permit Condition 9.4 requires tracking operating hours for use in emission calculations and to confirm compliance with Permit Condition 9.3.

# 5. Public Participation

## 5.1 Public Notice and Comment Period

As required in 40 CFR 71.11(a)(5) and 40 CFR 71.8, all draft operating permits must be publicly noticed and made available for public comment. The public notice of permit actions and public comment period is described in 40 CFR 71.11(d). There is a 30 day public comment period for actions pertaining to a draft permit. For this permit action, the requirements of 40 CFR 71.11(a)(5) and 40 CFR 71.8 are satisfied as follows:

Publishing the public notice for this draft permit in the Coeur d'Alene Press newspaper and Council Fires tribal newspaper;

Providing a copy of the public notice to: the permit applicant, the affected states, the air pollution control agencies of affected states, the Tribal, city and county executives, any comprehensive land use planning agency, any state or federal land manager whose lands may be affected by emissions from the source, the local emergency planning authorities which have jurisdiction over the area where the source is located and all persons who submitted a written request to be included on EPA Region 10's mailing list for Title V permitting actions;

Making available, on the Region 10 website [www.epa.gov/r10earth/ (once there, click on "Air")], a copy of the public notice and the draft permit and statement of basis prepared by EPA;

Making available, at the Region 10 office library and at the locations listed below, a copy of the public notice, draft permit, the statement of basis, the application, and relevant supporting materials:

| | |
|---|---|
| Plummer Public Library<br>849 D Street<br>Plummer, Idaho | St. Maries Public Library<br>822 College Avenue<br>St. Maries, Idaho |

## 5.2 Response to Public Comments and Permit Issuance

As required in 40 CFR 71.11(e) and (i), in making a final permit decision, EPA considered the comments received during the public comment period. As required in 40 CFR 71.11(i), EPA will notify the applicant and each person who submitted comments or requests notification of the final permit decision.

EPA only received comments from Steven Petrin with Stimson Lumber Company. The comments received and EPA's responses to the comments are as follows:

Permit Comments and Responses

1. Condition 3.41.2 - As worded in the draft, emission calculations can only be computed based on methods defined in the permit such as monitoring or source testing. Since many of the emission factors are not monitored parameters (e.g. hogged-fuel boiler toxics, hogged-fuel boiler sulfur dioxide, used oil sulfur dioxide), there is no allowance for using EPA factors or for using EPA approved test methods. As currently draft, the factors in Appendix A of the Statement of Basis are not credible. Stimson needs the ability to use other resources to calculate emissions and requests that the condition be changed to "Actual emissions shall be computed using methods required by the permit for determining compliance, such as monitoring or source testing data, EPA approved test methods (e.g. 40 CFR 60), or published EPA emission factors."

> EPA Response – The additional language "such as monitoring or source testing data" was originally added for clarification, but evidently has added some confusion. The additional language added for clarification has been removed from the permit, so this condition now reflects the actual wording in 40 CFR 71.9(h)(3). To be clear, actual emissions must be computed using methods for determining compliance in the permit, when specific methods are required by the permit, such as test data. When specific compliance determination methods are not required, other methods and information, including monitoring, source test data and emission factors can and should be used as explained in Sections 3.1, 3.2 and 4.3 of the Statement of Basis.

2. Condition 4.4 - Other biomass fuels may become available that will not produce emissions appreciably different from wood and the plant may need the flexibility to access such fuels. Under the alternative operating conditions provision of 40 CFR 70, Stimson requests that the condition to modified to state that "The permittee shall keep records showing that only wood biomass is combusted in the boilers."

> EPA Response – This condition reflects the actual wording in the rule, and the rule defines the term "wood." No revision has been made.

3. Condition 4.5 - This condition should exclude biomass.

> EPA Response – This condition only applies to liquid fuels and clearly does not apply to biomass. No revision has been made.

4. Condition 4.25 – The statement requires compliance at all times, but the Boiler MACT only requires compliance during operation and allows for higher values during a short startup period. Please incorporate the language of 40 CFR 63.11201(d) "These standard apply at all times the affected boiler is operating, except during periods of startup and shutdown as defined in 63.11237, during which time you must comply only with Table 2 of this subpart."

> EPA Response – The noted exception to the general duty requirement only applies to boilers subject to the emission limits in NESHAP Subpart JJJJJJ. Stimson is not subject to an emission limit in this NESHAP, so there is no need to include the exception. No revision has been made.

5. Condition 5.14.1 (Condition 5.15.1 in final permit) – The procedure in Appendix A needs to be amended to account for actual HCl emissions. As written, it targets potential emissions with no regard for removal from the wet scrubber. Since HCl is water soluble, we expect, and have shown through testing, that actual HCl emissions will be far lower than a simple fuel mass balance approach would indicate. This

concern applies even with different control equipment but certainly with a wet scrubber ATTACHED is our analysis of the control efficiency for HCl emissions through the use of a water scrubber. Plummer has been using 85% emissions control for HCl and … as you can see from the field data, the results were 87% which is better than the estimates.

> EPA Response – The approach taken to estimate worst-case HCl emissions (100% conversion to HCl) in the emission inventory is very common for biomass-fired boilers generally because most sources can comply with applicable limits without assuming additional reductions. It is clear that Stimson cannot comply with such a conservative assumption. In researching this comment, EPA did not find sufficient data to support an assumed 85% reduction by Stimson's somewhat unique scrubber that is designed for particulate control. Stimson tested the HCl emissions in the stack (downstream from the scrubber) and compared the results to fuel chlorine samples. That comparison does not distinguish the amount of HCl removed by the scrubber from the amount of chlorine that remains in the bottom or fly ash or becomes a salt but never becomes HCl. EPA acknowledges that HCl emissions can be captured by wet scrubbers and that Stimson's HCl emissions from the boiler are likely being reduced somewhat by the wet scrubber even though it is designed for particulate control. EPA's research did, however, uncover information that supports the idea that very little chlorine in biomass becomes HCl when burned. Simultaneous fuel sampling and stack testing at a northwest facility demonstrated that over 91% of the chlorine in the fuel does not convert to HCl, presumably remaining in the fly and bottom ash or converting to salts and other compounds that are collected or emitted as particulates rather than as gaseous HCl. EPA has seen other test data, but without simultaneous fuel sampling, that reflects consistently low HCl emissions in biomass-fired systems. In fact, it is likely that the reduction that Stimson is seeing in their system is largely the result of fuel chlorine not converting to gaseous HCl in the boiler. EPA has revised the HCl emission factor in the PTE inventory to apply an 85% reduction to the highest (monthly rolling) annual chlorine content Stimson has experienced. When reporting actual emissions, Stimson is allowed to apply an 85% reduction to the emission factor calculated using actual chlorine contents and the method in Appendix A to the permit (HCl Emission Factor Procedure for Hogged Fuel). To provide flexibility reflecting the formation of chloride salts and potential reductions by control devices, the permit has been revised to add an eighth step to the emission factor calculation procedure in Appendix A which states, "Apply reductions to the emission factor such as documented control efficiency or limited HCl conversion of fuel chlorine in the boiler." Sections 3.1, 3.2 and 4.3 of the Statement of Basis already explain that actual emissions generally are based on actual operations and controls. Stimson also has the option to perform fuel sampling and emission testing to verify the fate of the chlorine entering the boiler. Despite the fact that this change in approach significantly reduces the predicted HCl emissions, because Stimson has experienced some of the highest chlorine contents in the northwest, the permit will still require periodic chlorine sampling. In future permit renewals, EPA is willing to consider reducing the frequency of, or eliminating, fuel chlorine sampling, based on the latest information available then.

6. Condition 5.8 (Condition 5.9 in the final permit) – Please remove the requirement to "continuously measure/display" the 6 parameters continuously. This is wrought with potential "excursions" simply because of this language of the condition even if the facility meets the recording requirements defined in each of the six conditions. If the purpose is to ensure that an inspector could observe the condition at any time, perhaps simply adding a statement that the operating parameters should be able to query the parameter at any time. Then either electronic or handheld instruments would allow compliance with the condition.

> EPA Response – The specific requirement to continuously measure and display monitored parameters is necessary to ensure the information is available at all times. Excursions are defined in Permit Condition 5.9.5 (Condition 5.10.5 in the final permit). Operating without continuous

measurement and display of the required parameters is not an excursion, but is a permit deviation. No revision has been made.

Statement of Basis Comments and Responses

Appendix A – There are two issues here – (1) the potential emissions based on using the higher emission factors while still operating under a HAP PTE of 24 tpy and (2) the lack of site-specific data. To elaborate:

1. EU1 (page A-4) – The NOx emission factor is based on dry fuel. While some of the fuel may be dry as you indicated, the emissions calculations are based on field data for moisture content and energy value, then converted to a dry-basis and the use of a dry basis. Since the fuel generally has a moisture content of 40%, the dry emission factor of 0.49 lb/MMBTU is not equivalent to the wet-fuel emission factor of 0.22 lb/MMBTU (approximately 0.37 lb/MMBTU dry).

EPA Response – The NOx emission factor based on dry fuel is considered a worst-case emission factor for use in estimating PTE. EPA selected it because the facility is not restricted from burning only dry fuel. EPA recognizes, however, that using this approach for NOx may be unreasonable for facilities that cannot practically burn only dry fuel. Given that Stimson produces all of its fuel onsite and that always includes bark and sawdust generated upstream of the lumber drying kilns, it is reasonable to assume they will always be burning a mix of wet and dry fuel. Stimson claims they normally burn fuel with a moisture content of 40%. To establish a conservative PTE for NOx, EPA will assume 70% of the fuel is dry (dry fuel typically has about 10-15% moisture) and 30% of the fuel is wet (wet fuel typically has about 50% moisture) for an average moisture content of 25.5%. Using a 70/30 fuel mix, the new emission factor becomes 0.41 lb/mmBtu. For reporting actual emissions, Stimson is allowed to use a site-specific emission factor if they have adequate documentation (fuel moisture contents or records on the mixing of wet and dry fuel) that supports its use. For example, if records show that the fuel is a mix of half wet and half dry wood, then it would be acceptable to average the emission factors for wet and dry wood. In fact, NOx testing in 2005 reflected a much lower emission factor while burning fuel with a 45% moisture content; if the actual moisture content of fuels burned in the future have similar moisture content, it might be appropriate to use emission factors based upon the 2005 testing when reporting actual emissions. Sections 3.1, 3.2 and 4.3 of the Statement of Basis explain that actual emissions generally are based on actual operations and controls. The PTE inventory in Appendix A to the Statement of Basis has been revised to reflect this blended fuel EF.

2. EU1 (page A-4) – The PM emission factor doesn't include any PM control efficiency. Since the scrubber is included in the permit which includes monitoring conditions, it is federally enforceable and the control efficiency should be incorporated.

EPA Response – EPA based the boiler's PTE on the most stringent, applicable emission limit (in the FARR) because a direct correlation between emission and boiler operations does not exist. We are aware that emission test data has demonstrated that actual emissions are much lower than the FARR limit. In fact, AP42 indicates that emissions from a biomass-fired boiler with a multiclone and fuel blending can comply with the FARR emission limit. Given that multiclones tend to operate consistently while wet scrubbers can be less consistent, using an emission factor that reflects only a multiclone and fuel blending (which is inherent to Stimson's process) is a conservative enough approach for PTE. A similar approach will be taken for establishing PM10 and PM2.5 PTE. When reporting actual emissions, Stimson is allowed to use emission factors that reflect actual operation (including the wet scrubber) as long as they have adequate documentation to support it. Sections 3.1, 3.2 and 4.3 of the Statement of Basis explain that actual emissions generally are based on actual operations and controls. The emission inventory in Appendix A to the statement of basis has been revised to reflect this approach for PTE.

3. EU1 (page A-4) – The SO2 emission factor is not reasonable. Using publicly reported data (e.g. FARR) for a source that is not normally tested for SO2 is suspect. Furthermore, off-road diesel has 500 ppm and current fuel oil has a 15 ppm limit – why would wood that has no source of sulfur except from the atmosphere have as much or more sulfur than fuel oil! The AP-42 factor is 0.025 lb/MMBTU and should be used (2.6 lb/hr using AP-42 vs. 126 lb/hr using FARR).

> EPA Response – Similar to the PM emission factor, EPA based the boiler's PTE on the most stringent, applicable emission limit because Stimson is allowed to use fuel with a sulfur content up to that limit. EPA recognizes, however, that using this approach for SO2 results in unrealistic emission estimates. In researching this more, we have found references for an upper bound wood sulfur content of 0.2% by weight (dry). That information also supports the concept that the inherent alkaline nature of wood ash prevents about 85% of the SO2 from forming. Combining those two assumptions results in more realistic, yet still appropriately conservative, emissions factors of 0.069 lb/MMBtu for wood (at 8667 Btu/lb) and 0.067 lb/MMBtu for bark (at 9000 Btu/lb). The SO2 PTE for the boiler has been revised accordingly in Appendix A. When reporting actual emissions, Stimson is allowed to use emission factors that reflect actual fuel sulfur content as long as they have documentation to support them. Sections 3.1, 3.2 and 4.3 of the Statement of Basis explain that actual emissions generally are based on actual operations and controls.

4. EU2 (page A-5) – Stimson recommend using ODEQ 2013 emission factors rather than the "EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012", as it addresses statistical concerns to provide emission factors more representative of actual kiln operations (see memo previously supplied on 8/19/2013 by S. Petrin ATTACHED).

> EPA Response – EPA has gone to great length to review and document appropriate emission factors for lumber drying that reflect the data available and the need to be conservative when estimating PTE. Given the substantial changes to the emissions factors that have occurred in the recent past when new test data has become available, EPA believes it is very important to error on the side that hopefully avoids big surprises (and potential compliance issues) for companies in the future. Stimson is allowed to use their actual kiln temperatures, lumber species and lumber volumes when reporting actual emissions. Stimson is also allowed to test their own lumber and develop their own lumber-specific emission factors. No revision has been made.

5. EU3 (page A-6) – The PM2.5 emission factor for the green sawdust bin target box and the green ship bin target box should be 0 lb/bdt, based on "EPA Region 10 Particulate Matter Emission Factors for Sawmills, February 2013", not 0.085 lb/bdt according to the emission factor reference material.

> EPA Response – This comment identified an error in EPA's sawmill emission factor document that is referenced. The PM2.5 emission factor for target boxes should have been 50% of the PM emission factor or 0.05 lb/bdt. The sawmill emission factor compilation has been revised, and the appropriate PM2.5 emission factors have now been used in the emission inventory.

6. EU7 (page A-8) – Used Oil-Fired Boiler emissions as proposed are based on the FARR limit of 2% by weight in 40 CFR 49.130(5)(d). Since the value is significantly higher than the AP-42 factor, please allow for, but don't stipulate, testing of the fuel (e.g. condition 3.41.2) to define sulfur content.

> EPA Response – Similar to the boiler PM PTE, EPA based the heater's SO2 PTE on the most stringent, applicable emission limit because Stimson is allowed to use fuel with a sulfur content up to that limit. When reporting actual emissions, Stimson is allowed to use emission factors that reflect actual fuel sulfur content as long as they have documentation to support them. In fact, Stimson is required in Permit Condition 4.5 to document the fuel sulfur content through representative fuel sampling when vendor data is not available. The reference to vendor data may seem odd because all of the used oil is generated onsite; however, the condition wording is taken directly out of the FARR. Regarding representative fuel sampling, given that Stimson

accumulates used oil in a small tank until the fall when cooler weather requires the use of the heater, sampling the used oil in the tank at least at the beginning of each heating season would help confirm the sulfur content of the used oil burned each winter. If the actual sulfur content is close to the limit, additional periodic sampling would be appropriate; if not, then sampling once per year might be adequate. No revision to Appendix A has been made. Additional wording has been added to Permit Condition 4.5 to help clarify "representative sampling" when no vendor exists.

7. EU7 (page A-8) – On footnote #6, the emission factor in lb/Mgal have been converted to lb/MMBtu by dividing by 150 MMBtu/Mgal (assuming that the waste oil is blended with residual oil). The emission factor should be 140 MMBtu/Mgal which is the emission factor for distillate oil.

EPA Response – This comment identified an error. EPA intended to use the conversion factor for distillate oil, 140 MBtu/Mgal, and, in fact, did use it in the emission factor calculation for SO2 but not for all of the calculations. The emission inventory has been revised, and the distillate oil conversion factor has now been correctly used for all of the pollutants emitted by the heater.

8. EU8 (page A-9) – The area for bark, sawdust, chips, and shavings listed is 0.054 acres; based on previous inventory, this was 0.040+0.054 = 0.094 acres. Please correct the area.

EPA Response – EPA agrees and has made this revision.

Other Permit and Statement of Basis Edits by EPA

In addition to making necessary revisions to the permit and statement of basis in response to the comments received, EPA made other revisions to the permit and statement of basis as described below.

EPA Revision #1. Permit Condition 2.6 – This condition refers to compliance certifications in accordance with Condition 3.4.9 which is a typographical error. The reference to Condition 3.4.9 has been corrected to be Condition 3.49.

EPA Revision #2. Statement of Basis, Appendix A, EU1 (page A-4) – The published global warming potentials for individual greenhouse gases were updated in December 2013, after the draft permit was made available for comment. The new global warming potential for methane increased while the global warming potential for nitrous oxide decreased, resulting in a small increase in the total CO2e for the hog fuel-fired boiler. The latest global warming potential have been added to the statement of basis.

EPA Revision #3. Statement of Basis, Appendix A, EU1 (page A-4) and new Permit Condition 5.7 – In reviewing test data submitted by Stimson's consultant to support their permit comment #1 regarding NOx, EPA noticed that the 2005 source test included CO measurements. EPA generally considers actual test data more representative than AP-42; however, when there is limited test data, EPA tries to build in some conservatism for use in PTE. Although EPA is using the 2005 test data to create a new CO EF for use in the PTE inventory, EPA is using the highest of the three test runs to represent a conservative estimate. EPA is also relying on the 2005 NOx test data to support the decision to adjust the NOx EF as explained in the response to comment #1. Given the limited amount of data for both CO and NOx, the permit has also been revised to include a verification source test requirement in new Permit Condition 5.7. Testing for both pollutants must be completed within 180 days of permit issuance.

EPA Revision #4. Permit Cover Page – EPA's address was edited to add the last four digits of the zip code (now 98101-3140). Steven Petrin's contact information reflects his new phone number. Two new responsible officials replaced the previous one.

# 6. Abbreviations and Acronyms

| | |
|---|---|
| Btu | British thermal units |
| CAA | Clean Air Act [42 U.S.C. section 7401 et seq.] |
| CAM | Compliance assurance monitoring |

| | |
|---|---|
| CFR | Code of Federal Regulations |
| CO | Carbon monoxide |
| COMS | Continuous opacity monitoring system |
| dscf | Dry standard cubic feet |
| EU | Emission unit |
| EPA | United States Environmental Protection Agency (also U.S. EPA) |
| FARR | Federal Air Rules for Reservations |
| FR | Federal Register |
| gr/dscf | Grains per dry standard cubic foot (7,000 grains = 1 pound) |
| HAP | Hazardous air pollutant |
| hr | Hour |
| IEU | Insignificant emission unit |
| lb | Pound |
| 1bm | Pound-mole |
| MACT | Maximum Achievable Control Technology |
| mm | One million |
| NESHAP | National Emission Standards for Hazardous Air Pollutants (40 CFR Parts 61 and 63) |
| NOx | Nitrogen oxides |
| PM | Particulate matter |
| PM10 | Particulate matter less than or equal to 10 microns in aerodynamic diameter |
| ppmdv | Parts per million on a dry, volume basis |
| PSD | Prevention of significant deterioration |
| PTE | Potential to emit |
| S | Sulfur |
| $SO_2$ | Sulfur dioxide |
| tpy | Tons per year |
| VOC | Volatile organic compound |

# Appendix A

## EPA Estimation of Potential Air Pollutant Emissions

Statement of Basis
Title V Operating Permit
R10T5020100
Issued: August 13, 2014

Stimson Lumber Company
Plummer, Idaho

# Appendix A: Potential Emissions Inventory

## Summary of Facility Regulated Air Pollutant Potential Emissions

**Potential to Emit, (tons per year)**

**Non-Fugitive Emissions**

| | EU-1 | EU-2 | EU-3 | EU-4 | EU-5 | EU-6 | EU-7 | EU-8 | |
|---|---|---|---|---|---|---|---|---|---|
| | Hog Fuel Boiler | Lumber Drying Kilns | Sawmill | Planer Mill | Used Oil-Fired Heater | Piles | Tanks | Plant Traffic | **Non-Fugitive Subtotal** |
| Carbon Monoxide (CO) | 184.0 | 0 | | | 0.04 | | | | 184 |
| Lead (Pb) | 0.02 | 0 | | | 0.06 | | | | 0 |
| Nitrogen Oxides ($NO_X$) | 188.6 | 0 | | | 0.17 | | | | 189 |
| Particulates (PM) | 161.0 | 2.7 | 16.8 | 7.2 | 0.01 | | | | 188 |
| Respirable Particulates ($PM_{10}$) | 168.8 | 2.7 | 10.4 | 4.5 | 0.00 | | | | 186 |
| Fine Particulates ($PM_{2.5}$) | 168.8 | 2.7 | 5.6 | 2.5 | 0.00 | | | | 180 |
| Sulfur Dioxide ($SO_2$) | 31.7 | 0 | | | 2.47 | | | | 34 |
| Volatile Organic Compounds (VOC) | 10.6 | 92.7 | | | 0.01 | | | | 103 |
| Greenhouse Gas ($CO_2e$) | 97,187 | 0 | | | 200.08 | | | | 97,388 |

**Fugitive Emissions**

| | EU-1 | EU-2 | EU-3 | EU-4 | EU-5 | EU-6 | EU-7 | EU-8 | |
|---|---|---|---|---|---|---|---|---|---|
| | Hog Fuel Boiler | Lumber Drying Kilns | Sawmill | Planer Mill | Used Oil-Fired Heater | Piles | Tanks | Plant Traffic | **Fugitive Subtotal** |
| Carbon Monoxide (CO) | | | | | | | | | 0 |
| Lead (Pb) | | | | | | | | | 0 |
| Nitrogen Oxides ($NO_X$) | | | | | | | | | 0 |
| Particulates (PM) | | | 9.0 | 2.7 | | 0.1 | | 195.6 | 207 |
| Respirable Particulates ($PM_{10}$) | | | 4.5 | 2.3 | | 0.0 | | 55.8 | 63 |
| Fine ($PM_{2.5}$) | | | 2.2 | 1.4 | | 0.0 | | 27.9 | 31 |
| Sulfur Dioxide ($SO_2$) | | | | | | | | | 0 |
| Volatile Organic Compounds (VOC) | | | | | | | | | 0 |
| Greenhouse Gas ($CO_2e$) | | | | | | | | | 0 |

**All Emissions**

| | EU-1 | EU-2 | EU-3 | EU-4 | EU-5 | EU-6 | EU-7 | EU-8 | |
|---|---|---|---|---|---|---|---|---|---|
| | Hog Fuel Boiler | Lumber Drying Kilns | Sawmill | Planer Mill | Used Oil-Fired Heater | Piles | Tanks | Plant Traffic | **Plantwide PTE** |
| Carbon Monoxide (CO) | 184.0 | 0 | 0 | 0 | 0.0 | 0.0 | | 0 | 184 |
| Lead (Pb) | 0 | 0 | 0 | 0 | 0.1 | 0.0 | | 0 | 0 |
| Nitrogen Oxides ($NO_X$) | 188.6 | 0 | 0 | 0 | 0.2 | 0.0 | | 0 | 189 |
| Particulates (PM) | 161.0 | 2.7 | 25.8 | 9.9 | 0.0 | 0.1 | | 195.6 | 395 |
| Respirable Particulates ($PM_{10}$) | 168.8 | 2.7 | 14.9 | 6.9 | 0.0 | 0.0 | | 55.8 | 249 |
| Fine Particulates ($PM_{2.5}$) | 168.8 | 2.7 | 7.8 | 3.8 | 0.0 | 0.0 | | 27.9 | 211 |
| Sulfur Dioxide ($SO_2$) | 31.7 | 0 | 0 | 0 | 2.5 | 0.0 | | 0 | 34 |
| Volatile Organic Compounds (VOC) | 10.6 | 92.7 | 0 | 0 | 0.0 | 0.0 | | 0 | 103 |
| Greenhouse Gas ($CO_2e$) | 97,187 | 0 | 0 | 0 | 200.1 | 0.0 | | 0 | 97,388 |

Notes:

1. For EU-8, EPA is simply transmitting here the result of the calculations used in the previous Title V permit.

2. For PSD and Title V applicability considering NSR regulated pollutant emissions, only non-fugitive emissions are counted given the source category in which this facility (sawmill) is listed. For MACT and Title V applicability considering HAP emissions, all emissions are counted.

3. PM is not a pollutant considered in determining whether a source is subject to the requirement to obtain a Title V permit, however, PM emissions are considered in determining whether a facility/project is a major PSD source/modification and whether a source is subject to CAM.

4. The DC Circuit Court of Appeals on July 12, 2013 vacated EPA regulations that delayed until July 21, 2014 consideration of $CO_2$ emissions resulting from biomass combustion in determining PSD and Title V applicability pursuant to 40 CFR 52.21(b)(49)(ii)(a) and 40 CFR 71.2 definition of "subject to regulation." See explanation for exemption provided by EPA at 76 FR 43490. See DC Circuit Court of Appeals July 12, 2013 ruling vacating the exemption at http://www.cadc.uscourts.gov/internet/opinions.nsf/F523FF1F29C06ECA85257BA6005397B5/$file/11-1101-1446222.pdf

5. Tank emissions are so small that EPA is not estimating the PTE here, but the EU is listed for information purposes.

6. The "All Emissions" table sums the values in the "Non-Fugitive Emissions" and "Fugitive Emissions" tables.

# Appendix A: Potential Emissions Inventory

## Summary of Facility Hazardous Air Pollutant (HAP) Potential Emissions

**Potential to Emit, (tons per year)**

| Hazardous Air Pollutants | EU-1 Hog Fuel Boiler | EU-2 Lumber Drying Kilns | EU-5 Used Oil-Fired Heater | Single HAP Plantwide Totals (tons per year) |
|---|---|---|---|---|
| **Trace Metal Compounds** | | | | |
| Antimony Compounds | 3.63E-03 | | | 3.6E-03 |
| Arsenic Compounds (including arsine) | 1.01E-02 | | | 1.0E-02 |
| Beryllium Compounds | 5.06E-04 | | | 5.1E-04 |
| Cadmium Compounds | 1.89E-03 | | | 1.9E-03 |
| Chromium Compounds (including hexavalent) | 9.66E-03 | | | 9.7E-03 |
| Cobalt Compounds | 2.99E-03 | | | 3.0E-03 |
| Lead Compounds (not elemental lead) | 2.21E-02 | | | 2.2E-02 |
| Manganese Compounds | 7.36E-01 | | | 7.4E-01 |
| Mercury Compounds[2] | 1.61E-03 | | | |
| Nickel Compounds | 1.52E-02 | | | 1.5E-02 |
| Phophorus | 1.24E-02 | | | 1.2E-02 |
| Selenium Compounds | 1.29E-03 | | | 1.3E-03 |
| **Other Inorganic Compounds** | | | | |
| Chlorine | 3.63E-01 | | | 3.6E-01 |
| Hydrochloric acid (hydrogen chloride) | 7.04E+00 | | | 7.0E+00 |
| **Organic Compounds** | | | | |
| Acetaldehyde | 3.82E-01 | 7.52E+00 | | 7.9E+00 |
| Acetophenone | 1.47E-06 | | | 1.5E-06 |
| Acrolein | 1.84E+00 | 1.42E-01 | | 2.0E+00 |
| Benzene | 1.93E+00 | | | 1.9E+00 |
| 1,3-Butadiene | | | | 0.0E+00 |
| Bis(2-ethylhexyl)phthalate (DEHP) | 2.16E-05 | | | 2.2E-05 |
| Carbon tetrachloride | 2.07E-02 | | | 2.1E-02 |
| Chlorobenzene | 1.52E-02 | | | 1.5E-02 |
| Chloroform | 1.29E-02 | | | 1.3E-02 |
| Dibenzofurans* | 8.59E-07 | | | 8.6E-07 |
| 2,4-Dinitrophenol | 8.28E-05 | | | 8.3E-05 |
| Ethyl benzene | 1.43E-02 | | | 1.4E-02 |
| Ethylene dichloride (1,2-Dichloroethane) | 1.33E-02 | | | 1.3E-02 |
| Formaldehyde | 2.02E+00 | 8.90E-01 | | 2.9E+00 |
| Methanol | | 2.29E+01 | | 2.3E+01 |
| Methyl bromide (Bromomethane) | 6.90E-03 | | | 6.9E-03 |
| Methyl chloride (Chloromethane) | 1.06E-02 | | | 1.1E-02 |
| Methyl chloroform (1,1,1-trichloroethane) | 1.43E-02 | | | 1.4E-02 |
| Methylene chloride (Dichloromethane) | 1.33E-01 | | | 1.3E-01 |
| Naphthalene* | 4.46E-02 | | | 4.5E-02 |
| 4-Nitrophenol | 5.06E-05 | | | 5.1E-05 |
| Pentachlorophenol | 2.35E-05 | | | 2.3E-05 |
| Phenol | 2.35E-02 | | | 2.3E-02 |
| Polychlorinated biphenyls (PCB) | 3.65E-06 | | | 3.6E-06 |
| Polycyclic Organic Matter (POM) | 5.82E-02 | | | 5.8E-02 |
| Propionaldehyde | 2.81E-02 | 9.83E-02 | | 1.3E-01 |
| Propylene dichloride (1,2-Dichloropropane) | 1.52E-02 | | | 1.5E-02 |
| Styrene | 8.74E-01 | | | 8.7E-01 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin* | 3.96E-09 | | | 4.0E-09 |
| Tetrachloroethylene (tetrachloroethene) | 1.75E-02 | | | 1.7E-02 |
| Toluene | 4.23E-01 | | | 4.2E-01 |
| Trichloroethylene (Trichloroethene) | 1.38E-02 | | | 1.4E-02 |
| 2,4,6-Trichlorophenol | 1.01E-05 | | | 1.0E-05 |
| Vinyl chloride | 8.28E-03 | | | 8.3E-03 |
| Xylenes (inlc isomers and mixtures) | 1.15E-02 | | | 1.1E-02 |
| TOTAL[1] | 16.1 | 31.6 | 0.000 | |

| | | |
|---|---|---|
| Predicted Highest Plantwide Single HAP | ~~22.9~~ | tons per year, methanol |
| Predicted Plantwide HAP Total | ~~47.7~~ | tons per year, based on summing estimates |
| Highest Plantwide Single HAP PTE | 9 | tons per year, based on emission limit in FARR Non-Title V permit |
| Plantwide HAP PTE | 24 | tons per year, based on emission limit in FARR Non-Title V permit |

* designates a HAP that is subject individually to the 10 tpy major source threshold, but that is also one of several polycyclic organic matter (POM) compounds that, in aggregate, are subject to the same 10 tpy major source threshold.

[1] Because dibenzofurans, naphthalene and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (one of several dibenzodioxins) are accounted for individually and in the calculation of POM EF, their individual contribution here is discounted so as to avoid double-counting.

**Regulated Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-1**
Description: Hog fuel-fired boiler; manufactured in 1951, installed in 1983
Maximum Steam Production: 70,000 lb/hr
Particulate Matter Control Device: Joy multiclone followed by Yanke wet scrubber (required by permit)
Fuel: Biomass (hog fuel, wood residue)
Commence Construction: Prior to NSPS Dc applicabity with no known NSPS reconstruction or modification.
Startup:
Design Maximum Heat Input Capcity: 105 MMBtu/hr
Operation: 8760 hours per year

**NON-FUGITIVE EMISSIONS**

**Potential to Emit, (tons per year)**

| Criteria Pollutant Emissions | EF (lb/MMBtu) | PTE (tons per year) | EF Reference |
|---|---|---|---|
| Carbon Monoxide (CO) | 0.4 | 184.0 | 1, Option 3, because using the emission rate from highest of three test runs is acceptable with later confirmation. |
| Lead (Pb) | 4.80E-05 | 0.02 | 1, Option 1, because no specific limits apply. |
| Nitrogen Oxides ($NO_X$) | 0.41 | 188.6 | 1, Option 3, because assuming a moisture content of 25.5% (70% dry and 30% wet) is realistically conservative. |
| Particulate Matter (PM) | 0.35 | 161.0 | 1, Option 6, because AP42 predicts emissions lower than the most stringent FARR emission limit. |
| Particulate Matter ($PM_{10}$) | 0.367 | 168.8 | 1 and 2, Option 6, because AP42 predicts emission lower than the most stringent FARR emission limit. |
| Particulate Matter ($PM_{2.5}$) | 0.367 | 168.8 | 1 and 2, Option 6, because AP42 predicts emission lower than the most stringent FARR emission limit. |
| Sulfur Dioxide ($SO_2$) | 0.069 | 31.7 | 1, Option 3, because assuming 15% of the 0.2% wood sulfur content becomes SO2 is reasonably conservative. |
| Volatile Organic Compounds (VOC) | 0.023 | 10.6 | 1 |

| Greenhouse Gas Emissions ($CO_2$ Equivalent) | EF (lb/MMBtu) | PTE (tons per year) | EF Reference |
|---|---|---|---|
| Carbon Dioxide ($CO_2$)[1] | 206.8 | 95,107 | 1, Option 2, because the GHG Report Rule (40CFR98) is considered the primary reference for estimating GHG emissions when preparing or processing permit applications. |
| Methane ($CH_4$) | 1.764 | 811 | 1, Option 2, because the GHG Report Rule (40CFR98) is considered the primary reference for estimating GHG emissions when preparing or processing permit applications. |
| Nitrous Oxide ($N_2O$) | 2.759 | 1,269 | 1, Option 2, because the GHG Report Rule (40CFR98) is considered the primary reference for estimating GHG emissions when preparing or processing permit applications. |
| TOTAL | | 97,187 | |

[1] Prior to July 21, 2014, $CO_2$ emissions resulting from biomass combustion are not considered in determining PSD and Title V applicability pursuant to 40 CFR 52.21(b)(49)(ii)(a) and 40 CFR 71.2 definition of "subject to regulation." For further details, see explanation for exemption provided by EPA at 76 FR 43490.

| EF Reference | Description |
|---|---|
| 1 | EPA Region 10 Regulated NSR Air Pollutant Potential to Emit Emission Factors for Wood Residue-fired Boilers, July 2013. |
| 2 | Conservatively assume that all "filterable" PM is also $PM_{10}$ and $PM_{2.5}$. The "filterable" fraction equals 0.35 lb/MMBtu as noted in EF Reference No. 1. $PM_{10}$ and $PM_{2.5}$ emissions do include the "condensible" fraction as noted in October 25, 2012 Federal Register notice, pages 65107-65119. The "condensible" fraction equals 0.017 lb/MMBtu as noted in Table 1.6-1 of AP-42 (09/03). If a source is willing to use PM10 and PM2.5 test methods to demonstrate compliance, lower filterable fractions can be used. |

**Regulated Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-2**
Description: Lumber drying
Control Device: None
Work Practice: None
Fuel: None - indirect steam provided by EU-1
Predominant Species Dried: cedar, douglas fir, hemlock, lodgepole pine, white fir and western larch
Installed: Two double track 85 feet kilns and two double track 63 feet kilns
Annual Capacity: 109,200 mbf/yr

**NON-FUGITIVE EMISSIONS**

**Potential to Emit, (tons per year)**

| Criteria Pollutant Emissions | EF (lb/mbf) | PTE (tpy) | EF Reference |
|---|---|---|---|
| Carbon Monoxide (CO) | 0 | 0 | |
| Lead (Pb) | 0 | 0 | |
| Nitrogen Oxides ($NO_X$) | 0 | 0 | |
| Particulate Matter (PM) | 0.05 | 2.7 | 1 |
| Particulate Matter ($PM_{10}$) | 0.05 | 2.7 | 1,2 |
| Particulate Matter ($PM_{2.5}$) | 0.05 | 2.7 | 1,2 |
| Sulfur Dioxide ($SO_2$) | 0 | 0 | |
| Volatile Organic Compounds (VOC) | 1.6969 | 92.7 | 3 |

| Greenhouse Gas Emissions ($CO_2$ Equivalent) | EF (lb/mbf) | PTE (tpy) | EF Reference |
|---|---|---|---|
| Carbon Dioxide ($CO_2$) | 0 | 0 | |
| Methane ($CH_4$) | 0 | 0 | |
| Nitrous Oxide ($N_2O$) | 0 | 0 | |
| TOTAL | 0 | 0 | |

| EF Reference | Description |
|---|---|
| 1 | ODEQ ACDP Application Guidance AQ-EF02 (4/25/00), lumber drying Hemlock (highest EF). |
| 2 | Conservative engineering assumption that all PM is also $PM_{10}$ and $PM_{2.5}$. |
| 3 | EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012. See WPP1 VOC EF for drying douglas fir or western larch (the worst case species) at temperatures exceeding 200°F (the worst case temperature). |

Abbreviations
ACDP: air construction discharge permit
mbf: 1,000 board feet lumber
ODEQ: Oregon Department of Environmental Conservation
WPP1: Wood Products Protocol 1

**Regulated Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-3**

Description: Sawmill for producing green lumber including bucking saw, debarking, hogging, sawing, chipping and associated handling material via conveyor belt, drop and pneumatics

Capacity: 393000 tons logs/year (dry)
See individual activities listed below for individual capacities

Operations: 8760 hpy

Control: 80% Applied to operations inside buildings.

**NON-FUGITIVE EMISSIONS** **80**

**Potential to Emit, (tons per year)**

| Emissions Generating Activity | Annual Capacity | | EF | | | PTE | | |
|---|---|---|---|---|---|---|---|---|
| | | | PM | $PM_{10}$ | $PM_{2.5}$ | PM | $PM_{10}$ | $PM_{2.5}$ |
| | | | (lb/ton log, lb/bdt or lb/mbf; as applicable) | | | (tpy) | | |
| Debarker | 393,000 | tons log/yr | 0.024 | 0.012 | 0.006 | 3.8 | 1.9 | 0.9 |
| Bark conveyor drops | 80,000 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.0 | 0.0 | 0.0 |
| Saws | 393,000 | tons log/yr | 0.035 | 0.0175 | 0.00875 | 5.5 | 2.8 | 1.4 |
| Sawdust conveyor drops | 21,840 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.0 | 0.0 | 0.0 |
| Green sawdust bin target box | 21,840 | bdt/yr | 0.1 | 0.085 | 0.05 | 1.1 | 0.9 | 0.5 |
| Chipper | 91,728 | bdt/yr | 0.05 | 0.025 | 0.0125 | 1.8 | 0.9 | 0.5 |
| Chip conveyor drops | 91,728 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.0 | 0.0 | 0.0 |
| Green chip bin target box | 91,728 | bdt/yr | 0.1 | 0.085 | 0.05 | 4.6 | 3.9 | 2.3 |
| | | | | | TOTAL | 16.8 | 10.4 | 5.6 |

**FUGITIVE EMISSIONS**

**Potential to Emit, (tons per year)**

| Emissions Generating Activity | Annual Capacity | | EF | | | PTE | | |
|---|---|---|---|---|---|---|---|---|
| | | | PM | $PM_{10}$ | $PM_{2.5}$ | PM | $PM_{10}$ | $PM_{2.5}$ |
| | | | (lb/ton log, lb/bdt or lb/mbf; as applicable) | | | (tpy) | | |
| Bucking saw | 393,000 | tons log/yr | 0.035 | 0.0175 | 0.00875 | 6.9 | 3.4 | 1.7 |
| Hog | 80,000 | bdt/yr | 0.05 | 0.025 | 0.0125 | 2.0 | 1.0 | 0.5 |
| Bark conveyor drops | 80,000 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.0 | 0.0 | 0.0 |
| Green sawdust bin unloading to trucks | 21,840 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.0 | 0.0 | 0.0 |
| Green chip bin unloading to trucks | 91,728 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.0 | 0.0 | 0.0 |
| | | | | | TOTAL | 9.0 | 4.5 | 2.2 |

Notes: 1. Emission factors are from EPA R10 Particulate Matter Emission Factors for Sawmills, February 2013.

2. Operations inside buildings are considered to have non-fugitive emissions and have been reduced by 80% to reflect being inside a building.The planing emission factor from the reference document is assumed to already reflect activity occuring within a building.

3. Capacities are from previously issued Title V permit.

Abbreviations: mbf/yr = 1000 board feet of lumber per year
bdt/yr = bone dry tons per year

# Appendix A: Potential Emissions Inventory

**Regulated Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-6**
Description: Planer Mill
Capacity: 109200 mbf/yr
see capacity for other activities below
Operations: 8760 hpy

**NON-FUGITIVE EMISSIONS**

**Potential to Emit, (tons per year)**

| Emissions Generating Activity | Annual Capacity | | EF | | | PTE | | |
|---|---|---|---|---|---|---|---|---|
| | | | PM | $PM_{10}$ | $PM_{2.5}$ | PM | $PM_{10}$ | $PM_{2.5}$ |
| | | | (lb/ton log, lb/bdt or lb/mbf; as applicable) | | | (tpy) | | |
| Planer | 109,200 | mbf/yr | 0.0812 | 0.0406 | 0.0203 | 4.4 | 2.2 | 1.1 |
| Planer shavings cyclone on shavings bin | 5,460 | bdt/yr | 0.5 | 0.425 | 0.25 | 1.4 | 1.2 | 0.7 |
| Chip cyclone on shavings bin | 5,460 | bdt/yr | 0.5 | 0.425 | 0.25 | 1.4 | 1.2 | 0.7 |
| | | | | | TOTAL | 7.2 | 4.5 | 2.5 |

**FUGITIVE EMISSIONS**

**Potential to Emit, (tons per year)**

| Emissions Generating Activity | Annual Capacity | | EF | | | PTE | | |
|---|---|---|---|---|---|---|---|---|
| | | | PM | $PM_{10}$ | $PM_{2.5}$ | PM | $PM_{10}$ | $PM_{2.5}$ |
| | | | (lb/ton log, lb/bdt or lb/mbf; as applicable) | | | (tpy) | | |
| Shavings bin unloading to trucks | 10,920 | bdt/yr | 0.5 | 0.425 | 0.25 | 2.7 | 2.3 | 1.4 |
| | | | | | TOTAL | 2.7 | 2.3 | 1.4 |

Notes: 1. Emission factors are from EPA R10 Particulate Matter Emission Factors for Sawmills, February 2013.
2. Operations inside buildings are considered to have non-fugitive emissions and have been reduced by 80% to reflect being inside a building.The planing emission factor from the reference document is assumed to already reflect activity occuring within a building and is assumed to include all related activities.
3. Capacities are from previously issued Title V permit.
4. Chips and shavings assumed to each equal half of total material passing through shavings bin
5. The cyclone is assumed to be medium efficiency

Abbreviations: mbf/yr = 1000 board feet of lumber per year
bdt/yr = bone dry tons per year

**Regulated Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-5**
Description: Clean Burn 4000 Heater, provides building heat for truck shop
Control Device: none
Fuel: Used oil
Design Maximum Heat Input Capacity: 0.28 MMBtu/hr
Operation: 8760 hours per year

**NON-FUGITIVE EMISSIONS**
**Potential to Emit, (tons per year)**

| Criteria Pollutant Emissions | EF (lb/Mgal) | EF (lb/MMBtu) | PTE (tpy) |
|---|---|---|---|
| Carbon Monoxide (CO) | 5 | 0.0357 | 0.04 |
| Lead (Pb) | 6.545 | 0.0468 | 0.06 |
| Nitrogen Oxides ($NO_X$) | 19 | 0.1357 | 0.17 |
| Particulate Matter (PM) | 0.66 | 0.0047 | 0.01 |
| Particulate Matter ($PM_{10}$) | 0.57 | 0.0041 | 0.00 |
| Particulate Matter ($PM_{2.5}$) | 0.57 | 0.0041 | 0.00 |
| Sulfur Dioxide ($SO_2$) | | 2.01 | 2.47 |
| Volatile Organic Compounds (VOC) | 1 | 0.0071 | 0.01 |

| Greenhouse Gas Emissions ($CO_2$ Equivalent) | EF (lb/MMBtu) | PTE (tpy) |
|---|---|---|
| Carbon Dioxide ($CO_2$) | 163.140 | 200.1 |
| Methane ($CH_4$) | 0.003 | 0.0 |
| Nitrous Oxide ($N_2O$) | 0.0006 | 0.0 |
| TOTAL | | 200 |

Notes: 1. Criteria pollutant EF are from AP-42, Oct 1996, Table 1.11 for small boilers except as follows:
The PM amd PM10 EF are for atomizing burners.
The VOC EF is actually for TOC.
The SO2 EF is based on the FARR liquid fuel limit of 2% in 40 CFR 49.130(d)(5) - see the calculation below.
2. Lead content in the used oil is assumed to be 0.119%.
3. Ash content in the used oil is assumed to be 0.01%.
4. The greenhouse EF are described below.
5. This heater is not subject to the FARR emissions limits due to the capacity of the unit; however, it is subject to the FARR sulfur content limit of 2%.
6. EF in lb/Mgal have been converted to lb/MMBtu by dividing by 140 MMBtu/Mgal

7. SO2 EF calculation: 2.01 lb/MMBtu.
Basis: FARR distillate fuel oil No. 2 sulfur limit of 2.0% by weight at 40 CFR 49.130(d)(5)
EF (lb/MMBtu) = [FARR Fuel S Limit (%S) / 100] X $CF_{S\rightarrow SO2}$ X $CF_{lb\rightarrow gal}$ (lb/gal) X $CF_{Btu\rightarrow MMBtu}$ (Btu/MMBtu) / $CF_{gal\rightarrow Btu}$ (Btu/gal)
• $CF_{S\rightarrow SO2}$ = 2 lb $SO_2$/lb S. S + $O_2 \rightarrow SO_2$. For every 1 mol S (16 lb/lb-mol) reactant, there is 1 mol $SO_2$ (32 lb/lb-mol) product. 32 / 16 = 2.
• $CF_{lb\rightarrow gal}$ = 7.05 lb/gal fuel. See weight of distillate oil on page A-6 of Appendix A to AP-42, September 1985.
• $CF_{gal\rightarrow Btu}$ = 140,000 Btu/gal fuel. See heating value of distillate oil on page A-5 of Appendix A to AP-42, September 1985.

| FARR Fuel S Calculate $SO_2$ EF (lb/MMBtu) | FARR Fuel Sulfur Limit (% by weight) | $CF_{S\rightarrow SO2}$ (lb $SO_2$/lb S) | $CF_{lb\rightarrow gal}$ (lb/gal fuel) | $CF_{gal\rightarrow Btu}$ (Btu/gal fuel) | $CF_{Btu\rightarrow MMBtu}$ (Btu/MMBtu) |
|---|---|---|---|---|---|
| 2.01429 | 2 | 2 | 7.05 | 140,000 | 1.E+06 |

8. EPA's March 2011 guidance document "PSD and Title V Permitting Guidance for Greenhouse Gases" states that the GHG Report Rule (40 CFR 98), "should be considered a primary reference for sources and permitting authorities in estimating GHG emissions and establishing measurement techniques when preparing or processing permit applications." Therefore, GHG Reporting Rule emission factors will be employed to determine GHG PTE.

Carbon Dioxide ($CO_2$)
EF (lb $CO_2$e/MMBtu) = EF (kg $CO_2$/MMBtu) X $CF_{kg\rightarrow lb}$ (lb/kg) X $GWP_{CO2}$ (lb $CO_2$e/lb $CO_2$)

| Calculated $CO_2$e EF for $CO_2$ (lb $CO_2$e/MMBtu) | 40 CFR 98 Table C-1 EF (kg $CO_2$/MMBtu) | $CF_{kg\rightarrow lb}$ (lb/kg) | 40 CFR 98 Table A-1 $GWP_{CO2}$ (lb $CO_2$e/lb $CO_2$) |
|---|---|---|---|
| 163.142 | 74 | 2.20462262 | 1 |

Methane ($CH_4$)
EF (lb $CO_2$e/MMBtu) = EF (kg $CH_4$/MMBtu) X $CF_{kg\rightarrow lb}$ (lb/kg) X $GWP_{CH4}$ (lb $CO_2$e/lb $CH_4$)

| Calculated $CO_2$e EF for $CH_4$ (lb $CO_2$e/hp-hr) | 40 CFR 98 Table C-2 EF (kg $CH_4$/MMBtu) | $CF_{kg\rightarrow lb}$ (lb/kg) | 40 CFR 98 Table A-1 $GWP_{CO2}$ (lb $CO_2$e/lb $CH_4$) |
|---|---|---|---|
| 0.139 | 0.003 | 2.20462262 | 21 |

Nitrous Oxide ($N_2O$)
EF (lb $CO_2$e/MMBtu) = EF (kg $N_2O$/MMBtu) X $CF_{kg\rightarrow lb}$ (lb/kg) X $GWP_{N2O}$ (lb $CO_2$e/lb $N_2O$)

| Calculated $CO_2$e EF for $N_2O$ (lb $CO_2$e/hp-hr) | 40 CFR 98 Table C-2 EF (kg $N_2O$/MMBtu) | $CF_{kg\rightarrow lb}$ (lb/kg) | 40 CFR 98 Table A-1 $GWP_{CO2}$ (lb $CO_2$e/lb $N_2O$) |
|---|---|---|---|
| 0.410 | 0.0006 | 2.20462262 | 310 |

**Regulated Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-8**
Description: Fuel pile made up of bark, sawdust, chips and shavings
Capacity: 80,000 bdt/year green bark
21,840 bdt/year green sawdust
101,840 total green bark and sawdust into pile
10,920 bdt/year dry shavings and chips
0.094 acres (estimate)
Operations: 8760 hpy

**FUGITIVE EMISSIONS**
**Potential to Emit, (tons per year)**

| Emissions Generating Activity | Annual Capacity | | EF | | | PTE | | |
|---|---|---|---|---|---|---|---|---|
| | | | PM | $PM_{10}$ | $PM_{2.5}$ | PM | $PM_{10}$ | $PM_{2.5}$ |
| | | | (lb/ton log, lb/bdt or lb/mbf; as applicable) | | | (tpy) | | |
| Dumping green material to pile | 101,840 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.038 | 0.018 | 0.003 |
| Dumping dry material to pile | 10,920 | bdt/yr | 0.0015 | 0.0007 | 0.0001 | 0.008 | 0.004 | 0.001 |
| Pile wind erosion | 0.054 | acres | 0.38 | 0.19 | 0.095 | 0.000 | 0.000 | 0.000 |
| Loading green material from pile | 101,840 | bdt/yr | 0.00075 | 0.00035 | 0.00005 | 0.038 | 0.018 | 0.003 |
| Loading dry material from pile | 10,920 | bdt/yr | 0.0015 | 0.0007 | 0.0001 | 0.008 | 0.004 | 0.001 |
| | | | | | TOTAL | 0.09 | 0.04 | 0.01 |

Notes: 1. Emission factors are from EPA R10 Particulate Matter Emission Factors for Sawmills, February 2013.
2. Pile size and capacity is from previous Title V permit.

Abbreviations: mbf/yr = 1000 board feet of lumber per year
bdt/yr = bone dry tons per year

## Hazardous Air Pollutant Potential Emissions Inventory

Emission Unit: **EU-1**
Description: Hog fuel-fired boiler; manufactured in 1951, installed in 1983
Maximum Steam Production: 70,000 lb/hr
Particulate Matter Control Device: Joy multiclone followed by Yanke wet scrubber (required by permit)
Fuel: Biomass (hog fuel, wood residue)
Commence Construction: Prior to NSPS Dc applicabity with no known NSPS reconstruction or modification.
Startup:
Design Maximum Heat Input Capcity: 105 MMBtu/hr
Operation: 8760 hours per year

**Potential to Emit, (tons per year)**

| Hazardous Air Pollutants | EF (lb/MMBtu) | PTE (tpy) |
|---|---|---|
| **Trace Metal Compounds** | | |
| Antimony Compounds | 7.90E-06 | 3.63E-03 |
| Arsenic Compounds (including arsine) | 2.20E-05 | 1.01E-02 |
| Beryllium Compounds | 1.10E-06 | 5.06E-04 |
| Cadmium Compounds | 4.10E-06 | 1.89E-03 |
| Chromium Compounds (including hexavalent) | 2.10E-05 | 9.66E-03 |
| Cobalt Compounds | 6.50E-06 | 2.99E-03 |
| Lead Compounds (not elemental lead) | 4.80E-05 | 2.21E-02 |
| Manganese Compounds | 1.60E-03 | 7.36E-01 |
| Mercury Compounds | 3.50E-06 | 1.61E-03 |
| Nickel Compounds | 3.30E-05 | 1.52E-02 |
| Phophorus | 2.70E-05 | 1.24E-02 |
| Selenium Compounds | 2.80E-06 | 1.29E-03 |
| **Other Inorganic Compounds** | | |
| Chlorine | 7.90E-04 | 3.63E-01 |
| Hydrochloric acid (hydrogen chloride) | 1.53E-02 | 7.04E+00 |
| **Organic Compounds** | | |
| Acetaldehyde | 8.30E-04 | 3.82E-01 |
| Acetophenone | 3.20E-09 | 1.47E-06 |
| Acrolein | 4.00E-03 | 1.84E+00 |
| Benzene | 4.20E-03 | 1.93E+00 |
| Bis(2-ethylhexyl)phthalate (DEHP) | 4.70E-08 | 2.16E-05 |
| Carbon tetrachloride | 4.50E-05 | 2.07E-02 |
| Chlorobenzene | 3.30E-05 | 1.52E-02 |
| Chloroform | 2.80E-05 | 1.29E-02 |
| Dibenzofurans* | 1.87E-09 | 8.59E-07 |
| 2,4-Dinitrophenol | 1.80E-07 | 8.28E-05 |
| Ethyl benzene | 3.10E-05 | 1.43E-02 |
| Ethylene dichloride (1,2-Dichloroethane) | 2.90E-05 | 1.33E-02 |
| Formaldehyde | 4.40E-03 | 2.02E+00 |
| Methyl bromide (Bromomethane) | 1.50E-05 | 6.90E-03 |
| Methyl chloride (Chloromethane) | 2.30E-05 | 1.06E-02 |
| Methyl chloroform (1,1,1-trichloroethane) | 3.10E-05 | 1.43E-02 |
| Methylene chloride (Dichloromethane) | 2.90E-04 | 1.33E-01 |
| Naphthalene* | 9.70E-05 | 4.46E-02 |
| 4-Nitrophenol | 1.10E-07 | 5.06E-05 |
| Pentachlorophenol | 5.10E-08 | 2.35E-05 |
| Phenol | 5.10E-05 | 2.35E-02 |
| Polychlorinated biphenyls (PCB) | 7.93E-09 | 3.65E-06 |
| Polycyclic Organic Matter (POM) | 1.27E-04 | 5.82E-02 |
| Propionaldehyde | 6.10E-05 | 2.81E-02 |
| Propylene dichloride (1,2-Dichloropropane) | 3.30E-05 | 1.52E-02 |
| Styrene | 1.90E-03 | 8.74E-01 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin* | 8.60E-12 | 3.96E-09 |
| Tetrachloroethylene (tetrachloroethene) | 3.80E-05 | 1.75E-02 |
| Toluene | 9.20E-04 | 4.23E-01 |
| Trichloroethylene (Trichloroethene) | 3.00E-05 | 1.38E-02 |
| 2,4,6-Trichlorophenol | 2.20E-08 | 1.01E-05 |
| Vinyl chloride | 1.80E-05 | 8.28E-03 |
| Xylenes (inlc isomers and mixtures) | 2.50E-05 | 1.15E-02 |
| TOTAL[1] | 3.50E-02 | 16.1 |

* designates a HAP that is subject individually to the 10 tpy major source threshold, but that is also one of several polycyclic organic matter (POM) compounds that, in aggregate, are subject to the same 10 tpy major source threshold.

[1] Because dibenzofurans, naphthalene and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (one of several dibenzodioxins) are accounted for individually and in the calculation of POM EF, their individual contribution here is discounted so as to avoid double-counting.

EF Reference: Hazardous Air Pollutant Potential to Emit Emission Factors for Wood Residue-fired Boilers, July 2013. For the hydrochloric acid, the second option in the reference document was used because it employs site-specific data and a newly recognized limit on HCl conversion from Cl in biomass-fired boilers.

**Hazardous Air Pollutant Potential Emissions Inventory**

Emission Unit: **EU-2**
Description: Lumber drying
Control Device: None
Work Practice: None
Fuel: None - indirect steam provided by EU-1
Predominant Species Dried: cedar, douglas fir, hemlock, lodgepole pine, white fir and western larch
Installed: Two double track 85 feet kilns and two double track 63 feet kilns
Annual Capacity: 109,200 mbf/yr

**Potential to Emit, (tons per year)**

| Hazardous Air Pollutants | EF (lb/mbf) | PTE (tpy) |
|---|---|---|
| Methanol | 0.4200 | 22.9 |
| Formaldehyde | 0.0163 | 0.89 |
| Acetaldehyde | 0.1378 | 7.52 |
| Propionaldehyde | 0.0018 | 0.10 |
| Acrolein | 0.0026 | 0.14 |
| TOTAL | | 31.6 |

EF Reference: EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012. See HAP EF for drying western hemlock or western red cedar at temperatures exceeding 200°F.

Abbreviations
mbf: 1,000 board foot lumber

**EPA Region 10 Regulated Air Pollutant Potential to Emit Emission Factors for Wood Residue-Fired Boilers, July 2013.**

| No. | Criteria Pollutant | EF (lb/MMBtu) |
|---|---|---|
| 1 | Carbon Monoxide (CO)[1] | |
| 2 | Lead (Pb) | |
| 3 | Nitrogen Oxides ($NO_X$) | |
| 4 | Particulate Matter (PM)[2] | |
| 5 | Respirable Particulate ($PM_{10}$)[2] | |
| 6 | Fine Particulate ($PM_{2.5}$)[2] | |
| 7 | Sulfur Dioxide ($SO_2$) | |
| 8 | Volatile Organic Compounds (VOC) | |

| No. | Greenhouse Gas Pollutant | EF (lb $CO_2e$/MMBtu) |
|---|---|---|
| 9 | Carbon Dioxide ($CO_2$)[3] | |
| 10 | Methane ($CH_4$) | |
| 11 | Nitrous Oxide ($N_2O$) | |
| | **TOTAL** | 0.0 |

[1] If boiler is subject to Major Source Boiler MACT ("NESHAP Subpart DDDDD" or "NESHAP 5D"), do not use CO EF listed in table. Instead, calculate EF based upon applicable NESHAP 5D emission limit as illustrated below. Existing sources must comply with NESHAP 5D emission limits beginning January 31, 2016. The Potlatch facility in St. Maries, Idaho on the Coeur d'Alene Reservation is the only major HAP source operating a biomass boiler in Pacific Northwest Indian Country

[2] If boiler is subject to NSPS Db or Dc or NESHAP 5D or Minor Source Boiler MACT ("NESHAP Subpart JJJJJJ" or "NESHAP 6J"), do not use PM, $PM_{10}$ and $PM_{2.5}$ EF listed in table. Instead, calculate EF based upon most stringent applicable emission limit as illustrated below. Existing sources must comply with NESHAP 5D emission limits beginning January 31, 2016.

[3] Prior to July 21, 2014, $CO_2$ emissions resulting from biomass combustion are not considered in determining PSD and Title V applicability pursuant to 40 CFR 52.21(b)(49)(ii)(a) and 40 CFR 71.2 definition of "subject to regulation." For further details, see explanation for exemption provided by EPA at 76 FR 43490.

**No.** | **Reference**

Option 1: 0.6 lb/MMBtu
Basis: AP-42, September 2003. Table 1.6-2.
Option 2: 0.243 - 2.281 lb/MMBtu
Basis: NESHAP 5D

In order to create an EF in units of "lb/MMBtu heat input" based upon NESHAP 5D CO emission limits expressed in units of "ppm @3%$O_2$," the following equation must be employed:

EF (lb/MMBtu) = NESHAP 5D CO Limit (ppmvd@3%$O_2$) X $CF_{3\rightarrow 0\%O2}$ X $CF_{ppm\rightarrow lb/dscfCO}$ X $F_d$ (dscf/MMBtu)

• NESHAP 5D specifies a range of different CO emission limits based upon (a) the date the boiler commenced construction or reconstruction, (b) the design of the boiler and (c) type of fuel combusted. For the purpose of this PTE EF exercise, only the emission limits in units of "ppm" will be employed here. The alternative "lb/MMBtu steam output" or "lb/MWh electric generation output" emission limits could be employed if the efficiency of the boiler is known.

| Maximum Design Heat Input Capacity (MMBtu/hr) | Date Construction or Reconstruction Commenced | Boiler Design | NESHAP 5D CO Emission Limit (ppmvd@3%$O_2$) | Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP 5D… |
|---|---|---|---|---|
| 10 ≤ X | Y ≤ 06/04/10 | Stokers/sloped grate/others designed to burn wet biomass fuel | 1,500 (3-run avg)<br>720 (30-day rolling avg) | Table 2, Row 7 |
| | | Stokers/sloped grate/others designed to burn kiln-dried biomass fuel | 460 (3-run avg) | Table 2, Row 8 |
| | | Fluidized bed units designed to burn biomass/bio-based solid | 470 (3-run avg)<br>310 (30-day rolling avg) | Table 2, Row 9 |
| | | Suspension burners designed to burn biomass/bio-based solid | 2,400 (3-run avg)<br>2,000 (10-day rolling avg) | Table 2, Row 10 |
| | | Dutch ovens/pile burners designed to burn biomass/bio-based solid | 770 (3-run avg)<br>520 (10-day rolling avg) | Table 2, Row 11 |
| | | Fuel cell units designed to burn biomass/bio-based solid | 1,100 (3-run avg) | Table 2, Row 12 |
| | | Hybrid suspension grate boiler designed to burn biomass/bio-based solid | 2,800 (3-run avg)<br>900 (30-day rolling avg) | Table 2, Row 13 |
| | 06/04/10 < Y | Stokers/sloped grate/others designed to burn wet biomass fuel | 620 (3-run avg)<br>390 (30-day rolling avg) | Table 1, Row 7 |
| | | Stokers/sloped grate/others designed to burn kiln-dried biomass fuel | 460 (3-run avg) | Table 1, Row 8 |
| | | Fluidized bed units designed to burn biomass/bio-based solid | 230 (3-run avg)<br>310 (30-day rolling avg) | Table 1, Row 9 |
| | | Suspension burners designed to burn biomass/bio-based solid | 2,400 (3-run avg)<br>2,000 (10-day rolling avg) | Table 1, Row 10 |
| | | Dutch ovens/pile burners designed to burn biomass/bio-based solid | 330 (3-run avg)<br>520 (10-day rolling avg) | Table 1, Row 11 |
| | | Fuel cell units designed to burn biomass/bio-based solid | 910 (3-run avg) | Table 1, Row 12 |
| | | Hybrid suspension grate boiler designed to burn biomass/bio-based solid | 1,100 (3-run avg)<br>900 (30-day rolling avg) | Table 1, Row 13 |

• $CF_{3\rightarrow 0\%O2}$ (unitless) = (20.9 - $X_{O2Fd}$) / (20.9 - $X_{O2NESHAP5D}$). To create a conversion factor that adjusts the basis of the NESHAP 5D CO emission limit from 3% $O_2$ to 0% $O_2$ (the basis for $F_d$), $X_{O2Fd}$ = 0 and $X_{O2NESHAP5D}$ = 3. The value 20.9 is the percent by volume of the ambient air that is $O_2$. Decreasing the $O_2$ from the NESHAP 5D CO baseline increases the pollutant concentration. See Equation 19-1 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

• $CF_{ppm \rightarrow lb/dscfCO}$ (lb CO/dscf / ppm CO) = [CO Concentration (ppm)] X [$CF_{ppm \rightarrow unitless}$ (1/ppm)] X [MW CO (g/mol)] X [Ideal Gas Constant @ EPA Standard Conditions (L/mol)]$^{-1}$ X [$CF_{L \rightarrow ft3}$ (L/ft$^3$)] X [$CF_{g \rightarrow lb}$ (g/lb)]$^{-1}$. This factor converts CO concentration from units "ppm" to "lb/dscf." To create the conversion factor, start by assuming CO concentration of 1 ppm and dividing by 1,000,000 to create a volumetric ratio of CO to exhaust gas. The molecular weight of CO is 28.010 g/mol. EPA standard conditions for reference method testing are a temperature of 20°C and a pressure of 1 atm. See Footnote 1 of Table 19-2 of EPA Method 19. The ideal gas constant is 0.08205746 L-atm/°K-mol. At EPA standard conditions, the value for ideal gas constant becomes 24.05514 L/mol through the following calculation: (0.08205746 L-atm/°K-mol) X (1 atm)$^{-1}$ X (293.15°K). Note that °K = [°C] + 273.15. There are around 28.32 liters (L) in a cubic foot (ft$^3$) and around 453.6 grams (g) in a pound (lb).

The calculation to determine $CF_{COvolume}$ is presented in the following table:

| $CF_{ppm \rightarrow lb/dscfCO}$ | CO Concentration (ppm) | $CF_{ppm \rightarrow unitless}$ (1/ppm) | CO Molecular Weight (g/mol) | Ideal Gas Constant (L/mol) | $CF_{L \rightarrow ft3}$ (L/ft$^3$) | $CF_{g \rightarrow lb}$ (g/lb) |
|---|---|---|---|---|---|---|
| 7.27E-08 | 1 | 1.E-06 | 28.010 | 24.05514 | 28.3168466 | 453.59237 |

1 • $F_d$ = 9,240 dscf/MMBtu for combustion of "wood" or 9,600 dscf/MMBtu for combustion of "wood bark." See Table 19-2 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

Returning to the equation, EF (lb/MMBtu) = NESHAP 5D CO Limit (ppmvd@3%$O_2$) X $CF_{3 \rightarrow 0\%O2}$ X $CF_{ppm \rightarrow lb/dscfCO}$ X $F_d$ (dscf/MMBtu), the wood residue-fired boiler NESHAP 5D EF can now be calculated assuming combustion of two different types of solid biomass as illustrated in the following two tables:

For "Existing" Units (Commencing Construction or Reconstruction on or before June 4, 2010)

| Boiler Design | Fuel | NESHAP 5D CO Calculated EF (lb/MMBtu) | NESHAP 5D CO Limit Emission Limit[1] (ppmvd@3%$O_2$) | $CF_{3 \rightarrow 0\%O2}$ (unitless) | $CF_{ppm \rightarrow lb/dscfCO}$ (lb/dscf / ppm) | $F_d$ (dscf/MMBtu) |
|---|---|---|---|---|---|---|
| Stokers/sloped grate/others designed to burn wet biomass fuel | Wood | 1.176 | 1500 | 1.168 | 7.27E-08 | 9240 |
| | Bark | 1.222 | 1500 | | | 9600 |
| Stokers/sloped grate/others designed to burn kiln-dried biomass fuel | Wood | 0.361 | 460 | | | 9240 |
| | Bark | 0.375 | 460 | | | 9600 |
| Fluidized bed units designed to burn biomass/bio-based solids | Wood | 0.369 | 470 | | | 9240 |
| | Bark | 0.383 | 470 | | | 9600 |
| Suspension burners designed to burn biomass/bio-based solids | Wood | 1.882 | 2400 | | | 9240 |
| | Bark | 1.956 | 2400 | | | 9600 |
| Dutch ovens/pile burners designed to burn biomass/bio-based solids | Wood | 0.604 | 770 | | | 9240 |
| | Bark | 0.627 | 770 | | | 9600 |
| Fuel cell units designed to burn biomass/bio-based solids | Wood | 0.863 | 1100 | | | 9240 |
| | Bark | 0.896 | 1100 | | | 9600 |
| Hybrid suspension grate boiler designed to burn biomass/bio-based solids | Wood | 2.196 | 2800 | | | 9240 |
| | Bark | 2.281 | 2800 | | | 9600 |

[1] Least stringent emission limit selected to calculate EF when NESHAP 5D allows source to choose from among more than one.

For "New" Units (Commencing Construction or Reconstruction after June 4, 2010)

| Boiler Design | Fuel | NESHAP 5D CO Calculated EF (lb/MMBtu) | NESHAP 5D CO Limit Emission Limit[1] (ppmvd@3%$O_2$) | $CF_{3 \rightarrow 0\%O2}$ (no units) | $CF_{ppm \rightarrow lb/dscfCO}$ (lb/dscf / ppm) | $F_d$ (dscf/MMBtu) |
|---|---|---|---|---|---|---|
| Stokers/sloped grate/others designed to burn wet biomass fuel | Wood | 0.486 | 620 | 1.168 | 7.27E-08 | 9240 |
| | Bark | 0.505 | 620 | | | 9600 |
| Stokers/sloped grate/others designed to burn kiln-dried biomass fuel | Wood | 0.361 | 460 | | | 9240 |
| | Bark | 0.375 | 460 | | | 9600 |
| Fluidized bed units designed to burn biomass/bio-based solids | Wood | 0.243 | 310 | | | 9240 |
| | Bark | 0.253 | 310 | | | 9600 |
| Suspension burners designed to burn biomass/bio-based solids | Wood | 1.882 | 2400 | | | 9240 |
| | Bark | 1.956 | 2400 | | | 9600 |
| Dutch ovens/pile burners designed to burn biomass/bio-based solids | Wood | 0.408 | 520 | | | 9240 |
| | Bark | 0.424 | 520 | | | 9600 |
| Fuel cell units designed to burn biomass/bio-based solids | Wood | 0.714 | 910 | | | 9240 |
| | Bark | 0.741 | 910 | | | 9600 |
| Hybrid suspension grate boiler designed to burn biomass/bio-based solids | Wood | 0.863 | 1100 | | | 9240 |
| | Bark | 0.896 | 1100 | | | 9600 |

[1] Least stringent emission limit selected to calculate EF when NESHAP 5D allows source to choose from among more than one.

Option 3: 0.40 lb/MMBtu

Basis: May 13, 2005, Source test at Plummer mill and March 28, 2006, Data Certification by company

Emission rate using highest of three runs (#3): Run 1: 40.3 pph; Run 2: 44.4 pph; Run 3: 54.1 pph; Average = 46.3 pph

Fd fuel factors from RM 19 (40 CFR 60, Appendix A): Bark Fd = 9600 dscf/mmBtu; Wood Fd = 9240 dscf/mmBtu

Calculating the fuel mix Fd, dscf/mmBtu = (bark Fd x %bark/100 + wood Fd x %wood/100)

| Stack Test Run # | Bark Fd | % Bark (remainder is wood) | Wood Fd | Wood % | Fuel Mix Fd |
|---|---|---|---|---|---|
| 3 | 9600 | 47 | 9240 | 53 | 9409.2 |

Calculating the firing rate, mmBtu/hr = stack flow x 60 min/hr / Fd x ((21 - Stack O2%) / (21)

| Stack Test Run # | stack flow, dscf/min | Fuel Mix Fd, dscf/mmBtu | Stack O2% | Firing Rate, mmBtu/hr |
|---|---|---|---|---|
| 3 | 34419 | 9409.2 | 8.1 | 134.8 |

Calculating the EF, lb/mmBtu = emission rate / firing rate

| Test Run #3 Emission Rate, lb/hr | Firing rate, mmBtu/hr | Emission Factor, lb/mmBtu |
|---|---|---|
| 54.1 | 134.8 | 0.40 |

Note: Using highest test run makes EF based on a single test more conservative. If CO limits apply to the boiler, use those to establish PTE.

2 Option 1: 4.8x10$^{-5}$ lb/MMBtu

Basis: AP-42, September 2003. Table 1.6-4.

Note: No FARR, NESHAP or NSPS lead limits apply to wood residue-fired boilers.

3 Option 1: 0.22 lb/MMBtu

Basis: AP-42, September 2003. Table 1.6-2 for wet wood-fired boiler (typically 50% moisture)

Option 2: 0.49 lb/MMBtu

Basis: AP-42, September 2003. Table 1.6-2 for dry wood-fired boiler (typically 10-15% moisture)

Option 3: 0.41 lb/MMBtu

3

Basis: AP-42, September 2003. Table 1.6-2 using a more realistic, but still conservative, 25.5% moisture (70% dry and 30% wet mix); EF, lb/mmBtu = (0.49 x 0.7) + (0.22 x 0.3) = 0.41; Testing in May 2005 at 45% moisture resulted in 0.24 lb/mmBtu, showing that the EF for the assumed mix of fuel is conservative.

Note: Because each source in Pacific Northwest Indian Country is allowed to combust dry wood in its biomass boiler, it is appropriate to assume combustion of higher-emitting dry wood in determining $NO_X$ PTE. When a facility only burns fuel produced onsite which is always a blend that includes bark and wet wood, it is reasonable to consider a more realistic, but conservative, blend of wet and dry fuel for calculating PTE.

4

Option 1: 0.030 - 0.20 lb/MMBtu (EPA Reference Method 5)

Basis: NSPS Subpart Db as follows:

| Maximum Design Heat Input Capacity (MMBtu/hr) | Action* | Date Action Commenced | ACF | NSPS Db PM Emission Limit (lb/MMBtu) | NSPS Db PM Emission Limit (% removal) | Regulatory Citation |
|---|---|---|---|---|---|---|
| 100 < X | C, R, M | 06/19/84 < Y ≤ 02/28/05 | 30% < Z | 0.10 | N/A | 60.43b(c)(1) |
| 100 < X ≤ 250 | C, R, M | 06/19/84 < Y ≤ 02/28/05 | 30% ≥ Z | 0.20 | N/A | 60.43b(c)(2) |
| 100 < X | C, R, M | 02/28/05 < Y | N/A | 0.030 | N/A | 60.43b(h)(1) |
| 100 < X | M | 02/28/05 < Y | N/A | 0.051 | 99.8 | 60.43b(h)(2) |
| 100 < X ≤ 250 | M | 02/28/05 < Y | 30% < Z | 0.10 | N/A | 60.43b(h)(3) |
| 250 < X | M | 02/28/05 < Y | 30% < Z | 0.085 | N/A | 60.43b(h)(4) |

* C - construction, R - reconstruction and M - modification

Option 2: 0.030 - 0.30 lb/MMBtu (EPA Reference Method 5)

Basis: NSPS Subpart Dc as follows:

| Maximum Design Heat Input Capacity (MMBtu/hr) | Action* | Date Action Commenced | ACF | NSPS Dc PM Emission Limit (lb/MMBtu) | NSPS Dc PM Emission Limit (% removal) | Regulatory Citation |
|---|---|---|---|---|---|---|
| 30 ≤ X ≤ 100 | C, R, M | 06/09/89 < Y ≤ 02/28/05 | 30% < Z | 0.10 | N/A | 60.43c(b)(1) |
| | C, R, M | 06/09/89 < Y ≤ 02/28/05 | 30% ≥ Z | 0.30 | N/A | 60.43c(b)(2) |
| | C, R, M | 02/28/05 < Y | N/A | 0.030 | N/A | 60.43c(e)(1) |
| | M | 02/28/05 < Y | N/A | 0.051 | 99.8 | 60.43c(e)(2) |
| | M | 02/28/05 < Y | 30% < Z | 0.10 | N/A | 60.43c(e)(3) |

* C - construction, R - reconstruction and M - modification

Option 3: 0.03 - 0.07 lb/MMBtu (EPA Reference Method 5)

Basis: NESHAP 6J as follows:

| Maximum Design Heat Input Capacity (MMBtu/hr) | Date Construction or Reconstruction Commenced | NESHAP 6J PM Emission Limit (lb/MMBtu) | Regulatory Citation 40 CFR 63.11201(a) and NESHAP 5D… |
|---|---|---|---|
| 30 ≤ X | 06/04/10 < Y | 0.03 | Table 1, Row 3 |
| 10 ≤ X < 30 | 06/04/10 < Y | 0.07 | Table 1, Row 4 |

Option 4: 0.0032 - 0.44 lb/MMBtu (EPA Reference Method 5)

Basis: NESHAP 5D as follows:

• NESHAP 5D specifies a range of different PM emission limits based upon (a) the date the boiler commenced construction or reconstruction, (b) the design of the boiler and (c) type of fuel combusted. For the purpose of this PTE EF exercise, only the emission limits in units of "lb/MMBtu heat input" will be employed here. The source may choose to comply with an alternative "lb/MMBtu heat input" emission limit for total selected metals (TSM). Because TSM constitutes only a fraction of total PM, TSM emission limits will not be considered in determining PM PTE EF. TSM is limited to arsenic, beryllium, cadmium, chromium, lead, manganese, nickel and selenium.

| Maximum Design Heat Input Capacity (MMBtu/hr) | Date Construction or Reconstruction Commenced | Boiler Design | NESHAP 5D PM Emission Limit (lb/MMBtu; 3-run avg) | Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP 5D… |
|---|---|---|---|---|
| 10 ≤ X | Y ≤ 06/04/10 | Stokers/sloped grate/others designed to burn wet biomass fuel | 0.037 | Table 2, Row 7 |
| | | Stokers/sloped grate/others designed to burn kiln-dried biomass fuel | 0.32 | Table 2, Row 8 |
| | | Fluidized bed units designed to burn biomass/bio-based solid | 0.11 | Table 2, Row 9 |
| | | Suspension burners designed to burn biomass/bio-based solid | 0.051 | Table 2, Row 10 |
| | | Dutch ovens/pile burners designed to burn biomass/bio-based solid | 0.28 | Table 2, Row 11 |
| | | Fuel cell units designed to burn biomass/bio-based solid | 0.02 | Table 2, Row 12 |
| | | Hybrid suspension grate boiler designed to burn biomass/bio-based solid | 0.44 | Table 2, Row 13 |
| | 06/04/10 < Y | Stokers/sloped grate/others designed to burn wet biomass fuel | 0.03 | Table 1, Row 7 |
| | | Stokers/sloped grate/others designed to burn kiln-dried biomass fuel | 0.03 | Table 1, Row 8 |
| | | Fluidized bed units designed to burn biomass/bio-based solid | 0.0098 | Table 1, Row 9 |
| | | Suspension burners designed to burn biomass/bio-based solid | 0.03 | Table 1, Row 10 |
| | | Dutch ovens/pile burners designed to burn biomass/bio-based solid | 0.0032 | Table 1, Row 11 |
| | | Fuel cell units designed to burn biomass/bio-based solid | 0.02 | Table 1, Row 12 |
| | | Hybrid suspension grate boiler designed to burn biomass/bio-based solid | 0.026 | Table 1, Row 13 |

Option 5: 0.397 lb/MMBtu for wood and 0.412 lb/MMBtu for bark (EPA Reference Method 5)

Basis: FARR wood-fired boiler stack PM emission limit of 0.2 gr/dscf corrected to 7% $O_2$ at 40 CFR 49.125(d)(2)

EF (lb/MMBtu) = FARR PM Limit (gr/dscf@7%$O_2$) X $CF_{7\rightarrow 0\%O2}$ X $F_d$ (dscf/MMBtu) / $CF_{gr\rightarrow lb}$

• $CF_{7\rightarrow 0\%O2}$ = (20.9 - $X_{O2Fd}$) / (20.9 - $X_{O2FARR}$). To create a correction factor that adjusts the basis of the FARR emission limit from 7% $O_2$ to 0% $O_2$ (the basis for $F_d$), $X_{O2Fd}$ = 0 and $X_{O2FARR}$ = 7. The value 20.9 is the percent by volume of the ambient air that is $O_2$. Decreasing the $O_2$ from the FARR baseline increases the pollutant concentration. See Equation 19-1 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

• $F_d$ = 9,240 dscf/MMBtu for combustion of "wood" or 9,600 dscf/MMBtu for combustion of "wood bark." See Table 19-2 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

| Fuel | FARR PM Calculated EF (lb/MMBtu) | FARR PM Emission Limit (gr/dscf @7%$O_2$) | $CF_{7\rightarrow 0\%O2}$ (unitless) | $F_d$ (dscf/MMBtu) | $CF_{gr\rightarrow lb}$ (gr/lb) |
|---|---|---|---|---|---|
| Wood | 0.397 | 0.2 | 1.504 | 9240 | 7000 |
| Bark | 0.412 | 0.2 | 1.504 | 9600 | 7000 |

Option 6: 0.35 lb/MMBtu (EPA Reference Method 5)

Basis: (a) AP-42, September 2003. Table 1.6-1 with fuel blending and installation of mechanical collectors to comply with FARR PM limit.

According to AP-42 Table 1.6-1, combustion of bark and wet wood while blending bark with wood (a typical scenario for Stimson) with only a mechanical collector (multiclone) results in PM emissions of 0.35 lb/MMBtu which complies with the FARR PM emission limit (0.397 to 0.412 lb/mmBtu). Although Stimson has a wet scrubber downstream of the muliclone (which will result in much lower actual emissions), for PTE we can conservatively assume the scrubber is operating effectively, but the multiclone should operate relatively consistently.

5

Option 1: 0.047 - 0.217 lb/MMBtu

Basis: NSPS Subpart Db (0.03 - 0.20 lb/MMBtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 2: 0.047 - 0.317 lb/MMBtu

Basis: NSPS Subpart Dc (0.03 - 0.30 lb/MMBtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 3: 0.047 - 0.087 lb/MMBtu

Basis: NESHAP 6J (0.03 - 0.07 lb/MMbtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 4: 0.0202 - 0.457 lb/MMBtu

Basis: NESHAP 5D (0.0032 - 0.44 lb/MMBtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 5: 0.429 lb/MMBtu

Basis: FARR wood-fired boiler stack PM emission limit of 0.2 gr/dscf corrected to 7% $O_2$ at 40 CFR 49.125(d)(2) for filterable portion and AP-42 for condensible portion.

As stated previously in analysis of PM EF, an EF of 0.412 is calculated assuming compliance with FARR PM limit and combustion of bark. EPA Reference Method 5 is the test method employed to determine compliance with the limit. EPA Reference Method 5 measures only filterable PM, but $PM_{10}$ consists of both a filterable and condensible portion. AP-42 estimates the condensible contribution to be 0.017 lb/MMBtu. Adding the two together, 0.412 + 0.017 = 0.429 lb/MMBtu.

Option 6: 0.367 lb/MMBtu

Basis: (a) AP-42, September 2003. Table 1.6-1 with fuel blending and installation of mechanical collectors to comply with FARR PM limit and adding condensables.

As stated previously in analysis of PM EF, an EF of 0.35 lb/mmBtu is from AP42 and based on filterable PM, a multiclone control device and fuel blending. A slightly lower value can be used for PM10 if a source needs that and is willing to use PM10 test methods. EPA Reference Method 5 is the test method employed to determine compliance with the filterable PM limit. EPA Reference Method 5 measures only filterable PM, but $PM_{10}$ consists of both a filterable and condensible portion. AP-42 estimates the condensible contribution to be 0.017 lb/MMBtu. Adding the two together, 0.35 + 0.017 = 0.367 lb/MMBtu.

6

Option 1: 0.047 - 0.217 lb/MMBtu

Basis: NSPS Subpart Db (0.03 - 0.20 lb/MMBtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 2: 0.047 - 0.317 lb/MMBtu

Basis: NSPS Subpart Dc (0.03 - 0.30 lb/MMBtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 3: 0.047 - 0.087 lb/MMBtu

Basis: NESHAP 6J (0.03 - 0.07 lb/MMbtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 4: 0.0202 - 0.457 lb/MMBtu

Basis: NESHAP 5D (0.0032 - 0.44 lb/MMBtu) as noted above for PM plus 0.017 lb/MMBtu condensible portion as noted in AP-42.

Option 5: 0.429 lb/MMBtu

Basis: FARR wood-fired boiler stack PM emission limit of 0.2 gr/dscf corrected to 7% $O_2$ at 40 CFR 49.125(d)(2) for filterable portion and AP-42 for condensible portion.

As stated previously in analysis of PM EF, an EF of 0.412 is calculated assuming compliance with FARR PM limit and combustion of bark. EPA Reference Method 5 is the test method employed to determine compliance with the limit. EPA Reference Method 5 measures only filterable PM, but $PM_{2.5}$ consists of both a filterable and condensible portion. AP-42 estimates the condensible contribution to be 0.017 lb/MMBtu. Adding the two together, 0.412 + 0.017 = 0.429 lb/MMBtu.

Option 6: 0.367 lb/MMBtu

Basis: (a) AP-42, September 2003. Table 1.6-1 with fuel blending and installation of mechanical collectors to comply with FARR PM limit and adding condensables.

As stated previously in analysis of PM EF, an EF of 0.35 lb/mmBtu is from AP42 and based on filterable PM, a multiclone control device and fuel blending. A lower value can be used for PM2.5 if a source needs that and is willing to use PM2.5 test methods. EPA Reference Method 5 is the test method employed to determine compliance with the filterable PM limit. EPA Reference Method 5 measures only filterable PM, but PM2.5 consists of both a filterable and condensible portion. AP-42 estimates the condensible contribution to be 0.017 lb/MMBtu. Adding the two together, 0.35 + 0.017 = 0.367 lb/MMBtu.

7

Option 1: 1.153 lb/MMBtu for wood and 1.198 lb/MMBtu for bark

Basis: FARR combustion source stack $SO_2$ emission limit of 500 parts per million by volume dry basis (ppmvd) corrected to 7% $O_2$ at 40 CFR 49.129(d)(1)

EF (lb/MMBtu) = FARR $SO_2$ Limit (ppmvd@7%$O_2$) X $CF_{7\rightarrow 0\%O2}$ X $CF_{ppm\rightarrow lb/dscfSO2}$ X $F_d$ (dscf/MMBtu)

• $CF_{7\rightarrow 0\%O2}$ = (20.9 - $X_{O2Fd}$) / (20.9 - $X_{O2FARR}$). To create a correction factor that adjusts the basis of the FARR emission limit from 7% $O_2$ to 0% $O_2$ (the basis for $F_d$), $X_{O2Fd}$ = 0 and $X_{O2FARR}$ = 7. The value 20.9 is the percent by volume of the ambient air that is $O_2$. Decreasing the $O_2$ from the FARR baseline increases the pollutant concentration. See Equation 19-1 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

• $CF_{ppm\rightarrow lb/dscfSO2}$ = 1.660 X $10^{-7}$ lb $SO_2$/dscf / ppm $SO_2$. See Table 19-1 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

• $F_d$ = 9,240 dscf/MMBtu for combustion of "wood" or 9,600 dscf/MMBtu for combustion of "wood bark." See Table 19-2 of EPA Method 19 at Appendix A-7 to 40 CFR Part 60.

| Fuel | FARR 500 ppm Calculate $SO_2$ EF (lb/MMBtu) | FARR $SO_2$ Emission Limit (ppmvd@7%$O_2$) | $CF_{7\rightarrow 0\%O2}$ (unitless) | $CF_{ppm\rightarrow lb/dscfSO2}$ (lb/dscf / ppm) | $F_d$ (dscf/MMBtu) |
|---|---|---|---|---|---|
| Wood | 1.153 | 500 | 1.504 | 1.66E-07 | 9240 |
| Bark | 1.198 | 500 | 1.504 | 1.66E-07 | 9600 |

Option 2: 4.615 lb/MMBtu for wood and 4.444 lb/MMBtu for bark

Basis: FARR solid fuel sulfur limit of 2% by weight (dry) at 40 CFR 49.130(d)(7)

EF (lb/MMBtu) = {[FARR Fuel S Limit (%S) / 100] X $CF_{S\rightarrow SO2}$ / $HV_{fuel}$ (Btu/lb)} X $CF_{Btu\rightarrow MMBtu}$ (Btu/MMBtu)

• $CF_{S\rightarrow SO2}$ = 2 lb $SO_2$/lb S. S + $O_2$ → $SO_2$. For every 1 mol S (16 lb/lb-mol) reactant, there is 1 mol $SO_2$ (32 lb/lb-mol) product. 32 / 16 = 2.

• HV (heating value) wood (dry) = 8,667 Btu/lb. (5200/(1-0.4)). HV bark (dry) = 9,000 Btu/lb. (4500/(1-0.5)). See page A-5 of Appendix A to AP-42, September 1985.

| Fuel | FARR Fuel S Calculate $SO_2$ EF (lb/MMBtu) | FARR Fuel Sulfur Limit (% by weight) | $CF_{S\rightarrow SO2}$ (lb $SO_2$/lb S) | $HV_{fuel}$ (Btu/lb) | $CF_{Btu\rightarrow MMBtu}$ (Btu/MMBtu) |
|---|---|---|---|---|---|
| Wood | 4.615 | 2 | 2 | 8667 | 1.0E+06 |
| Bark | 4.444 | 2 | 2 | 9000 | 1.0E+06 |

Option 3: 0.069 lb/MMBtu for wood and 0.067 lb/MMBtu for bark

Basis: Bark upper bound sulfur estimate of 0.2% by weight (dry) and 15% conversion to $SO_2$. See H. S. Oglesby & R. O. Blosser (1980) Information on the Sulfur Content of Bark and Assuming that 15 percent of sulfur introduced to boiler is exhausted as $SO_2$ strikes a balance between Option 3's 100% and Option 4's 10% sulfur-to-$SO_2$ conversion factors. A 15%

EF (lb/MMBtu) = {[Upper bound S Content (%S) / 100] X $CF_{S\rightarrow SO2}$ / $HV_{fuel}$ (Btu/lb)} X $CF_{Btu\rightarrow MMBtu}$ (Btu/MMBtu)

• $CF_{S\rightarrow SO2}$ = 2 lb $SO_2$/lb S. S + $O_2$ → $SO_2$. For every 1 mol S (16 lb/lb-mol) reactant, there is 1 mol $SO_2$ (32 lb/lb-mol) product. 32 / 16 = 2. Assume that only 15% of sulfur is exhausted to atmosphere as $SO_2$. The balance precipitates out as sulfates in the ash. Multiplying by 0.15, resultant $CF_{S\rightarrow SO2}$ = 0.3 lb $SO_2$/lb S.

• HV (heating value) wood (dry) = 8,667 Btu/lb. (5200/(1-0.4)). HV bark (dry) = 9,000 Btu/lb. (4500/(1-0.5)). See page A-5 of Appendix A to AP-42, September 1985.

| | Calculate $SO_2$ EF (lb/MMBtu) | Reasonable Upper Bound Fuel Sulfur Content (% by weight) | 15% Conversion $CF_{S\rightarrow SO2}$ (lb $SO_2$/lb S) | $HV_{fuel}$ (Btu/lb) | $CF_{Btu\rightarrow MMBtu}$ (Btu/MMBtu) |
|---|---|---|---|---|---|
| Wood | 0.069 | 0.2 | 0.3 | 8667 | 1.0E+06 |
| Bark | 0.067 | 0.2 | 0.3 | 9000 | 1.0E+06 |

Option 4: 0.025 lb/MMBtu

Basis: AP-42, September 2003. Table 1.6-2.

Note:

Option 1: 0.023 lb/MMBtu

Basis: AP-42, September 2003. Table 1.6-3 and calculating VOC as compound emitted.

Calculating VOC (as weighted-average VOC)

VOC (as weighted-average VOC) = $(VOC_C)$ X $[(MW_{wt\text{-}avg\ VOC}) / (MW_C)]$ X $[(\#C_C) / (\#C_{wt\text{-}avg\ VOC})]$

where:

$VOC_C$ equals "0.017 lb/MMBtu" from AP-42, September 2003. Table 1.6-3.

$MW_{wt\text{-}avg\ VOC}$ equals "64.689 lb/lb-mol" and is the weighted-average molecular weight for VOC assuming speciated organic compound ratios supported by AP-42 Table 1.6-3

$MW_C$ equals "12.0110 lb/lb-mol" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25 VOC test results were determined

$\#C_{wt\text{-}avg\ VOC}$ equals "3.975" and is the weighted-average number of carbon atoms present in VOC assuming speciated organic compound ratios supported by AP-42 Table 1.6-3

Calculating value for VOC (as weighted-average VOC):

| | | |
|---|---|---|
| VOC (as carbon): | 0.017 | lb/MMBtu |
| $MW_{wt\text{-}avg\ VOC}$: | 64.689 | lb/lb-mol |
| $MW_C$: | 12.011 | lb/lb-mol |
| $\#C_C$: | 1 | |
| $\#C_{wt\text{-}avg\ VOC}$: | 3.975 | |
| VOC (as weighted average VOC) | 0.023 | lb/MMBtu |

The first two columns of the following table are extracted from AP-42, September 2003. Table 1.6-3. The third and fourth columns were created based upon information widely available over the internet. The fifth and sixth columns illustrate calculations necessary to determine weighted-average molecular weight and weighted-average number of carbon atoms comprising VOC emissions resulting from wood residue combustion.

| Wood Residue Combustion Organic Compounds | EF (lb/MMBtu) | MW lb/lb-mol | Number of Carbon Atoms | EF x MW | EF X #C atoms |
|---|---|---|---|---|---|
| Acenaphthene | 9.10E-07 | 154.21 | 12 | 1.40E-04 | 1.09E-05 |
| Acenaphthylene | 5.00E-06 | 152.19 | 12 | 7.61E-04 | 6.00E-05 |
| Acetaldehyde | 8.30E-04 | 44.05 | 2 | 3.66E-02 | 1.66E-03 |
| Acetone | 1.90E-04 | 58.08 | 3 | 1.10E-02 | 5.70E-04 |
| Acetophenone | 3.20E-09 | 120.15 | 8 | 3.84E-07 | 2.56E-08 |
| Acrolein | 4.00E-03 | 56.06 | 3 | 2.24E-01 | 1.20E-02 |
| Anthracene | 3.00E-06 | 178.23 | 14 | 5.35E-04 | 4.20E-05 |
| Benzaldehyde | 8.50E-07 | 106.12 | 7 | 9.02E-05 | 5.95E-06 |
| Benzene | 4.20E-03 | 78.11 | 6 | 3.28E-01 | 2.52E-02 |
| Benzo(a)anthracene | 6.50E-08 | 228.29 | 18 | 1.48E-05 | 1.17E-06 |
| Benzo(a)pyrene | 2.60E-06 | 252.31 | 20 | 6.56E-04 | 5.20E-05 |
| Benzo(b)fluoranthene | 1.00E-07 | 252.31 | 20 | 2.52E-05 | 2.00E-06 |
| Benzo(e)pyrene | 2.60E-09 | 252.31 | 20 | 6.56E-07 | 5.20E-08 |
| Benzo(g,h,i)perylene | 9.30E-08 | 276.33 | 22 | 2.57E-05 | 2.05E-06 |
| Benzo(j,k)fluoranthene | 1.60E-07 | 202.26 | 16 | 3.24E-05 | 2.56E-06 |
| Benzo(k)fluoranthene | 3.60E-08 | 252.31 | 20 | 9.08E-06 | 7.20E-07 |
| Benzoic acid | 4.70E-08 | 122.12 | 7 | 5.74E-06 | 3.29E-07 |
| Bis(2-ethylhexyl)phthalate (DEHP) | 4.70E-08 | 390.56 | 24 | 1.84E-05 | 1.13E-06 |
| Bromomethane (Methyle bromide) | 1.50E-05 | 94.94 | 1 | 1.42E-03 | 1.50E-05 |
| 2-Butanone (MEK) | 5.40E-06 | 72.11 | 4 | 3.89E-04 | 2.16E-05 |
| Carbazole | 1.80E-06 | 167.21 | 12 | 3.01E-04 | 2.16E-05 |
| Carbon tetrachloride | 4.50E-05 | 153.82 | 1 | 6.92E-03 | 4.50E-05 |
| Chlorobenzene | 3.30E-05 | 112.56 | 6 | 3.71E-03 | 1.98E-04 |
| Chloroform | 2.80E-05 | 119.38 | 1 | 3.34E-03 | 2.80E-05 |
| Chloromethane (Methyl chloride) | 2.30E-05 | 50.49 | 1 | 1.16E-03 | 2.30E-05 |
| 2-Chloronaphthalene | 2.40E-09 | 162.62 | 10 | 3.90E-07 | 2.40E-08 |
| 2-Chlorophenol | 2.40E-08 | 128.56 | 6 | 3.09E-06 | 1.44E-07 |
| Chrysene | 3.80E-08 | 228.28 | 18 | 8.67E-06 | 6.84E-07 |
| Crotonaldehyde | 9.90E-06 | 70.09 | 4 | 6.94E-04 | 3.96E-05 |
| Decachlorobiphenyl | 2.70E-10 | 498.6584 | 12 | 1.35E-07 | 3.24E-09 |
| Dibenzo(a,h)anthracene | 9.10E-09 | 278.35 | 22 | 2.53E-06 | 2.00E-07 |
| 1,2-Dibromoethene | 5.50E-05 | 185.85 | 2 | 1.02E-02 | 1.10E-04 |
| Dichlorobiphenyl | 7.40E-10 | 223.09792 | 12 | 1.65E-07 | 8.88E-09 |
| 1,2-Dichloroethane (Ethylene dichloride) | 2.90E-05 | 98.96 | 2 | 2.87E-03 | 5.80E-05 |
| Dichloromethane (Methylene chloride) | 2.90E-04 | 84.93 | 2 | 2.46E-02 | 5.80E-04 |
| 1,2-Dichloropropane (Propylene dichloride) | 3.30E-05 | 122.99 | 3 | 4.06E-03 | 9.90E-05 |
| 2,4-Dinitrophenol | 1.80E-07 | 184.11 | 6 | 3.31E-05 | 1.08E-06 |
| Ethyl benzene | 3.10E-05 | 106.17 | 8 | 3.29E-03 | 2.48E-04 |
| Fluoranthene | 1.60E-06 | 202.26 | 16 | 3.24E-04 | 2.56E-05 |
| Fluorene | 3.40E-06 | 166.22 | 13 | 5.65E-04 | 4.42E-05 |
| Formaldehyde | 4.40E-03 | 30.03 | 1 | 1.32E-01 | 4.40E-03 |
| Heptachlorobiphenyl | 6.60E-11 | 395.32322 | 12 | 2.61E-08 | 7.92E-10 |
| Hexachlorobiphenyl | 5.50E-10 | 360.87816 | 12 | 1.98E-07 | 6.60E-09 |
| Hexanal | 7.00E-06 | 100.15888 | 6 | 7.01E-04 | 4.20E-05 |
| Heptachlorodibenzo-p-dioxins | 2.00E-09 | 425.30614 | 12 | 8.51E-07 | 2.40E-08 |
| Heptachlorodibenzo-p-furans | 2.40E-10 | 409.30674 | 12 | 9.82E-08 | 2.88E-09 |
| Hexachlorodibenzo-p-dioxins | 1.60E-06 | 390.82 | 12 | 6.25E-04 | 1.92E-05 |
| Hexachlorodibenzo-p-furans | 2.80E-10 | 374.86168 | 12 | 1.05E-07 | 3.36E-09 |
| Indeno(1,2,3-cd)pyrene | 8.70E-08 | 326.34 | 22 | 2.84E-05 | 1.91E-06 |
| Isobutyraldehyde | 1.20E-05 | 72.10572 | 4 | 8.65E-04 | 4.80E-05 |
| 2-Methylnaphthalene | 1.60E-07 | 142.20 | 11 | 2.28E-05 | 1.76E-06 |
| Monochlorobiphenyl | 2.20E-10 | 187.64492 | 12 | 4.13E-08 | 2.64E-09 |
| Naphthalene | 9.70E-05 | 128.17 | 10 | 1.24E-02 | 9.70E-04 |
| 2-Nitrophenol | 2.40E-07 | 139.11 | 6 | 3.34E-05 | 1.44E-06 |
| 4-Nitrophenol | 1.10E-07 | 139.11 | 6 | 1.53E-05 | 6.60E-07 |
| Octachlorodibenzo-p-dioxins | 6.60E-08 | 459.7512 | 12 | 3.03E-05 | 7.92E-07 |
| Octachlorodibenzo-p-furans | 8.80E-11 | 443.7518 | 12 | 3.91E-08 | 1.06E-09 |
| Pentachlorodibenzo-p-dioxins | 1.50E-09 | 356.41602 | 12 | 5.35E-07 | 1.80E-08 |
| Pentachlorodibenzo-p-furans | 4.20E-10 | 340.41662 | 12 | 1.43E-07 | 5.04E-09 |
| Pentachlorobiphenyl | 1.20E-09 | 326.4331 | 12 | 3.92E-07 | 1.44E-08 |
| Pentachlorophenol | 5.10E-08 | 266.34 | 6 | 1.36E-05 | 3.06E-07 |
| Perylene | 5.20E-10 | 252.31 | 20 | 1.31E-07 | 1.04E-08 |
| Phenanthrene | 7.00E-06 | 178.23 | 14 | 1.25E-03 | 9.80E-05 |
| Phenol | 5.10E-05 | 94.11 | 6 | 4.80E-03 | 3.06E-04 |
| Propanal | 3.20E-06 | 58.08 | 3 | 1.86E-04 | 9.60E-06 |
| Propionaldehyde | 6.10E-05 | 58.08 | 3 | 3.54E-03 | 1.83E-04 |
| Pyrene | 3.70E-06 | 202.25 | 16 | 7.48E-04 | 5.92E-05 |
| Styrene | 1.90E-03 | 104.15 | 8 | 1.98E-01 | 1.52E-02 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxins | 8.60E-12 | 321.97096 | 12 | 2.77E-09 | 1.03E-10 |
| Tetrachlorodibenzo-p-dioxins | 4.70E-10 | 321.97096 | 12 | 1.51E-07 | 5.64E-09 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 2,3,7,8-Tetrachlorodibenzo-p-furans | 9.00E-11 | 305.97156 | 12 | 2.75E-08 | 1.08E-09 |
| | Tetrachlorodibenzo-p-furans | 7.50E-10 | 305.97156 | 12 | 2.29E-07 | 9.00E-09 |
| | Tetrachlorobiphenyl | 2.50E-09 | 291.98804 | 12 | 7.30E-07 | 3.00E-08 |
| | Tetrachloroethene (Tetrachloroethylene) | 3.80E-05 | 165.83 | 2 | 6.30E-03 | 7.60E-05 |
| | o-Tolualdehyde | 7.20E-06 | 120.15 | 8 | 8.65E-04 | 5.76E-05 |
| | p-Tolualdehyde | 1.10E-05 | 120.15 | 8 | 1.32E-03 | 8.80E-05 |
| | Toluene | 9.20E-04 | 92.14 | 7 | 8.48E-02 | 6.44E-03 |
| | Trichlorobiphenyl | 2.60E-09 | 257.54298 | 12 | 6.70E-07 | 3.12E-08 |
| | 1,1,1-trichloroethane (Methyl chloroform) | 3.10E-05 | 133.40 | 2 | 4.14E-03 | 6.20E-05 |
| | Trichloroethene (Trichloroethylene) | 3.00E-05 | 131.39 | 2 | 3.94E-03 | 6.00E-05 |
| | Trichlorofluoromethane | 4.10E-05 | 137.37 | 1 | 5.63E-03 | 4.10E-05 |
| | 2,4,6-Trichlorophenol | 2.20E-08 | 197.45 | 6 | 4.34E-06 | 1.32E-07 |
| | Vinyl chloride | 1.80E-05 | 62.50 | 2 | 1.13E-03 | 3.60E-05 |
| | o-Xylene | 2.50E-05 | 106.16 | 8 | 2.65E-03 | 2.00E-04 |
| | **TOTAL** | 1.75E-02 | | | 1.13E+00 | 6.96E-02 |
| | | | | weighted-average molecular weight of VOC → | 64.689 | 3.975 ← weighted-average number of carbon atoms comprising VOC |

9

Option 1: 195 lb $CO_2$e/MMBtu

Basis: (a) AP-42, September 2003. Table 1.6-3. (b) 40 CFR 98, Subpart A. Table A-1.

EF (lb $CO_2$e/MMBtu) = EF (lb $CO_2$/MMBtu) X $GWP_{CO2}$ (lb $CO_2$e/lb $CO_2$)

| AP-42 Calculated $CO_2$e EF (lb $CO_2$e/MMBtu) | AP-42 EF (lb $CO_2$/MMBtu) | 40 CFR 98 $GWP_{CO2}$ (lb $CO_2$e/lb $CO_2$) |
|---|---|---|
| 195.0 | 195 | 1 |

Option 2: 206.8 lb $CO_2$e/MMBtu

Basis: (a) 40 CFR 98, Subpart C. Table C-1. (b) 40 CFR 98, Subpart A. Table A-1.

EF (lb $CO_2$e/MMBtu) = EF (kg $CO_2$/MMBtu) X $CF_{kg \rightarrow lb}$ (lb/kg) X $GWP_{CO2}$ (lb $CO_2$e/lb $CO_2$)

| 40 CFR 98 Calculated $CO_2$e EF (lb $CO_2$e/MMBtu) | 40 CFR 98 EF (kg $CO_2$/MMBtu) | $CF_{kg \rightarrow lb}$ (lb/kg) | 40 CFR 98 $GWP_{CO2}$ (lb $CO_2$e/lb $CO_2$) |
|---|---|---|---|
| 206.8 | 93.8 | 2.20462262 | 1 |

Note: EPA's March 2011 guidance document "PSD and Title V Permitting Guidance for Greenhouse Gases" states that the GHG Report Rule (40 CFR 98), "should be considered a primary reference for sources and permitting authorities in estimating GHG emissions and establishing measurement techniques when preparing or processing permit applications."

10

Option 1: 0.4 lb $CO_2$e/MMBtu

Basis: (a) AP-42, September 2003. Table 1.6-3. (b) 40 CFR 98, Subpart A. Table A-1.

EF (lb $CO_2$e/MMBtu) = EF (lb $CH_4$/MMBtu) X $GWP_{CH4}$ (lb $CO_2$e/lb $CH_4$)

| AP-42 Calculated $CO_2$e EF (lb $CO_2$e/MMBtu) | AP-42 EF (lb $CH_4$/MMBtu) | 40 CFR 98 $GWP_{CH4}$ (lb $CO_2$e/lb $CH_4$) |
|---|---|---|
| 0.4 | 0.021 | 21 |

Option 2: 1.5 lb $CO_2$e/MMBtu

Basis: (a) 40 CFR 98, Subpart C. Table C-2. (b) 40 CFR 98, Subpart A. Table A-1.

EF (lb $CO_2$e/MMBtu) = EF (kg $CH_4$/MMBtu) X $CF_{kg \rightarrow lb}$ (lb/kg) X $GWP_{CH4}$ (lb $CO_2$e/lb $CH_4$)

| 40 CFR 98 Calculated $CO_2$e EF (lb $CO_2$e/MMBtu) | 40 CFR 98 EF (kg $CH_4$/MMBtu) | $CF_{kg \rightarrow lb}$ (lb/kg) | 40 CFR 98 $GWP_{CH4}$ $GWP_{CH4}$ (lb $CO_2$e/lb $CH_4$) |
|---|---|---|---|
| 1.5 | 0.032 | 2.20462262 | 21 |

Note: EPA's March 2011 guidance document "PSD and Title V Permitting Guidance for Greenhouse Gases" states that the GHG Report Rule (40 CFR 98), "should be considered a primary reference for sources and permitting authorities in estimating GHG emissions and establishing measurement techniques when preparing or processing permit applications."

11

Option 1: 4.0 lb $CO_2$e/MMBtu

Basis: (a) AP-42, September 2003. Table 1.6-3. (b) 40 CFR 98, Subpart A. Table A-1.

EF (lb $CO_2$e/MMBtu) = EF (lb $N_2O$/MMBtu) X $GWP_{N2O}$ (lb $CO_2$e/lb $N_2O$)

| AP-42 Calculated $CO_2$e EF (lb $CO_2$e/MMBtu) | AP-42 EF (lb $N_2O$/MMBtu) | 40 CFR 98 $GWP_{N2O}$ (lb $CO_2$e/lb $N_2O$) |
|---|---|---|
| 4.0 | 0.013 | 310 |

Option 2: 2.9 lb $CO_2$e/MMBtu

Basis: (a) 40 CFR 98, Subpart C. Table C-2. (b) 40 CFR 98, Subpart A. Table A-1.

EF (lb $CO_2$e/MMBtu) = EF (kg $N_2O$/MMBtu) X $CF_{kg \rightarrow lb}$ (lb/kg) X $GWP_{N2O}$ (lb $CO_2$e/lb $N_2O$)

| 40 CFR 98 Calculated $CO_2$e EF (lb $CO_2$e/MMBtu) | 40 CFR 98 EF (kg $N_2O$/MMBtu) | $CF_{kg \rightarrow lb}$ (lb/kg) | 40 CFR 98 $GWP_{N2O}$ (lb $CO_2$e/lb $N_2O$) |
|---|---|---|---|
| 2.9 | 0.0042 | 2.20462262 | 310 |

Note: EPA's March 2011 guidance document "PSD and Title V Permitting Guidance for Greenhouse Gases" states that the GHG Report Rule (40 CFR 98), "should be considered a primary reference for sources and permitting authorities in estimating GHG emissions and establishing measurement techniques when preparing or processing permit applications."

ACF: Annual Capacity Factor for Wood
C: Construction
CF: Conversion Factor
EF: Emission Factor
FARR: Federal Air Rules for Reservations
GWP: Global Warming Potential
HV: Heating Value
M: Modification
MW: Molecular Weight
PTE: Potential to Emit
R: Reconstruction

**EPA Region 10 Hazardous Air Pollutant Potential to Emit Emission Factors for Wood Residue-Fired Boilers, July 2013.**

| HAP Categories | EF (lb/MMBtu) |
|---|---|
| Trace Metal Compounds[1] | 1.78E-03 |
| Other Inorganic Compounds[2] | 1.61E-02 |
| Organic Compounds[3] | 1.72E-02 |
| **TOTAL** | 3.50E-02 |

[1] See Table 1.
[2] See Table 2.
[3] See Table 3.

**Table 1 - Trace Metal HAP EF[1]**

| Trace Metal Compounds | EF (lb/MMBtu) |
|---|---|
| Antimony Compounds | 7.90E-06 |
| Arsenic Compounds (including arsine) | 2.20E-05 |
| Beryllium Compounds | 1.10E-06 |
| Cadmium Compounds | 4.10E-06 |
| Chromium Compounds (including hexavalent) | 2.10E-05 |
| Cobalt Compounds | 6.50E-06 |
| Lead Compounds (not elemental lead) | 4.80E-05 |
| Manganese Compounds | 1.60E-03 |
| Mercury Compounds[2] | 3.50E-06 |
| Nickel Compounds | 3.30E-05 |
| Phophorus | 2.70E-05 |
| Selenium Compounds | 2.80E-06 |
| **SUBTOTAL** | 1.78E-03 |

EF Basis: AP-42, September 2003. Table 1.6-4.

[1] Major Source Boiler MACT ("NESHAP Subpart DDDDD" or "NESHAP 5D") provides a source the option of complying with an emission limit for either PM or total selected metals (TSM). TSM includes only arsenic, beryllium, cadmium, chromium, lead, manganese, nickel and selenium. Because NESHAP 5D does not limit TSM compounds individually, it is not possible to create compound-specific EF. AP-42 will remain the basis for the PTE EF even if a boiler is subject to NESHAP 5D.

[2] If boiler is subject to NESHAP 5D, do not use mercury EF listed in table. Instead, employ emission limits specified in table immediately below beginning on source's compliance date. Existing sources must comply with NESHAP 5D emission limits beginning circa January 1, 2016.

| Maximum Design Heat Input Capacity (MMBtu/hr) | Date Construction or Reconstruction Commenced | NESHAP 5D Mercury Emission Limit (lb/MMBtu) | Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP 5D… |
|---|---|---|---|
| 10 ≤ X | Y ≤ 06/04/10 | 5.7E-06 | Table 2, Row 1 |
| | 06/04/10 < Y | 8.0E-07 | Table 1, Row 1 |

**Table 2 - Other Inorganic HAP EF**

| Other Inorganic Compounds | EF (lb/MMBtu) |
|---|---|
| Chlorine | 7.90E-04 |
| Hydrochloric acid (hydrogen chloride)[1] | 1.53E-02 |
| **SUBTOTAL** | 1.61E-02 |

EF Basis: AP-42, September 2003. Table 1.6-3.

[1] Option 1 is AP-42 where EF = 0.019 lb/mmBtu. Option 2 is based on the highest (monthly rolling) annual average fuel chlorine (1.721 lbCl/bdt) using actual fuel sampling data at the Plummer facility, the heat value for wood (8667 Btu/lb dry) from AP-42 and assuming only 15% of the chlorine in the fuel becomes HCl. No reduction for the wet scrubber has been assumed. EF = 1.721 x (36 lb HCl / 35 lb Cl) / 8667 / (2000 lb/ton) * (1,000,000 Btu/mmBtu) * (0.15 lb HCl / lb Cl) = 0.0153 lb/mmBtu. The 15% chlorine conversion factor comes from testing at Boise Building Solutions, Elgin Complex: Boilers 1 and 2, April 5, 2012.

| Maximum Design Heat Input Capacity (MMBtu/hr) | Date Construction or Reconstruction Commenced | NESHAP 5D Hydrogen Chloride Emission Limit (lb/MMBtu) | Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP 5D… |
|---|---|---|---|
| 10 ≤ X | Y ≤ 06/04/10 | 2.2E-02 | Table 2, Row 1 |
| 10 ≤ X | 06/04/10 < Y | 2.2E-02 | Table 1, Row 1 |

**Table 3 - Organic HAP EF**

| Organic Compounds | EF (lb/MMBtu) |
|---|---|
| Acetaldehyde | 8.30E-04 |
| Acetophenone | 3.20E-09 |
| Acrolein | 4.00E-03 |
| Benzene | 4.20E-03 |
| Bis(2-ethylhexyl)phthalate (DEHP) | 4.70E-08 |
| Carbon tetrachloride | 4.50E-05 |
| Chlorobenzene | 3.30E-05 |
| Chloroform | 2.80E-05 |
| Dibenzofurans*,[1] | 1.87E-09 |
| 2,4-Dinitrophenol | 1.80E-07 |
| Ethyl benzene | 3.10E-05 |
| Ethylene dichloride (1,2-Dichloroethane) | 2.90E-05 |
| Formaldehyde | 4.40E-03 |
| Methyl bromide (Bromomethane) | 1.50E-05 |
| Methyl chloride (Chloromethane) | 2.30E-05 |
| Methyl chloroform (1,1,1-trichloroethane) | 3.10E-05 |
| Methylene chloride (Dichloromethane) | 2.90E-04 |
| Naphthalene* | 9.70E-05 |
| 4-Nitrophenol | 1.10E-07 |
| Pentachlorophenol | 5.10E-08 |
| Phenol | 5.10E-05 |
| Polychlorinated biphenyls (PCB)[2] | 8.15E-09 |
| Polycyclic Organic Matter (POM)[3] | 1.27E-04 |
| Propionaldehyde | 6.10E-05 |
| Propylene dichloride (1,2-Dichloropropane) | 3.30E-05 |
| Styrene | 1.90E-03 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin* | 8.60E-12 |
| Tetrachloroethylene (tetrachloroethene) | 3.80E-05 |
| Toluene | 9.20E-04 |
| Trichloroethylene (Trichloroethene) | 3.00E-05 |
| 2,4,6-Trichlorophenol | 2.20E-08 |
| Vinyl chloride | 1.80E-05 |
| Xylenes (inlc isomers and mixtures) | 2.50E-05 |
| **SUBTOTAL[4]** | 1.72E-02 |

EF Basis: AP-42, September 2003. Table 1.6-3.

* designates a HAP that is subject individually to the 10 tpy major source threshold, but that is also one of several polycyclic organic matter (POM) compounds that, in aggregate, are subject to the same 10 tpy major source threshold.

[1] See Table 4 for list of individual dibenzofurans.

[2] See Table 5 for list of individual polychlorinated biphenyls (PCBs).

[3] See Table 6 for list of individual polycyclic organic matter (POM) compounds. POM defines a broad class of compounds that generally includes all organic structures having two or more fused aromatic rings (i.e., rings that share a common border), and that have a boiling point greater than or equal to 212°F (100°C). See http://www.epa.gov/ttn/atw/hlthef/polycycl.html#ref11

[4] Because dibenzofurans, naphthalene and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (one of several dibenzodioxins) are accounted for individually and in the calculation of POM EF, their individual contribution here is discounted so as to avoid double-counting.

**Table 4 - Dibenzofurans EF**

| Dibenzofurans | EF (lb/MMBtu) |
|---|---|
| Heptachlorodibenzo-p-furans | 2.40E-10 |
| Hexachlorodibenzo-p-furans | 2.80E-10 |
| Octachlorodibenzo-p-furans | 8.80E-11 |
| Pentachlorodibenzo-p-furans | 4.20E-10 |
| 2,3,7,8-Tetrachlorodibenzo-p-furans | 9.00E-11 |
| Tetrachlorodibenzo-p-furans | 7.50E-10 |
| **SUBTOTAL** | 1.87E-09 |

EF Basis: AP-42, September 2003. Table 1.6-3.

**Table 5 - PCB EF**

| PCB Compounds | EF (lb/MMBtu) |
|---|---|
| Decachlorobiphenyl | 2.70E-10 |
| Dichlorobiphenyl | 7.40E-10 |
| Heptachlorobiphenyl | 6.60E-11 |
| Hexachlorobiphenyl | 5.50E-10 |
| Monochlorobiphenyl | 2.20E-10 |
| Pentachlorobiphenyl | 1.20E-09 |
| Tetrachlorobiphenyl | 2.50E-09 |
| Trichlorobiphenyl | 2.60E-09 |
| **SUBTOTAL** | 8.15E-09 |

EF Basis: AP-42, September 2003. Table 1.6-3.

**Table 6 - POM EF**

| POM Compounds | EF (lb/MMBtu) |
|---|---|
| Acenaphthene* | 9.10E-07 |
| Acenaphthylene* | 5.00E-06 |
| Anthracene* | 3.00E-06 |
| Benzo(a)anthracene* | 6.50E-08 |
| Benzo(b)fluoranthene* | 1.00E-07 |
| Benzo(j,k)fluoranthene* | 1.60E-07 |
| Benzo(k)fluoranthene* | 3.60E-08 |
| Benzo(g,h,i)perylene* | 9.30E-08 |
| Benzo(a)pyrene* | 2.60E-06 |
| Benzo(e)pyrene* | 2.60E-09 |
| 2-Chloronaphthalene | 2.40E-09 |
| Chrysene* | 3.80E-08 |
| Dibenzo(a,h)anthracene* | 9.10E-09 |
| Dibenzodioxins**,[1] | 1.67E-06 |
| Dibenzofurans**,[2] | 1.87E-09 |
| Fluoranthene* | 1.60E-06 |
| Fluorene* | 3.40E-06 |
| Indeno(1,2,3-cd)pyrene* | 8.70E-08 |
| 2-Methylnaphthalene | 1.60E-07 |
| Naphthalene*,** | 9.70E-05 |
| Perylene | 5.20E-10 |
| Phenanthrene* | 7.00E-06 |
| Pyrene* | 3.70E-06 |
| **SUBTOTAL** | 1.27E-04 |

EF Basis: AP-42, September 2003. Table 1.6-3.

* designates a polycyclic aromatic hydrocarbon (PAH). PAHs are potent atmospheric pollutants that consist of fused aromatic rings and do not contain heteroatoms or carry substituents. See http://en.wikipedia.org/wiki/Polycyclic_aromatic_hydrocarbon#PAH_compounds

** designates a POM compound that is also an individual HAP. For Dibenzodioxins, only 2,3,7,8-Tetrachlorodibenzo-p-dioxins is also an individual HAP.

[1] See Table 7.

[2] See Table 4.

**Table 7 - Dibenzodioxins EF**

| Dibenzodioxins | EF (lb/MMBtu) |
|---|---|
| Heptachlorodibenzo-p-dioxins | 2.00E-09 |
| Hexachlorodibenzo-p-dioxins | 1.60E-06 |
| Octachlorodibenzo-p-dioxins | 6.60E-08 |
| Pentachlorodibenzo-p-dioxins | 1.50E-09 |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxins | 8.60E-12 |
| Tetrachlorodibenzo-p-dioxins | 4.70E-10 |
| **SUBTOTAL** | 1.67E-06 |

EF Basis: AP-42, September 2003. Table 1.6-3.

# Appendix A: Potential Emissions Inventory

**EPA Region 10 Particulate Matter Emission Factors for Sawmills, February 2013**

| No. | Emissions Generating Activity | PM EF | $PM_{10}$ % of PM | $PM_{10}$ EF | $PM_{2.5}$ % of PM | $PM_{2.5}$ EF | Units[1] |
|---|---|---|---|---|---|---|---|
| **Sawmill Activities (upstream of lumber drying)** | | | | | | | |
| IMPORTANT: If sawmill activities (categories No. 1 - 5 listed below) occur within a building, reduce the PM, $PM_{10}$ and $PM_{2.5}$ EF listed below by 80 percent (engineering judgement) as emissions struggle to escape through doorways and other openings. If an activity occurs within an interior enclosure of the building and the activity's by-products are evacuated pneumatically from the building to a target box, cyclone or bag filter system, then only the associated downstream "material handling" emissions are counted. | | | | | | | |
| 1 | Log Bucking | 0.035 | 50 | 0.0175 | 25 | 0.00875 | lb/ton log |
| 2 | Log Debarking | 0.024 | 50 | 0.012 | 25 | 0.006 | lb/ton log |
| 3 | Hogging | 0.050 | 50 | 0.025 | 25 | 0.0125 | lb/bdt material |
| 4 | Sawing | 0.350 | 50 | 0.175 | 25 | 0.0875 | lb/ton log |
| 5 | Chipping | 0.050 | 50 | 0.025 | 25 | 0.0125 | lb/bdt material |
| **Planing Activities (downstream of lumber drying)** | | | | | | | |
| 6 | Accumulation of activities that generate planed dry lumber, chips, sawdust and shavings from rough dried lumber | 0.0812 | 50 | 0.0406 | 25 | 0.0203 | lb/mbf |
| **By-Product Conveying or "Material Handling" Activities** | | | | | | | |
| IMPORTANT: The "material" in the "material handling" entries listed below refers to bark, hogged fuel, green chips, dry chips, green sawdust, dry sawdust, shavings and any other woody by-product of lumber production. In the case of material "drops," EF are to be applied to each "drop" separately. Similarly, EF are to be applied to each "material handling" device separately. | | | | | | | |
| 7 | "Drop" of "wet" material from one surface to another including, but not limited to, (a) each mechanical conveyance drop between point of generation and target box, (b) loadout from target box into a truck bed or railcar and (c) drop onto a pile. | 0.00075 | N/A | 0.00035 | N/A | 0.00005 | lb/bdt material |
| 8 | "Drop" of "dry" material from one surface to another including, but not limited to, (a) each mechanical conveyance drop between point of generation and target box, (b) loadout from target box into a truck bed or railcar and (c) drop onto a pile. | 0.0015 | N/A | 0.0007 | N/A | 0.0001 | lb/bdt material |
| 9 | Pneumatically convey material through medium efficiency cyclone to bin | 0.5 | 85 | 0.425 | 50 | 0.25 | lb/bdt material |
| 10 | Pneumatically convey material through high efficiency cyclone to bin | 0.2 | 95 | 0.19 | 80 | 0.16 | lb/bdt material |
| 11 | Pneumatically convey material through cyclone to bin. Exhaust routed through baghouse. | 0.001 | 99.5 | 0.000995 | 99 | 0.00099 | lb/bdt material |
| 12 | Pneumatically convey material into target box | 0.1 | 85 | 0.085 | 50 | 0.05 | lb/bdt material |
| **Yard Activities** | | | | | | | |
| 13 | Wind Erosion of Pile | 0.38 | 50 | 0.19 | 25 | 0.095 | ton/acre-yr |
| 14 | Paved Roads | Emission factors based upon site-specific parameters. | | | | | lb/VMT |
| 15 | Unpaved Roads | Emission factors based upon site-specific parameters. | | | | | lb/VMT |

Acronyms

bdt: bone dry ton

mbf: 1000 board foot lumber

VMT: vehicle mile traveled

[1] EF for log bucking, debarking and sawing are expressed in units of "lb/ton log" in the table above. The EF can be expressed in units of "lb/mbf" lumber as follows:

$$\text{lb/mbf} = (\text{lb PM/ton log}) \times (\text{ton/2000 lb}) \times (\text{LD lb/ft}^3) \times (\text{LRF bf lumber/ft}^3 \text{ log}) \times (1000 \text{ bf/mbf})$$

where "LD" stands for log density and "LRF" stands for log recovery factor

• LD values are species-specific and are provided by The Engineering ToolBox and are listed at http://www.engineeringtoolbox.com/weigt-wood-d_821.html

• LRF value of 6.33 $bf/ft^3$ log is specific to softwood species of the Pacific Coast East. See Section 2 of Appendix D to Forest Products Measurements and Conversion Factors with Special Emphasis on the U.S. Pacific Northwest. College of Forest Resources, University of Washington. 1994. See http://www.ruraltech.org/projects/conversions/briggs_conversions/briggs_append2/appendix02_combined.pdf

| No. | Reference |
|---|---|

1

For PM, $PM_{10}$, and $PM_{2.5}$ EF, apply engineering judgement to estimate that log bucking emissions are one-tenth sawing emissions. EPA has stated that log bucking is normally a negligible source of fugitive PM emissions. See page 2-125 of Assessment of Fugitive Particulate Emission Factor for Industrial Processes, EPA-450/3-78-107, September 1978. The document can be downloaded from internet at http://nepis.epa.gov/Simple.html by entering EPA publication number. For sawing emissions details, see Reference No. 4 below.

2

• For PM EF, see Table 2-47 of Assessment of Fugitive Particulate Emission Factor for Industrial Processes, EPA-450/3-78-107, September 1978. See also Table 2-59 of Technical Guidance for Controls of Industrial Process Fugitive Particulate Emissions, EPA-450/3-77-010, March 1977. Both documents can be downloaded from internet at http://nepis.epa.gov/Simple.html by entering EPA publication number. EPA revoked the PM EF from WebFIRE on January 1, 2002. See detailed search results for SCC 3-07-008-01 (include revoked factors) at http://cfpub.epa.gov/webfire/index.cfm?action=fire.detailedSearch

• For $PM_{10}$ and $PM_{2.5}$ EF, apply engineering judgement to estimate that (a) $PM_{10}$ emissions are one-half PM emissions and (b) $PM_{2.5}$ emissions are one-half $PM_{10}$ emissions.

3

Apply engineering judgement to estimate that (a) hogging PM emissions are one-half pneumatic target box emissions, (b) hogging $PM_{10}$ emisions are one-half hogging PM emissions and (c) hogging $PM_{2.5}$ emissions are one-half hogging $PM_{10}$ emissions.

4

• Sawing consists of the following cummulative activities: breaking the log into cants and flitches with a smooth edge, breaking cant further down into multiple flitches and/or boards, taking the flitch and trim off all irregular edges to leave four-sided lumber and trimming to square the ends.

• For PM EF, see Table 2-47 of Assessment of Fugitive Particulate Emission Factor for Industrial Processes, EPA-450/3-78-107, September 1978. See also Table 2-59 of Technical Guidance for Controls of Industrial Process Fugitive Particulate Emissions, EPA-450/3-77-010, March 1977. Both documents can be downloaded from internet at http://nepis.epa.gov/Simple.html by entering EPA publication number. EPA revoked the PM EF from WebFIRE on January 1, 2002. See detailed search results for SCC 3-07-008-01 (include revoked factors) at http://cfpub.epa.gov/webfire/index.cfm?action=fire.detailedSearch

• For $PM_{10}$ and $PM_{2.5}$ EF, apply engineering judgement to estimate that (a) $PM_{10}$ emissions are one-half PM emissions and (b) $PM_{2.5}$ emissions are one-half $PM_{10}$ emissions.

5

Apply engineering judgement to estimate that (a) chipping PM emissions are one-half pneumatic target box emissions, (b) chipping $PM_{10}$ emisions are one-half chipping PM emissions and (c) chipping $PM_{2.5}$ emissions are one-half chipping $PM_{10}$ emissions.

6

• For PM, see Table 1.4 on page 8 of CORRIM: Phase I Final Report, Module B, Softwood Lumber - Pacific Northwest Region. June 1, 2004 Review Draft prepared by Michael Milota, Oregon State University.
• For $PM_{10}$ and $PM_{2.5}$ EF, apply engineering judgement to estimate that (a) $PM_{10}$ emissions are one-half PM emissions and (b) $PM_{2.5}$ emissions are one-half $PM_{10}$ emissions.

7
8

• See Section 13.2.4 of EPA's AP-42, November 2006 at http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf. Apply Equation 1 on page 13.2.4-4 to estimate emissions resulting from material loadout from target box as follows: E [lb PM/ton] = (k) X (0.0032) X $(U/5)^{1.3}$ / $(M/2)^{1.4}$

Wet Material Loadout

| Particulate | k | × 0.0032 × | $(U/5)^{1.3}$ | / $(M/2)^{1.4}$ = | lb PM / ton |
|---|---|---|---|---|---|
| PM | 0.74 | 0.0032 | 6.6693 | 21.0552 | 0.00075 |
| $PM_{10}$ | 0.35 | | | | 0.00035 |
| $PM_{2.5}$ | 0.053 | | | | 0.00005 |

The following conservative assumptions were made in applying Equation 1:

Mean wind speed (U) = 15 miles per hour
$(U/5)^{1.3}$ = 6.66930
Material moisture content (M) = 34 percent. Value based upon observations
$(M/2)^{1.4}$ = 21.05520

Note: • Mean wind speed of 15 mph is a reasonable upper bounder estimate.
• Moisture content of 34 percent for "wet" material is based upon observation that average moisture content (dry basis) of green douglas fir lumber (common to the Pacific Northwest) is 51 percent as recorded prior to lab scale kiln VOC emissions testing conducting by Oregon State University's Mike Milota and organized in Microsoft Excel workbook entitled, "EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012." 51 percent moisture content (dry basis) is equivalent to 34 percent moisture content (wet basis) as illustrated below:
MCD = MCW / (1-MCW); where
MCD: moisture content dry basis
MCW: moisture content wet basis

0.51 = MCW / (1 - MCW)
0.51 - (0.51)(MCW) = MCW
(1.51)(MCW) = 0.51
MCW = 0.34, or 34 percent

Dry Material Loadout

| Particulate | k | × 0.0032 × | $(U/5)^{1.3}$ | / $(M/2)^{1.4}$ = | lb PM / ton |
|---|---|---|---|---|---|
| PM | 0.74 | 0.0032 | 6.6693 | 10.5552 | 0.0015 |
| $PM_{10}$ | 0.35 | | | | 0.0007 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | $PM_{2.5}$ | 0.053 | | | | 0.0001 |

The following conservative assumptions were made in applying Equation 1:

| | | |
|---|---|---|
| Mean wind speed (U) = | 15 | miles per hour |
| $(U/5)^{1.3}$ = | 6.6693 | |
| Material moisture content (M) = | 13 | percent |
| $(M/2)^{1.4}$ = | 10.5552 | |

Note: • Mean wind speed of 15 mph is a reasonable upper bounder estimate.
• Moisture content of 13 percent for "dry" material is based upon observation that typical moisture content (dry basis) of kiln-dried lumber is 15 percent as recorded during lab scale kiln emissions testing conducting by Oregon State University's Mike Milota and organized in Microsoft Excel workbook entitled, "EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012." 15 percent moisture content (dry basis) is equivalent to 13 percent moisture content (wet basis) as illustrated below:
MCD = MCW / (1-MCW); where
MCD: moisture content dry basis
MCW: moisture content wet basis

0.15 = MCW / (1 - MCW)
0.15 - (0.15)(MCW) = MCW
(1.15)(MCW) = 0.15
MCW = 0.13, or 13 percent

| | |
|---|---|
| 9<br>10<br>11<br>12 | • For PM EF, see Oregon Department of Environmental Quality (ODEQ) Wood Products Emission Factors, AQ-EF02 Revised 08/01/11. http://www.deq.state.or.us/aq/permit/acdp/docs/AQ-EF02.pdf<br>• For $PM_{10}$ and $PM_{2.5}$ EF, see ODEQ Wood Products Emission Factors - $PM_{10}/PM_{2.5}$ Fractions, AQ-EF03 Revised 08/01/11. http://www.deq.state.or.us/aq/permit/acdp/docs/AQ-EF03.pdf |
| 13 | • For PM EF, see last row of Table 11.9-4 on page 11.9-11 of Section 11.9 of EPA's AP-42, July 1998 at http://www.epa.gov/ttn/chief/ap42/ch11/final/c11s09.pdf.<br>• For $PM_{10}$ and $PM_{2.5}$ EF, apply engineering judgement to estimate that (a) $PM_{10}$ emissions are one-half PM emissions and (b) $PM_{2.5}$ emissions are one-half $PM_{10}$ emissions. |
| 14 | See Equation 1 on page 13.2.1-4 of Chapter 13.2.1 of AP-42, January 2011 at http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf |
| 15 | See Equation 1a on page 13.2.2-4 of Chapter 13.2.2 of AP-42, November 2006 at http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf |

# Appendix A: Potential Emissions Inventory

**EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012**

This spreadsheet calculates and compiles volatile organic compound (VOC) and hazardous air pollutant (HAP) emission factors (EF) in units of pounds of pollutant per thousand board feet of lumber dried (lb/mbf) that are preferred by EPA Region 10 for estimating emissions from lumber drying kilns. The EFs are based on actual lab-scale emission test data when available; when not available, EFs for similar species are substituted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

A summary of the EFs for each species of wood is included on this sheet. The sheets that follow present the original test data as well as the calculations for creating each EF. There are two sheets per lumber species: one for HAPs and one for VOCs. To assure adequate conservatism for use in applicability determinations and compliance assurance applications, the EFs represent the 90th percentile of the data when three or more test values are available and the maximum test value of the data when less than three test values are available.

| Species | Maximum Kiln Temperature (°F) | WPP1 VOC[1] (lb/mbf) | Total HAP (lb/mbf) | Methanol[2] (lb/mbf) | Formaldehyde[2] (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|---|---|---|
| Non-Resinous Softwood Species | | | | | | | | |
| White Fir[3] | ≤200 | 0.8388 | 0.2107 | 0.1480 | 0.0034 | 0.0550 | 0.0018 | 0.0026 |
| | >200 | 1.0902 | 0.4956 | 0.4200 | 0.0163 | | | |
| Western Hemlock | ≤200 | 0.5253 | 0.2921 | 0.1484 | 0.0016 | 0.1378 | 0.0018 | 0.0026 |
| | >200 | 0.6615 | 0.3661 | 0.2196 | 0.0044 | | | |
| Western Red Cedar | ≤200 | 0.3631 | 0.2939 | 0.1484 | 0.0034 | 0.1378 | 0.0018 | 0.0026 |
| | >200 | 1.1453 | 0.5784 | 0.4200 | 0.0163 | | | |
| Resinous Softwood Species (Non-Pine Family) | | | | | | | | |
| Douglas Fir | ≤200 | 1.1576 | 0.1409 | 0.0690 | 0.0019 | 0.0682 | 0.0007 | 0.0011 |
| | >200 | 1.6969 | 0.1913 | 0.1170 | 0.0043 | | | |
| Engelmann Spruce | ≤200 | 0.1775 | 0.0640 | 0.0250 | 0.0013 | 0.0360 | 0.0007 | 0.0010 |
| | >200 | 0.2161 | 0.1201 | 0.0780 | 0.0044 | | | |
| Larch | ≤200 | 1.1576 | 0.1409 | 0.0690 | 0.0019 | 0.0682 | 0.0007 | 0.0011 |
| | >200 | 1.6969 | 0.1914 | 0.1170 | 0.0044 | | | |
| Resinous Softwood Species (Pine Family) | | | | | | | | |
| Lodgepole Pine | ≤200 | 1.5293 | 0.1125 | 0.0628 | | 0.0420 | 0.0032 | 0.0045 |
| | >200 | 1.5293 | 0.1166 | 0.0628 | 0.0041 | | | |
| Ponderosa Pine | ≤200 | 2.3450 | 0.1271 | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 |
| | >200 | 3.8087 | 0.2029 | 0.1440 | 0.0092 | | | |
| Western White Pine | ≤200 | 2.8505 | 0.1271 | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 |
| | >200 | 3.8087 | 0.2029 | 0.1440 | 0.0092 | | | |

[1] VOC emissions have been approximated consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC). Employing WPP1 VOC underestimates emissions when the mass-to-carbon ratio of unidentified VOC exceeds that of propane. Ethanol and acetic acid are examples of compounds that contribute to lumber drying VOC emissions (for some species more than others), and both have mass-to-carbon ratios exceeding that of propane.

[2] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

[3] White fir in this context refers to any one of several species of true fir grown in the West. The collection of timber commonly referred to as "white fir" includes the following species: white fir, grand fir, noble fir and subalpine fir.

**Hazardous Air Pollutant Emission Factors for Drying White Fir Lumber**

This sheet presents lab-scale test data and calculations used to create HAP EF for drying any one of several species of true fir grown in the West commonly referred to as "white fir." True fir includes the following species: white fir, grand fir, noble fir and subalpine fir; all classified in the same Abies genus. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Step One: Compile White Fir HAP Emission Test Data by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial / Final) | Time to Final Moisture Content (hours) | HAP Sample Collection Technique | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 0.096 | 0.0022 | no data | no data | no data | 2x6 | 122.0 / 15 | 42.6 | NCASI Method IM/CAN/WP-99.01 without cannisters. | 3, 4, 5, 12, 14 |
| 180 | 0.148 | 0.0034 | no data | no data | no data | 2x6 | 133.2 / 15 | 46.9 | | |
| 225 | no data | no data | 0.0550 | no data | no data | 2x4 | 170 / 13 | 54 | Dinitrophenylhydrazine coated cartridges. | 7 |
| 240 | 0.42 | 0.0156 | no data | no data | no data | 2x6 | 126.3 / 15 | 24 | NCASI chilled impinger method. | 5 |
| 240 | 0.419 | 0.0163 | no data | no data | no data | 2x6 | 119.0 / 15 | 24 | | |

[1] Yellow highlight denotes data not considered by EPA Region 10 in 2007 when providing notice of original EFs prior to initial PCWP (Plywood and Composite Wood Products) MACT compliance date.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate White Fir HAP Emission Factors Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde[2] (lb/mbf) | Acrolein[2] (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.1480 | 0.0034 | 0.0550 | 0.0018 | 0.0026 |
| > 200°F | 0.4200 | 0.0163 | | | |

[1] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

[2] In the absence of white fir test data for propionaldehyde and acrolein, western hemlock test data has been substituted. The two wood species are similar in that both are non-resinous softwood species in the scientific classification family Pinaceae. See western hemlock HAP sheet for lab-scale test data and calculations.

**Volatile Organic Compound Emission Factors for Drying White Fir Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying any one of several species of true fir grown in the West commonly referred to as "white fir." True fir includes the following species: white fir, grand fir, noble fir and subalpine fir; all classified in the same Abies genus. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile White Fir VOC Emission Test Data by Drying Temperature**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[1] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| 180 | 0.26 | 2x6 | 106.3 / 15 | 36.6 | JUM 3-200 | 3, 4 |
| 180 | 0.27 | 2x6 | 113.6 / 15 | 43.2 | | |
| 180 | 0.22 | 2x6 | 122.0 / 15 | 42.6 | JUM 3-200 | 3, 4, 5, 12 |
| 180 | 0.25 | 2x6 | 133.2 / 15 | 46.9 | | |
| 190 | 0.63 | 2x4 | 138.1 / 15 | 70 | JUM VE-7 | 2 |
| 190 | 0.50 | 2x4 | 138.1 / 15 | 75 | | |
| 200 | 0.53 | 2x4 | 96.1 / 15 | 47 | | |
| 225 | 0.39 | 2x4 | 170 / 13 | 54 | JUM VE-7 | 7 |
| 240 | 0.62 | 2x6 | 126.3 / 15 | 25 | JUM 3-200 | 5 |
| 240 | 0.6 | 2x6 | 119.0 / 15 | 25 | | |

[1] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate White Fir VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 0.5700 |
| > 200°F | 0.6160 |

[1] Because VOC emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Step Three: Compile White Fir Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.1480 | 0.0034 | 0.0550 | 0.0018 | 0.0026 |
| > 200°F | 0.4200 | 0.0163 | | | |

[1] See white fir HAP sheet for lab-scale test data and calculations.

**Step Four: Convert White Fir Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200 °F | 0.0399 | 0 | 0.0150 | 0.0007 | 0.0011 | SUM ⇨ | 0.0567 |
| > 200 °F | 0.1134 | 0 | | | | | 0.1302 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from White Fir VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | Propane Mass Conversion | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) | | | | |
| ≤ 200 °F | 0.5700 | MINUS ⇨ | 0.0567 | EQUALS ⇨ | 0.5133 | X 1.2238 = | 0.6281 |
| > 200 °F | 0.6160 | | 0.1302 | | 0.4858 | | 0.5946 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to White Fir VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 0.6281 | ⇨ | 0.1480 | 0.0034 | 0.0550 | 0.0018 | 0.0026 | ⇨ | 0.8388 |
| > 200°F | 0.5946 | | 0.4200 | 0.0163 | | | | | 1.0902 |

**Hazardous Air Pollutant Emission Factors for Western Hemlock Lumber**

This sheet presents lab-scale test data and calculations used to create HAP EF for drying western hemlock lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Step One: Compile Western Hemlock HAP Emission Test Data by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial / Final) | Time to Final Moisture Content (hours) | HAP Sample Collection Technique | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 0.083 | 0.0013 | no data | no data | no data | 2x4 | 102.3 / 14.7 | 49.5 | NCASI Method 98.01 | 14, 15 |
| 180 | 0.075 | 0.0014 | 0.078 | 0.002 | 0.0012 | 2x4 | 102.3 / 14.7 | 49.5 | NCASI Method 105 | 14, 15, 18 |
| 180 | 0.094 | 0.0015 | 0.141 | 0.0008 | 0.0012 | 2x4 or 2x6 | 93.5 / 17.5 | no data | NCASI Method 105 | 18 |
| 180 | 0.052 | 0.0007 | no data | no data | no data | 2x4 | 88.8 / 15 | 46.2 | NCASI Method CI//WP-98.01 | 13 |
| 180 | 0.0312 | 0.00082 | no data | no data | no data | 2x4 | 56.8 / 15 | 38.35 | NCASI Method CI//WP-98.01 | 8, 11, 14 |
| 180 | 0.0304 | 0.00082 | no data | no data | no data | 2x4 | 51.1 / 15 | 35.75 | | |
| 200 | 0.098 | 0.0015 | no data | no data | no data | 2x6 | 81.0 / 15 | 45.2 | NCASI Method CI//WP-98.01 | 11, 14 |
| 200 | 0.175 | 0.0016 | no data | no data | no data | 2x6 | 73.7 / 15 | 36.5 | | |
| 200 | 0.154 | 0.0018 | no data | no data | no data | 2x6 | 100.1 / 15 | 47.4 | | |
| 200 | 0.044 | 0.0008 | 0.133 | 0.0008 | 0.0024 | 2x4 or 2x6 | 83.9 / 15.0 | no data | NCASI Method 105 | 14, 18 |
| 200 | 0.077 | 0.0014 | 0.128 | 0.001 | 0.0011 | 2x4 or 2x6 | 98.6 / 15.0 | no data | | |
| 200 | 0.057 | 0.0014 | no data | no data | no data | 2x4 | 76.0 / 15 | 30.25 | NCASI Method CI//WP-98.01 | 9, 11, 14 |
| 215 | 0.138 | 0.0043 | no data | no data | 0.0027 | 2x4 | 119.7 / 15 | 38 | no data | 6, 11, 14 |
| 225 | 0.189 | 0.0035 | no data | no data | | 2x6 | 82 / 15 | 31.3 | NCASI Method CI//WP-98.01 | 11, 14 |
| 225 | 0.167 | 0.0034 | no data | no data | no data | 2x6 | 77.4 / 15 | 28.6 | | |
| 225 | 0.24 | 0.004 | no data | no data | no data | 2x6 | 101.7 / 15 | 33.5 | | |
| 235 | 0.187 | 0.0045 | 0.084 | 0.0014 | 0.0019 | 2x4 or 2x6 | 76.2 / 15.0 | no data | NCASI Method 105 | 18 |

[1] Yellow highlight denotes data not considered by EPA Region 10 in 2007 when providing notice of original EFs prior to initial PCWP (Plywood and Composite Wood Products) MACT compliance date.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Western Hemlock HAP Emission Factors Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.1484 | 0.0016 | 0.1378 | 0.0018 | 0.0026 |
| > 200°F | 0.2196 | 0.0044 | | | |

[1] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Drying Western Hemlock Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying western hemlock lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile Western Hemlock VOC Emission Test Data by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| 180 | ~~0.73~~ | 2x6 | 126.6 / 15 | 66.5 | no data | 11 |
| 180 | ~~0.66~~ | 2x6 | 139.3 / 15 | 67.9 | | |
| 180 | ~~0.6~~ | 2x6 | 127.8 / 15 | 65.7 | | |
| 180 | ~~0.67~~ | 2x6 | 132.7 / 15 | 67 | | |
| 180 | 0.17 | 2x4 | 114.8 / 15 | 45 | no data | 11 |
| 180 | 0.07 | 2x4 | 103.1 / 15 | 40.7 | | |
| 180 | 0.12 | 2x4 | 98.0 / 15 | 37.5 | | |
| 180 | 0.4 | 2x4 | 115.7 / 15 | 52.9 | | |
| 180 | 0.236 | 2x4 or 2x6 | 93.5 / 17.5 | no data | JUM VE-7 | 18 |
| 180 | 0.142 | 2x4 | 102.3 / 14.7 | 49.5 | JUM VE-7 | 15, 18 |
| 180 | 0.18 | 2x4 | 88.8 / 15 | 46.2 | JUM VE-7 | 13 |
| 180 | 0.198 | 2x4 | 56.8 / 15 | 38.35 | | 8, 11 |
| 180 | 0.122 | 2x4 | 51.1 / 15 | 35.75 | | |
| 200 | 0.24 | 2x4 | 112.8 / 15 | 40 | JUM VE-7 | 2 |
| 200 | 0.2 | 2x6 | 81.0 / 15 | 45.2 | no data | 11 |
| 200 | 0.15 | 2x6 | 73.7 / 15 | 36.5 | | |
| 200 | 0.3 | 2x6 | 100.1 / 15 | 47.4 | | |
| 200 | 0.204 | 2x4 | 76.0 / 15 | 30.25 | JUM 3-200 | 9, 11 |
| 200 | 0.214 | 2x4 or 2x6 | 83.9 / 15.0 | no data | JUM VE-7 | 18 |
| 200 | 0.239 | 2x4 or 2x6 | 98.6 / 15.0 | no data | | |
| 215 | 0.34 | 2x4 | 112.9 / 15 | 32.7 | no data | 11 |
| 215 | 0.34 | 2x4 | 119.7 / 15 | 38 | JUM 3-200 | 6, 11 |
| 225 | 0.28 | 2x6 | 82 / 15 | 31.3 | no data | 11 |
| 225 | 0.27 | 2x6 | 77.4 / 15 | 28.6 | | |
| 225 | 0.31 | 2x6 | 101.7 / 15 | 33.5 | | |
| 235 | 0.247 | 2x4 or 2x6 | 81.6 / 15.0 | no data | JUM VE-7 | 18 |
| 235 | 0.226 | 2x4 or 2x6 | 76.2 / 15.0 | no data | | |

[1] Blue highlight denotes data not considered by EPA Region 10 in 2012. The four test runs not considered here were obtained from a single "sample" and appeared to use a much longer drying cycle than would be in common use in the Pacific Northwest. Therefore, these highlighted values were not used in the EF derivation.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Western Hemlock VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 0.2700 |
| > 200°F | 0.3400 |

[1] Because VOC emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Step Three: Compile Western Hemlock Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.1484 | 0.0016 | 0.1378 | 0.0018 | 0.0026 |
| > 200°F | 0.2196 | 0.0044 | | | |

[1] See western hemlock HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Western Hemlock Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200°F | 0.0401 | 0 | 0.0376 | 0.0007 | 0.0011 | SUM ⇨ | 0.0794 |
| > 200°F | 0.0593 | 0 | | | | | 0.0986 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Western Hemlock VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | | Propane Mass Conversion | |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | MINUS ⇨ | Speciated Compounds as Carbon (lb/mbf) | EQUALS ⇨ | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | X 1.2238 = | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
| ≤ 200°F | 0.2700 | | 0.0794 | | 0.1906 | | 0.2332 |
| > 200°F | 0.3400 | | 0.0986 | | 0.2414 | | 0.2954 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Western Hemlock VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS ⇨ | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS ⇨ | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 0.2332 | | 0.1484 | 0.0016 | 0.1378 | 0.0018 | 0.0026 | | 0.5253 |
| > 200°F | 0.2954 | | 0.2196 | 0.0044 | | | | | 0.6615 |

**Hazardous Air Pollutant Emission Factors for Drying Western Red Cedar Lumber**

This sheet presents the HAP EF for drying western red cedar lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. EPA Region 10 is not aware of any HAP emission testing of western red cedar. Consistent with other species, when actual test data is not available, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Western Red Cedar HAP Emission Factors[1]**

| Maximum Dry Bulb Temperature[2] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.1484 | 0.0034 | 0.1378 | 0.0018 | 0.0026 |
| > 200°F | 0.4200 | 0.0163 | | | |

[1] In the absence of western red cedar test data, white fir test data has been substituted for methanol and high-temperature formaldehyde and western hemlock test data has been substituted for acetaldehyde, propionaldehyde, acrolein and low-temperature formaldehyde. Western red cedar is similar to white fir and western hemlock in that all three species are non-resinous softwood species in the scientific classification order Pinales. See the white fir and western hemlock HAP sheets for lab-scale test data and calculations.

[2] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature in other species (no observations for western red cedar), separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Western Red Cedar Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying western red cedar. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile Western Red Cedar VOC Emission Test Data by Drying Temperature**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[1] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| 160 | 0.096 | 1x4 | 33.3 / 15 | 21 | JUM VE-7 | 2 |
| 160 | 0.136 | 1x4 | 44.9 / 15 | 18 | | |
| > 200°F | no data | | | | | |

[1] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Western Red Cedar VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature[2] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 0.1360 |
| > 200°F | 0.6160 |

[1] In the absence of western red cedar test data for high-temperature drying, white fir test data has been substituted. Western red cedar, white fir and western hemlock are similar in that all three are non-resinous softwood species in the scientific classification order Pinales. See the white fir and western hemlock VOC sheets for lab-scale test data and calculations.

[2] Because VOC emissions appear to be dependent upon drying temperature in other species (no observed high-temperature observations for western red cedar), separate values are calculated for low and high-temperature drying.

**Step Three: Compile Western Red Cedar Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.1484 | 0.0034 | 0.1378 | 0.0018 | 0.0026 |
| > 200°F | 0.4200 | 0.0163 | | | |

[1] See western red cedar HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Western Red Cedar Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200°F | 0.0401 | 0 | 0.0376 | 0.0007 | 0.0011 | SUM ⇨ | 0.0794 |
| > 200°F | 0.1134 | 0 | | | | | 0.1527 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Western Red Cedar VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | Propane Mass Conversion | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) | | | | |
| ≤ 200°F | 0.1360 | MINUS ⇨ | 0.0794 | EQUALS ⇨ | 0.0566 | X 1.2238 = | 0.0692 |
| > 200°F | 0.6160 | | 0.1527 | | 0.4633 | | 0.5669 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Western Red Cedar VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 0.0692 | | 0.1484 | 0.0034 | 0.1378 | 0.0018 | 0.0026 | | 0.3631 |
| > 200°F | 0.5669 | | 0.4200 | 0.0163 | | | | | 1.1453 |

**Hazardous Air Pollutant Emission Factors for Drying Douglas Fir Lumber**

This sheet presents lab-scale test data and calculations used to create HAP EF for drying douglas fir lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Step One: Compile Douglas Fir HAP Emission Test Data by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial / Final) | Time to Final Moisture Content (hours) | HAP Sample Collection Technique | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 0.025 | 0.0008 | no data | no data | no data | 2x6 | 37.3 / 15 | 23.5 | NCASI Method IM/CAN/WP-99.01 without cannisters. | 3, 4, 12, 14 |
| 160 | 0.023 | 0.0008 | no data | no data | no data | 2x6 | 44.9 / 15 | 28.5 | | |
| 160 | 0.026 | 0.0017 | no data | no data | no data | 2x6 | 40.3 / 15 | 27.1 | | |
| 160 | 0.018 | 0.0011 | no data | no data | no data | 2x6 | 31.9 / 15 | 25.2 | | |
| 170 | 0.015 | 0.0005 | no data | no data | no data | 2x4 | 79.9 / 15 | 40.5 | NCASI Method CI//WP-98.01 | 13 |
| 170 | 0.026 | 0.0008 | no data | no data | no data | 2x4 | 56.9 / 15 | 27.5 | NCASI Method 98.01 | 15 |
| 170 | 0.024 | 0.0008 | 0.03 | 0.0004 | 0.0005 | 2x4 | 56.9 / 15 | 27.5 | NCASI Method 105 | 15, 18 |
| 180 | 0.050 | 0.0023 | 0.050 | 0.0005 | 0.0009 | 2x4 | 43.7 / 15 | 48 | NCASI Method 105 | 18, 22 |
| 180 | 0.084 | 0.0019 | 0.061 | 0.0003 | 0.0007 | 4x4 | 44.7 / 15 | 111 | NCASI Method 105 | 19 |
| 200 | 0.068 | 0.0018 | 0.043 | 0.0005 | 0.0009 | 2x4 | 64.3 / 15 | 60 | NCASI Method 105 | 14, 18, 22 |
| 200 | 0.069 | 0.0019 | 0.071 | 0.0006 | 0.0004 | 2x4 | 59.5 / 15 | 56 | | |
| 220 | no data | no data | 0.030 | no data | no data | 2x4 | 73 / 12 | 46 | Dinitrophenylhydrazine coated cartridges. | 7 |
| 220 | no data | no data | 0.022 | no data | no data | 2x4 | 73 / 15 | 46 | | |
| 235 | 0.117 | 0.0043 | 0.067 | 0.0008 | | 2x4 or 2x6 | 47.7 / 15 | 19 | NCASI Method 105 | 18, 21 |

[1] Yellow highlight denotes data not considered by EPA Region 10 in 2007 when providing notice of original EFs prior to initial PCWP (Plywood and Composite Wood Products) MACT compliance date.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Douglas Fir HAP Emission Factors Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0690 | 0.0019 | 0.0682 | 0.0007 | 0.0009 |
| > 200°F | 0.1170 | 0.0043 | | | |

[1] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Drying Douglas Fir Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying douglas fir lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile Douglas Fir VOC Emission Test Data by Drying Temperature**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[1] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| 160 | 0.51 | 2x6 | 37.3 / 15 | 23.5 | JUM 3-200 | 3, 4, 12 |
| 160 | 0.55 | 2x6 | 44.9 / 15 | 28.5 | | |
| 160 | 0.45 | 2x6 | 40.3 / 15 | 27.1 | | |
| 160 | 0.46 | 2x6 | 31.9 / 15 | 25.2 | | |
| 170 | 0.65 | 2x4 | 79.9 / 15 | 40.5 | JUM VE-7 | 13 |
| 170 | 0.24 | 2x4 | 56.9 / 15 | 27.5 | JUM VE-7 | 15, 18 |
| 180 | 0.942 | 2x4 | 38.9 / 15 | 63 | JUM VE-7 | 2 |
| 180 | 0.669 | 2x4 | 44.9 / 15 | 42 | | |
| 180 | 0.21 | 2x4 | 56.3 / 15 | 27 | | |
| 180 | 0.575 | 2x4 or 2x6 | 43.7 / 15 | no data | JUM VE-7 | 18 |
| 180 | 0.39 | 4x4 | 29.8 / 19 | 67.5 | JUM 3-200 | 10 |
| 180 | 0.845 | 4x4 | 44.7 / 15 | 111 | | 19 |
| 200 | 0.707 | 2x4 or 2x6 | 64.3 / 15 | no data | JUM VE-7 | 18 |
| 200 | 0.879 | 2x4 or 2x6 | 59.5 / 15 | no data | | |
| 220 | 1.2 | 2x4 | 73 / 12 | 46 | JUM VE-7 | 7 |
| 220 | 1.3 | 2x4 | 73 / 15 | 46 | | |
| 235 | 1.206 | 2x4 or 2x6 | 47.7 / 15 | 19 | JUM VE-7 | 18, 21 |

[1] Dry basis. Moisture content = (weight of water / weight wood) x 100.

**Step Two: Calculate Douglas Fir VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 0.8688 |
| > 200°F | 1.2812 |

[1] Because VOC emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Step Three: Compile Douglas Fir Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0690 | 0.0019 | 0.0682 | 0.0007 | 0.0009 |
| > 200°F | 0.1170 | 0.0043 | | | |

[1] See douglas fir HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Douglas Fir Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200°F | 0.0186 | 0 | 0.0186 | 0.0003 | 0.0004 | SUM ⇨ | 0.0379 |
| > 200°F | 0.0316 | 0 | | | | | 0.0508 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Douglas Fir VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | | Propane Mass Conversion | |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | MINUS | Speciated Compounds as Carbon (lb/mbf) | EQUALS | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | X 1.2238 = | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
| ≤ 200°F | 0.8688 | | 0.0379 | | 0.8309 | | 1.0169 |
| > 200°F | 1.2812 | | 0.0508 | | 1.2304 | | 1.5057 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Douglas Fir VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 1.0169 | | 0.0690 | 0.0019 | 0.0682 | 0.0007 | 0.0009 | | 1.1576 |
| > 200°F | 1.5057 | | 0.1170 | 0.0043 | | | | | 1.6968 |

**Hazardous Air Pollutant Emission Factors for Engelmann Spruce Lumber**

This sheet presents the HAP EF for drying engelmann spruce lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. EPA is not aware of any HAP emission testing of englemann spruce. Consistent with other species, when actual test data is not available, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Step One: Compile HAP Emission Test Data for Similar Species (White Spruce) by Drying Temperature[1,2]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | Lumber Dimensions | Moisture Content[3] (%) (Initial / Final) | Time to Final Moisture Content (hours) | HAP Sample Collection Technique | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 0.025 | 0.0013 | 0.036 | 0.0003 | 0.0005 | 2x4 or 2x6 | 33.5 / 15 | no data | NCASI Method 105 | 18 |
| 235 | 0.078 | 0.0044 | 0.031 | 0.0007 | 0.001 | 2x4 or 2x6 | 32.7 / 15 | no data | | |

[1] In the absence of engelmann spruce test data, white spruce test data has been substituted. The two wood species are similar in that both are resinous softwood species in the scientific classification genus Picea.

[2] Yellow highlight denotes data not considered by EPA Region 10 in 2007 when providing notice of original EFs prior to initial PCWP (Plywood and Composite Wood Products) MACT compliance date.

[3] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Engelmann Spruce HAP Emission Factors Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0250 | 0.0013 | 0.0360 | 0.0007 | 0.0010 |
| > 200°F | 0.0780 | 0.0044 | | | |

[1] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Drying Engelmann Spruce Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for engelmann spruce lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile VOC Emission Test Data for Similar Species (White Spruce) by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| ≤ 200°F | no data | | | | | |
| 235 | 0.11 | 2x4 or 2x6 | 32.7 / 15 | no data | JUM VE-7 | 18 |

[1] In the absence of engelmann spruce test data, white spruce test data has been substituted. The two wood species are similar in that both are resinous softwood species in the scientific classification genus Picea.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Engelmann Spruce VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature[2] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 0.1100 |
| > 200°F | 0.1100 |

[1] In the absence of white spruce test data for low-temperature drying, high-temperature test data has been substituted.

[2] Because VOC emissions appear to be dependent upon drying temperature in other species (no observed low-temperature observations for white spruce), separate values are calculated for low and high-temperature drying.

**Step Three: Compile Engelmann Spruce Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0250 | 0.0013 | 0.0360 | 0.0007 | 0.0010 |
| > 200°F | 0.0780 | 0.0044 | | | |

[1] See engelmann spruce HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Engelmann Spruce Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200°F | 0.0067 | 0 | 0.0098 | 0.0003 | 0.0004 | SUM ⇨ | 0.0173 |
| > 200°F | 0.0211 | 0 | | | | | 0.0316 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Engelmann Spruce VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | Propane Mass Conversion | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) | | | | |
| ≤ 200°F | 0.1100 | MINUS ⇨ | 0.0173 | EQUALS ⇨ | 0.0927 | X 1.2238 = | 0.1135 |
| > 200°F | 0.1100 | | 0.0316 | | 0.0784 | | 0.0960 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Engelmann Spruce VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 0.1135 | ⇨ | 0.0250 | 0.0013 | 0.0360 | 0.0007 | 0.0010 | ⇨ | 0.1775 |
| > 200°F | 0.0960 | | 0.0780 | 0.0044 | | | | | 0.2161 |

**Hazardous Air Pollutant Emission Factors for Drying Larch Lumber**

This sheet presents the HAP EF for drying larch lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. EPA Region 10 is not aware of any HAP emission testing of larch. Consistent with other species, when actual test data is not available, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Larch HAP Emission Factors[1]**

| Maximum Dry Bulb Temperature[2] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0690 | 0.0019 | 0.0682 | 0.0007 | 0.0010 |
| > 200°F | 0.1170 | 0.0044 | | | |

[1] In the absence of larch test data, douglas fir test data has been substituted for methanol, acetaldehyde, propionaldehyde, acrolein and low-temperature formaldehyde while white spruce test data has been substituted for high-temperature formaldehyde. Larch is similar to douglas fir, engelmann spruce, white spruce, lodgepole pine, ponderosa pine and western white pine in that all seven species are resinous softwood species in the scientific classification order Pinaceae, but larch does not share a common genus with any of these species. It appears to be most similar to douglas fir, engelmann spruce and white spruce in that the four species have small, sparse resin canals as opposed to the large numerous resin canals of the pines. See hhttp://www.faculty.sfasu.edu/mcbroommatth/lectures/wood_science/lab_2_resin_canal_species.pdf. See the douglas fir and englemann spruce HAP sheets for lab-scale test data and calculations.

[2] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature in other species (no observations for larch), separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Drying Larch Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying larch lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Larch WPP1 VOC Emission Factors**[1]

| Maximum Dry Bulb Temperature[2] (°F) | WPP1 VOC (lb/mbf) |
|---|---|
| ≤200 | 1.1576 |
| >200 | 1.6968 |

[1] In the absence of larch test data, douglas fir test data has been substituted. Larch is similar to douglas fir, engelmann spruce, white spruce, lodgepole pine, ponderosa pine and western white pine in that all seven species are resinous softwood species in the scientific classification order Pinaceae, but larch does not share a common genus with any of these species. It appears to be most similar to douglas fir, engelmann spruce and white spruce in that the four species have small, sparse resin canals as opposed to the large numerous resin canals of the pines. See hhttp://www.faculty.sfasu.edu/mcbroommatth/lectures/wood_science/lab_2_resin_canal_species.pdf. See the douglas fir and englemann spruce VOC sheets for lab-scale test data and calculations.

[2] Because VOC emissions appear to be dependent upon drying temperature in other species (no observations for larch), separate values are calculated for low and high-temperature drying.

**Hazardous Air Pollutant Emission Factors for Drying Lodgepole Pine Lumber**

This sheet presents lab-scale test data and calculations used to create HAP EF for drying lodgepole pine lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Step One: Compile Lodgepole Pine HAP Emission Test Data by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial / Final) | Time to Final Moisture Content (hours) | HAP Sample Collection Technique | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 195 | ~~0.073~~ | ~~no data~~ | ~~0.012~~ | ~~no data~~ | ~~no data~~ | no data | no data | no data | no data | 14 |
| 195 | ~~0.092~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | no data | no data | no data | no data | |
| 195 | ~~0.064~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | no data | no data | no data | no data | |
| 195 | ~~0.028~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | no data | no data | no data | no data | |
| 195 | ~~0.02~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | ~~no data~~ | no data | no data | no data | no data | |
| ≤ 200°F | no data | | | | | | | | | |
| 236 | 0.063 | 0.0041 | no data | no data | no data | 2x4 | 59.1 / 15 | 16 | NCASI Method IM/CAN/WP-99.01 without cannisters. | 3, 4, 12, 14 |
| 237 | 0.062 | 0.0041 | no data | no data | no data | 2x4 | 59.7 / 15 | 16.6 | | |
| 238 | 0.056 | 0.0039 | no data | no data | no data | 2x4 | 56.9 / 15 | 16 | | |

[1] Blue highlight denotes data not considered by EPA Region 10 in 2012. Five test runs considered by EPA Region 10 in 2007 are not considered here due to lack of documentation. The omitted test values are presented in Oregon Department of Environmental Quality memorandum May 8, 2007 entitled, "Title III Implications of Drying Kiln Source Test Results." The memorandum lists "Forintec #1, #2 and #5" along with "OSU QA # 1 and #2 " as the test data sources.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Lodgepole Pine HAP Emission Factors Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Methanol[2] (lb/mbf) | Formaldehyde[2] (lb/mbf) | Acetaldehyde[3] (lb/mbf) | Propionaldehyde[3] (lb/mbf) | (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0628 | 0.0041 | 0.0420 | 0.0032 | 0.0045 |
| > 200°F | 0.0628 | 0.0041 | | | |

[1] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature in other species (no confirmed low-temperature observations for lodgepole pine), separate values are calculated for low and high-temperature drying.

[2] In the absence of lodgepole pine test data for low-temperature drying, high-temperature test data has been substituted.

[3] In the absence of lodgepole pine test data for acetaldeyde, propionaldehyde and acrolein, ponderosa pine test data has been substituted. Lodgepole pine, ponderosa pine and western white pine are similar in that all three are resinous softwood species in the scientific classification genus Pinus. See the ponderosa pine and western white pine HAP sheets for lab-scale test data and calculations.

**Volatile Organic Compound Emission Factors for Drying Lodgepole Pine Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying lodgepole pine lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90th percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile Lodgepole Pine VOC Emission Test Data by Drying Temperature**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[1] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| ≤ 200°F | no data | | | | | |
| 236 | 1.17 | 2x4 | 59.1 / 15 | 16.01 | JUM 3-200 | 3, 4, 12 |
| 238 | 0.87 | 2x4 | 56.9 / 15 | 16.01 | | |
| 240 | 1.19 | 2x4 | 64.9 / 15 | 16.81 | | |

[1] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Lodgepole Pine VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature[2] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 1.1860 |
| > 200°F | 1.1860 |

[1] In the absence of lodgepole pine test data for low-temperature drying, high-temperature test data has been substituted.

[2] Because VOC emissions appear to be dependent upon drying temperature in other species (no observed low-temperature observations for lodgepole pine), separate values are calculated for low and high-temperature drying.

**Step Three: Compile Lodgepole Pine Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0628 | 0.0041 | 0.0420 | 0.0032 | 0.0045 |
| > 200°F | 0.0628 | 0.0041 | | | |

[1] See lodgepole pine HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Lodgepole Pine Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200°F | 0.0169 | 0 | 0.0115 | 0.0013 | 0.0019 | SUM ⇨ | 0.0316 |
| > 200°F | 0.0169 | 0 | | | | | 0.0316 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Lodgepole Pine VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | Propane Mass Conversion | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) | | | | |
| ≤ 200°F | 1.1860 | MINUS ⇨ | 0.0316 | EQUALS ⇨ | 1.1544 | X 1.2238 = | 1.4127 |
| > 200°F | 1.1860 | | 0.0316 | | 1.1544 | | 1.4127 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Lodgepole Pine VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 1.4127 | | 0.0628 | 0.0041 | 0.0420 | 0.0032 | 0.0045 | | 1.5293 |
| > 200°F | 1.4127 | | 0.0628 | 0.0041 | | | | | 1.5293 |

**Hazardous Air Pollutant Emission Factors for Drying Ponderosa Pine Lumber**

This sheet presents lab-scale test data and calculations used to create HAP EF for drying ponderosa pine lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Step One: Compile Ponderosa Pine HAP Emission Test Data by Drying Temperature[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | Lumber Dimensions | Moisture Content[2] (%) (Initial / Final) | Time to Final Moisture Content (hours) | HAP Sample Collection Technique | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 170 | 0.035 | 0.0027 | 0.042 | 0.0019 | 0.0017 | 2x4 | 82.6 / 15 | 42 | NCASI Method 105 | 17, 18 |
| 176 | 0.05 | 0.0022 | no data | no data | no data | 2x10 & 2x12 | 107.1 / 12 | 55 | NCASI Method IM/CAN/WP-99.01 without cannisters | 3, 4, 12, 14 |
| 176 | 0.08 | 0.0036 | no data | no data | no data | 2x10 & 2x12 | 124.1 / 12 | 57 | | |
| 235 | 0.144 | 0.0092 | 0.028 | 0.0032 | 0.0045 | 2x4 or 2x6 | 89.1 / 15 | 19 | NCASI Method 105 | 18, 21 |

[1] Yellow highlight denotes data not considered by EPA Region 10 in 2007 when providing notice of original EFs prior to initial PCWP (Plywood and Composite Wood Products) MACT compliance date.

[2] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Ponderosa Pine HAP Emission Factors Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 |
| > 200°F | 0.1440 | 0.0092 | | | |

[1] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Drying Ponderosa Pine Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying ponderosa pine lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile Ponderosa Pine VOC Emission Test Data by Drying Temperature**

| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | Lumber Dimensions | Moisture Content[1] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| 170 | 1.59 | 2x4 | 82.6 / 15 | 42 | JUM VE-7 | 17, 18 |
| 170 | 1.795 | 1x4 | 112.8 / 15 | 29 | JUM VE-7 | 2 |
| 170 | 1.925 | 1x4 | 88.7 / 15 | 28 | | |
| 176 | 1.29 | 2x10 & 2x12 | 107.1 / 12 | 55 | JUM 3-200 | 3, 4, 12 |
| 176 | 1.54 | 2x10 & 2x12 | 124.1 / 12 | 57 | | |
| 176 | 1.40 | 2x10 & 2x12 | 114.8 / 12 | 58.5 | JUM 3-200 | 3, 4 |
| 176 | 1.30 | 2x10 & 2x12 | 93.0 / 12 | 57.1 | | |
| 235 | 3.00 | 2x4 or 2x6 | 89.1 / 15 | 19 | JUM VE-7 | 18, 21 |

[1] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Ponderosa Pine VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data**

| Maximum Dry Bulb Temperature[1] (°F) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200°F | 1.8470 |
| > 200°F | 3.0000 |

[1] Because VOC emissions appear to be dependent upon drying temperature, separate values are calculated for low and high-temperature drying.

**Step Three: Compile Ponderosa Pine Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 |
| > 200°F | 0.1440 | 0.0092 | | | |

[1] See ponderosa pine HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Ponderosa Pine Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200 °F | 0.0200 | 0 | 0.0115 | 0.0013 | 0.0019 | SUM ⇨ | 0.0346 |
| > 200 °F | 0.0389 | 0 | | | | | 0.0535 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Ponderosa Pine VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | Propane Mass Conversion | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | MINUS ⇨ | Speciated Compounds as Carbon (lb/mbf) | EQUALS ⇨ | | | |
| ≤ 200 °F | 1.8470 | | 0.0346 | | 1.8124 | X 1.2238 = | 2.2179 |
| > 200 °F | 3.0000 | | 0.0535 | | 2.9465 | | 3.6058 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Ponderosa Pine VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 2.2179 | | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 | | 2.3450 |
| > 200°F | 3.6058 | | 0.1440 | 0.0092 | | | | | 3.8087 |

**Hazardous Air Pollutant Emission Factors for Drying Western White Pine Lumber**

This sheet presents the HAP EF for drying western white pine lumber. The EFs are based on the 90th percentile value of actual lab-scale HAP test data when three or more data points are available and on the maximum value when less than three data points are available. EPA Region 10 is not aware of any HAP emission testing of western white pine. Consistent with other species, when actual test data is not available, data for a similar species is substituted as noted. When there are more than one similar species, the highest of the EF for the similar species is substituted.

**Western White Pine HAP Emission Factors[1]**

| Maximum Dry Bulb Temperature[2] (°F) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200°F | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 |
| > 200°F | 0.1440 | 0.0092 | | | |

[1] In the absence of western white pine test data, ponderosa pine test data has been substituted for all HAP. Western white pine is similar to ponderosa pine and lodgepole pine in that all three species are resinous softwood species in the scientific classification genus Pinus. See the ponderosa pine and lodgepole pine HAP sheets for lab-scale test data and calculations.

[2] Because methanol and formaldehyde emissions appear to be dependent upon drying temperature in other species (no observations for western white pine), separate values are calculated for low and high-temperature drying.

**Volatile Organic Compound Emission Factors for Drying Western White Pine Lumber**

This sheet presents lab-scale VOC and HAP test data and calculations used to create VOC EF for drying western white pine lumber. The VOC test method used (EPA Reference Method 25A) has some limitations in that it misses some HAP (or portions of HAP) compounds that are VOC and known to exist and reports the results "as carbon" which only accounts for the carbon portion of each compound measured. The missed HAP compounds are accounted for through separate testing. The VOC test data is adjusted to fully account for five known HAPs that are VOC using separate HAP (speciated) test data and is reported "as propane" to better represent all of the unspeciated VOC compounds. This technique is consistent with EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 (WPP1 VOC) except that the VOC results are adjusted to account for not only methanol and formaldehyde but also acetaldehyde, propionaldehyde and acrolein.

Specifically, EFs are calculated from the VOC and HAP test data based on the 90$^{th}$ percentile value of actual lab-scale test data when three or more data points are available and on the maximum value when less than three data points are available. When actual test data is not available for this wood species, data for a similar species is substituted. When there are more than one similar species, the highest of the EF for the similar species is substituted. That portion of the (speciated) HAP compounds that are measured by the VOC test method (based on known flame ionization detector response factors) is subtracted from the VOC EF. The remaining "unspeciated" VOC EF is adjusted to represent propane rather than carbon and then added to the speciated HAP EF to provide the "total" VOC EF.

Note that reporting the unspeciated VOC as propane (mass-to-carbon ratio of 1.22 and a response factor of 1) may underestimate the actual mass of VOC for certain wood species because VOC compounds like ethanol and acetic acid with higher mass-to-carbon ratios (1.92 and 2.5, respectively) and lower response factors (0.66 and 0.575, respectively) can be a significant portion of the total VOC. Without reliable test data for such compounds, EPA assumes propane adequately represents the mix of unspeciated VOC.

**Step One: Compile Western White Pine VOC Emission Test Data by Drying Temperature**

| Max Dry Bulb Temperature, ℉ | Method 25A VOC as Carbon, lb/mbf | Lumber Dimension | Moisture Content[1] (%) (Initial/Final) | Time to Final Moisture Content (hours) | Method 25A Analyzer | Reference |
|---|---|---|---|---|---|---|
| 170 | 2.26 | 1x4 | 117.4 / 15 | 44 | JUM VE-7 | 2 |
| > 200 ℉ | no data | | | | | |

[1] Dry basis. Moisture content = (weight of water / weight wood) x 100

**Step Two: Calculate Western White Pine VOC Emission Factors "as Carbon" Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature[2] (℉) | Method 25A VOC as Carbon (lb/mbf) |
|---|---|
| ≤ 200 ℉ | 2.2600 |
| > 200 ℉ | 3.0000 |

[1] In the absence of western white pine test data for high-temperature drying, ponderosa pine test data has been substituted. Western white pine, ponderosa pine and lodgepole pine are similar in that all three are resinous softwood species in the scientific classification genus Pinus. See the ponderosa pine and lodgepole pine sheets for lab-scale test data and calculations.

[2] Because VOC emissions appear to be dependent upon drying temperature in other species (no high-temperature observations for western white pine), separate values are calculated for low and high-temperature drying.

**Step Three: Compile Western White Pine Speciated HAP Emission Factors Based on Maximum/90th Percentile Test Data[1]**

| Maximum Dry Bulb Temperature (℉) | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) |
|---|---|---|---|---|---|
| ≤ 200 ℉ | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 |
| > 200 ℉ | 0.1440 | 0.0092 | | | |

[1] See western white pine HAP sheet for lab-scale test data and calculations.

**Step Four: Convert Western White Pine Speciated HAP Emission Factors to "as Carbon" and Total**

Speciated Compound "X" expressed as carbon = $(RF_X)$ X $(SC_X)$ X $[(MW_C) / (MW_X)]$ X $[(\#C_X) / (\#C_C)]$

where: $RF_X$ represents the flame ionization detector (FID) response factor (RF) for speciated compound "X"

$SC_X$ represents emissions of speciated compound "X" expressed as the entire mass of compound emitted

$MW_C$ equals "12.0110" representing the molecular weight (MW) for carbon as carbon is becoming the "basis" for expressing mass of speciated compound "X"

$MW_X$ represents the molecular weight for speciated compound "X"

$\#C_X$ represents the number of carbon atoms in speciated compound "X"

$\#C_C$ equals "1" as the single carbon atom is becoming the "basis" for expressing mass of speciated compound "X"

| Maximum Dry Bulb Temperature (°F) | Methanol as Carbon (lb/mbf) | Formaldehyde as Carbon (lb/mbf) | Acetaldehyde as Carbon (lb/mbf) | Propionaldehyde as Carbon (lb/mbf) | Acrolein as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) |
|---|---|---|---|---|---|---|---|
| ≤ 200°F | 0.0200 | 0 | 0.0115 | 0.0013 | 0.0019 | SUM ⇨ | 0.0346 |
| > 200°F | 0.0389 | 0 | | | | | 0.0535 |

Element and Compound Information

| Element / Compound | FID RF[1] | Molecular Weight (lb/lb-mol) | Formula | Number of Carbon Atoms | Number of Hydrogen Atoms | Number of Oxygen Atoms | Reference |
|---|---|---|---|---|---|---|---|
| Methanol | 0.72 | 32.042 | $CH_40$ | 1 | 4 | 1 | 1 |
| Formaldehyde | 0 | 30.0262 | $CH_2O$ | 1 | 2 | 1 | 16 |
| Acetaldehyde | 0.5 | 44.053 | $C_2H_4O$ | 2 | 4 | 1 | 20 |
| Propionaldehyde | 0.66 | 58.0798 | $C_3H_6O$ | 3 | 6 | 1 | 20 |
| Acrolein | 0.66 | 56.064 | $C_3H_4O$ | 3 | 4 | 1 | 20 |
| Propane | 1 | 44.0962 | $C_3H_8$ | 3 | 8 | 0 | 16 |
| Carbon | - | 12.0110 | C | 1 | - | - | - |
| Hydrogen | - | 1.0079 | H | - | 1 | - | - |
| Oxygen | - | 15.9994 | O | - | - | 1 | - |

[1] FID RF = volumetric concentration or "instrument display" / compound's actual known concentration. Numerator and denominator expressed on same basis (ie. carbon, propane, etc) and concentration in units of "ppm."

**Step Five: Subtract Speciated HAP Compounds from Western White Pine VOC Emission Factors and Convert Result to "as Propane"**

| | FROM STEP TWO | | FROM STEP FOUR | | Method 25A VOC as Carbon without Speciated Compounds (lb/mbf) | Propane Mass Conversion | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) |
|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Carbon (lb/mbf) | | Speciated Compounds as Carbon (lb/mbf) | | | | |
| ≤ 200°F | 2.2600 | MINUS ⇨ | 0.0346 | EQUALS ⇨ | 2.2254 | X 1.2238 = | 2.7233 |
| > 200°F | 3.0000 | | 0.0535 | | 2.9465 | | 3.6058 |

Method 25A VOC as propane without speciated compounds = $(VOC_C)$ X $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$

where: $VOC_C$ represents Method 25A VOC as carbon without speciated compounds

$RF_{C3H8}$ equals "1" and represents the FID RF for propane. All alkanes, including propane, have a RF of 1.

$MW_{C3H8}$ equals "44.0962" and represents the molecular weight for propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

$MW_C$ equals "12.0110" and represents the molecular weight for carbon

$\#C_C$ equals "1" as the single carbon atom was the "basis" for which Method 25A VOC test results were determined as illustrated in Step One of this spreadsheet

$\#C_{C3H8}$ equals "3" as three carbon atoms are present within propane; the compound that is the "basis" for expressing mass of VOC per WPP1 VOC

Note: The following portion from the equation immediately above, $(1/RF_{C3H8})$ X $[(MW_{C3H8}) / (MW_C)]$ X $[(\#C_C) / (\#C_{C3H8})]$, equals 1.2238 and can be referred to as the "propane mass conversion factor."

**Step Six: Calculate WPP1 VOC by Adding Speciated HAP Compounds to Western White Pine VOC Emission Factors "as Propane"**

WPP1 VOC = Method 25A VOC as propane without speciated compounds + ∑ speciated compounds expressed as the entire mass of compound

| | FROM STEP FIVE | | FROM STEP THREE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Maximum Dry Bulb Temperature (°F) | Method 25A VOC as Propane without Speciated Compounds (lb/mbf) | PLUS | Methanol (lb/mbf) | Formaldehyde (lb/mbf) | Acetaldehyde (lb/mbf) | Propionaldehyde (lb/mbf) | Acrolein (lb/mbf) | EQUALS | WPP1 VOC (lb/mbf) |
| ≤ 200°F | 2.7233 | ⇨ | 0.0740 | 0.0034 | 0.0420 | 0.0032 | 0.0045 | ⇨ | 2.8505 |
| > 200°F | 3.6058 | | 0.1440 | 0.0092 | | | | | 3.8087 |

## Index to References Appearing in EPA Region 10 HAP and VOC Emission Factors for Lumber Drying, December 2012

**Reference No. 1**
(Undated) J.U.M. Flame Ionization Detector Response Factor Technical Information presented at http://www.jum-aerosol.com/images/E-Fakt-02.pdf

Notes
Methanol response factor (RF) of 0.72 equals average of three response factors 0.69, 0.68 and 0.79 for J.U.M. models 3-200 and VE-7. These two models were exclusively employed to determine Method 25A VOC in the testing EPA Region 10 is relying upon to support VOC emission factor derivation.

An alternative RF of 0.65 from Appendix 3 to EPA's Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 at http://www.epa.gov/ttn/emc/prelim/otm26.pdf could have been employed instead.

Employing RF of 0.72 (as opposed to 0.65) generates lower VOC emission factors (EF). A higher RF means that the EPA Method 25A flame ionization detector (FID) measures more of the compound. With the methanol EF having already been determined through speciated sampling and analysis, assuming the FID measures a greater portion of the methanol leaves less of the Method 25A measurement to be accounted for as unspeciated VOC.

**Reference No. 2**
National Council of the Paper Industry for Air and Stream Improvement, Inc. Technical Bulletin No. 718. July 1, 1996. A Small-Scale Kiln Study on Method 25A Measurements of Volatile Organic Compound Emissions from Lumber Drying.

Notes
To convert Method 25A VOC from "lb C/ODT" to "lb C/mbf," the following calculations were performed:

White Fir – Runs 15 and 16.
(0.85 lb/ODT) X (0.57 lb/mbf) / (0.77 lb/ODT) = 0.63 lb/mbf
(0.68 lb/ODT) X (0.57 lb/mbf) / (0.77 lb/ODT) = 0.50 lb/mbf
See pages 14 and 15 of the reference document.

Western Red Cedar – Runs 10 and 11.
(0.12 lb/ODT) X (0.12 lb/mbf) / (0.15 lb/ODT) = 0.096 lb/mbf
(0.17 lb/ODT) X (0.12 lb/mbf) / (0.15 lb/ODT) = 0.136 lb/mbf
See pages 14 and 15 of the reference document.

Douglas fir – Runs 1 and 3.
(1.00 lb/ODT) X (0.81 lb/mbf) / (0.86 lb/ODT) = 0.942
(0.71 lb/ODT) X (0.81 lb/mbf) / (0.86 lb/ODT) = 0.669
See pages 12 and 15 of the reference document.

Ponderosa Pine – Runs 5 and 6.
(1.92 lb/ODT) X (1.86 lb/mbf) / ( 1.99 lb/ODT) = 1.795 lb/mbf
(2.06 lb/ODT) X (1.86 lb/mbf) / (1.99 lb/ODT) = 1.925 lb/mbf
See pages 14 and 15 of the reference document.

The moisture content of wood was originally reported on a wet basis. It has been corrected to be on a dry basis using the following equation:
(moisture content on dry basis) = (moisture content on wet basis) / [1 – (moisture content on wet basis)]

**Reference No. 3**
Small-scale Kiln Study Utilizing Ponderosa Pine, Lodgepole Pine, White Fir, and Douglas-fir. Report by Michael R. Milota to Intermountain Forest Association. September 29, 2000.

**Reference No. 4**
Milota, Michael. VOC and HAP Emissions from Western Species. Western Dry Kiln Association: May 2001, p. 62-68.

**Reference No. 5**
Milota, M.R. 2003. HAP and VOC Emissions from White Fir Lumber Dried at High and Conventional Temperatures. Forest Prod. J. 53(3):60-64.

**Reference No. 6**
VOC and HAP Emissions from the High Temperature Drying of Hemlock Lumber. Report by Michael R. Milota to Hampton Affiliates. June 21, 2004.

**Reference No. 7**
Fritz, Brad. 2004. Pilot- and Full-Scale Measurements of VOC Emissions from Lumber Drying of Inland Northwest Species. Forest Prod. J. 54(7/8):50-56.

Notes
To convert acetaldehyde from "µg/min-bf" to "lb/mbf," the following calculations were performed:

White fir.
0.0550 lb/mbf = (7.7 µg/min-bf) X (60 min/hr) X (54 hr) X (kg/1x$10^9$g) X (2.205 lb/kg) X (1,000 bf/mbf).
See page 54 of the reference document.

Douglas fir.
0.030 lb/mbf = (4.9 µg/min-bf) X (60 min/hr) X (46 hr) X (kg/1x$10^9$g) X (2.205 lb/kg) X (1,000 bf/mbf).
0.022 lb/mbf = (3.6 µg/min-bf) X (60 min/hr) X (46 hr) X (kg/1x$10^9$g) X (2.205 lb/kg) X (1,000 bf/mbf).
See page 53 of the reference document.

**Reference No. 8**
VOC and Methanol Emissions from the Drying of Hemlock Lumber. Report by Michael R. Milota to Hampton Affiliates. August 24, 2004.

**Reference No. 9**
VOC, Methanol, and Formaldehyde Emissions from the Drying of Hemlock Lumber. Report by Michael R. Milota to Hampton Affiliates. October 15, 2004.

**Reference No. 10**
VOC Emissions from the Drying of Douglas-fir Lumber. Report by Michael R. Milota to Columbia Vista Corporation. June 14, 2005.

**Reference No. 11**
Milota, M.R. and P. Mosher. 2006. Emissions from Western Hemlock Lumber During Drying. Forest Prod. J. 56(5):66-70.

**Reference No. 12**

**Reference No. 12**
Milota, M.R. 2006. Hazardous Air Pollutant Emissions from Lumber Drying. Forest Prod. J. 56(7/8):79-84.

**Reference No. 13**
VOC, Methanol, and Formaldehyde Emissions from the Drying of Hemlock, ESLP, and Douglas Fir Lumber. Report by Michael R. Milota to Hampton Affiliates. March 23, 2007.

**Reference No. 14**
Oregon Department of Environmental Quality memorandum May 8, 2007 entitled, "Title III Implications of Drying Kiln Source Test Results."

Notes
The reference document presents a compilation of EF.

**Reference No. 15**
HAP Emissions from the Drying of Hemlock and Douglas-fir Lumber by NCASI 98.01 and 105. Report by Michael R. Milota to Hampton Affiliates. May 22, 2007 report.

**Reference No. 16**
EPA Interim VOC Measurement Protocol for the Wood Products Industry - July 2007 presented at http://www.epa.gov/ttn/emc/prelim/otm26.pdf

Notes
VOC determined through use of this document is referred to as WPP1 VOC. The document is alternatively known as EPA Other Test Method 26 or “OTM26.”

Default formaldehyde RF of 0 and propane (an alkane) RF of 1 appear in Appendix 3 – Procedure for Response Factor Determination for the Interim VOC Measurement Protocol for the Wood Products Industry.

**Reference No. 17**
HAP Emissions by NCASI 98.01 and 105 from Drying of Ponderosa Pine and White Wood Lumber. Report by Michael R. Milota to Hampton Affiliates. July 25, 2007.

**Reference No. 18**
Milota, M.R. and P. Mosher. 2008. Emission of Hazardous Air Pollutants from Lumber Drying. Forest Prod. J. 58(7/8):50-55.

**Reference No. 19**
VOC Emissions From the Drying of Douglas-fir Lumber. Report by Michael R. Milota to Columbia Vista Corp. November 12, 2010.

**Reference No. 20**
NCASI Technical Bulletin No. 991. September 2011. Characterization, Measurement, and Reporting of Volatile Organic Compounds Emitted from Southern Pine Wood Products Sources.

Notes
Acetaldehyde and propionaldehyde RF appear in Table C-1 of Appendix C. The values are estimates based upon dividing the compound’s effective carbon numbers (ECN) by the number of carbon atoms in the compound. See Attachment 2 to Appendix C.

Acrolein RF is also an estimate based upon dividing the compound’s ECN by the number of carbon atoms in the compound. In this case, the RF estimate does not appear in Table C-1 of Appendix C. The value is calculated as described above pursuant to Attachment 2 to Appendix C.
RF = (ECN) / (number of carbon atoms in compound)
where ECN = 2 given the aliphatic carbon contribution of $CH_2CHCHO$ (see Table 2.1 to Appendix C) and the number of carbon atoms in acrolein = 3.
RF = 2/3 or 0.66

**Reference No. 21**
Email of 03/26/12 email from Oregon State University's Michael Milota to EPA Region 10's Dan Meyer.

**Reference No. 22**
Email of 03/27/12 from Oregon State University's Michael Milota to EPA Region 10's Dan Meyer.