

**PERMIT BOILERPLATE PROCEDURES
FOR SMALL BOILERS FIRING WOOD, WOOD WASTE,
WOOD/BARK, AND/OR BARK WASTE**

1. PURPOSE

To specify requirements for permit approval for wood, wood waste, wood/bark, or bark waste fired boilers having a maximum design heat input capacity from 350,000 BTU per hour through 100 million BTU per hour. Boilers burning wood, wood waste, wood/bark, or bark waste with distillate oil and/or gaseous fuels may utilize this boilerplate in combination with other approved permit boilerplates (i.e. small gas and distillate oil fired units or residual oil fired units) provided that all the requirements in this boilerplate are met. This boilerplate does not apply to boilers subject to Prevention of Significant Deterioration (PSD) or Nonattainment permit review. Additional details concerning applicability are given in Section VI.A. of these procedures.

This boilerplate is meant to provide a guideline for the minimum requirements of the Department of Environmental Quality - Air Division.

2. REFERENCES

Commonwealth of Virginia Administrative Code (VAC); Chapter 50, Article 1 (9 VAC 5-50-60 et seq.) through Article 5 (9 VAC 5-50-400 et seq.); Chapter 80, Part I, 9 VAC 5-80-10 (formerly 9 120-08-01); 40 CFR 60.40c through 60.48c (NSPS, Subpart Dc).

3. DEFINITIONS

The following definitions are for use in this guideline and do not necessarily have the same meaning in other portions of the regulations.

Affected facility - with reference to a stationary source, any apparatus to which a standard is applicable.

Annual capacity factor - the ratio between the actual heat input to a steam generating unit from an individual fuel or combination of fuels during a period of 12 consecutive calendar months and the potential heat input to the steam generating unit from all fuels had the steam generating unit been operated for 8760 hours during that 12-month period at the maximum design heat input capacity.

Construction - fabrication, erection, or installation of an emissions unit.

Emissions unit - any part of a stationary source which emits or would have the potential to emit any air pollutant.

Existing facility - with reference to a stationary source, any apparatus of the type for which a standard is promulgated in 40 CFR 60, and the construction or modification of which was commenced before the date of proposal of that standard; or any apparatus which could be altered in such a way as to be of that type. (Also see definition of Existing source under 9 VAC 5-10-20)

Maximum design heat input capacity - the ability of a steam generating unit to combust a stated maximum amount of fuel (or combination of fuels) on a steady state basis as determined by the physical design and characteristics of the steam generating unit.

Modification - (From 40 CFR 60.14) any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any air pollutant to which a standard applies.

(From 9 VAC 5-80-10 B.3.) Any physical change in, change in the method of operation of, or addition to, an emissions unit which increases the uncontrolled emission rate of any air pollutant emitted into the atmosphere by the unit or which results in the emission of any air pollutant into the atmosphere not previously emitted. (Also see full definition of "modification" under 9 VAC 5-80-10 B.3.)

Reconstruction - the replacement of an emissions unit or its components to such an extent that the fixed capital cost of the new components exceeds 50 percent of the fixed capital costs required to construct a comparable entirely new unit.

Steam generating unit - a device that combusts any fuel and produces steam or heats water or any other heat transfer medium.

Wood - means wood, wood residue, bark, or any derivative fuel or residue thereof, in any form including but not limited to sawdust, sander dust, wood chips, scraps, slabs, millings, shavings, and processed pellets made from wood or other forest residues and including any wood which has affixed thereto paint and/or finishing material.

4. FUEL QUALITY SPECIFICATIONS

1. Heat content

The heat content of the wood shall be initially provided and documented by the applicant. The heat content value reported should conform to the fuel on an "as fired" basis, and on a higher heating value basis. The moisture content of the wood on an "as fired" basis shall also be reported by the applicant in the permit application.

5. EMISSIONS CALCULATIONS

1. Criteria Pollutant Emission Factors

The following factors are as listed in AP-42, Chapter 1, Section 6 (dated 10/96). The following emission factors can be used to calculate **uncontrolled** emissions for units firing the specified fuel(s) without other more appropriate emission factors:

Bark			SCC 1-02-009-01
PM	47	pounds per ton fuel burned	& 1-02-009-04
PM-10	16.8	"	& 1-03-009-01
CO	13.6	"	
SO ₂	0.15	"	
NO _x	1.5	"	
VOC	0.22	"	

Wood/bark			SCC 1-02-009-02
TSP	7.2	pounds per ton fuel burned	& 1-02-009-05
PM-10	6.48	"	& 1-03-009-02
CO	13.6	"	
SO ₂	0.15	"	
NO _x	1.5	"	
VOC	0.22	"	

Wood			SCC 1-02-009-03
PM	8.8	pounds per ton fuel burned	& 1-02-009-06
PM-10*	8.8	"	& 1-03-009-03
CO	13.6	"	
SO ₂	0.15	"	
NO _x	1.5	"	
VOC	0.22	"	

* Use PM-10 = PM

These factors may also be used to calculate expected emissions for all cited pollutants, and allowable emissions for pollutants other than particulate matter provided any applicable pollution control efficiency factors, and/or permit throughput limitations are used in the calculations. Expected and allowable particulate matter emission limits should be based on the BACT emission limit of 0.1 or 0.3 lb/10⁶ BTU, whichever applies, as specified in V.D. Stack test data from comparable units may be used at the discretion of the permit engineer.

2. Toxic Emission Factors

These factors are for all wood fuels and all boiler sizes from AP-42, Section 1.6, dated October 1996. Only priority pollutants with TLVs are included in the table. The priority pollutants without TLVs were evaluated using a surrogate TLV and were determined to be exempt when formaldehyde is exempt; refer to

Tables 1.6-4 and 1.6-5 of AP-42. Calculations to determine toxic pollutant emission rates should be done in accordance with current agency policy. Also listed are the specific boiler cut-off ratings, below which the specified toxic pollutant will be exempt for toxic pollutants

Emission Factors for Priority Toxic Pollutants from Wood Waste Combustion				
Pollutant	Avg. Em. Fctr.	EER	EER	Blr. size cutoff
Volatiles compounds	lb/T	lb/hr	T/yr	MMBtu/hr
Acetaldehyde	1.92e-03	8.91	26.1	27,932.4
Acrolein	4.0e-06	0.02277	0.03335	17,131.8
Benzene	9.95e-03	2.112	4.64	958.2
2,4-Dinitrophenol	4.23e-06	0.0132	0.029	14,087.2
Formaldehyde	8.2e-03	0.0825	0.174	43.6
Naphthalene	3.39e-03	2.607	7.54	4,570.3
Phenols	1.47e-05	1.254	2.755	385,099.2
Metals				
Arsenic	8.53e-05	0.0132	0.029	698.6
Cadmium	2.12e-05	0.0033	0.00725	702.7
Chlorine	7.8e-03	0.0957	2.175	110.4
Chromium (Total)	1.56e-04	0.033	0.0725	955.0
Chromium (VI)	4.6e-05	0.0033	0.00725	323.9
Cobalt	1.3e-04	0.0033	0.00725	114.6
Manganese	1.26e-02	0.33	0.725	118.2
Mercury	5.15e-06	0.00099	0.00145	578.5
Nickel	6.90e-05	0.0066	0.0145	431.8
Selenium	4.59e-05	0.0132	0.029	1,298.2

Example calculations are outlined in Appendix A of these procedures. Below is an example of the cut-off size calculations:

Formaldehyde Emission factor - 8.2×10^{-3} lb/T
 TLV-TWA 1.2 mg/m³
 TLV-STEL 2.5 mg/m³
 EER(lb/hr) = 2.5 * 0.033 = 0.0825 lb/hr
 EER(T/yr) = 1.2 * 0.145 = 0.174 T/yr

$$\frac{0.0825 \text{ lb/hr} * 4500 \text{ Btu/lb} * 2000 \text{ lb/T}}{0.0082 \text{ lb/T} * 1 \times 10^6 \text{ Btu/MMBtu}} = 90.5 \text{ MMBtu/hr}$$
$$\frac{0.174 \text{ T/yr} * 4500 \text{ Btu/lb} * 2000 \text{ lb/T}}{0.0082 \text{ lb/T} * 1 \times 10^6 \text{ Btu/MMBtu} * 8760 \text{ hr/yr}} = 43.6 \text{ MMBtu/hr}$$

3. Emission Controls and BACT

All wood fired boilers having a maximum design heat input capacity from 0.35-100 million BTU per hour must have some type of particulate matter control device **and NSPS Subpart Dc applies to those units 10 million BTU per hour and more.** The following list is an overview of some typical emission control devices most commonly used on wood fired boilers, and is provided for reference purposes only:

1. multicyclone mechanical collector - generally used on wood fired boilers not required to meet the 0.1 lb/10⁶ BTU particulate matter limit,
 2. multiple multicyclone mechanical collectors in series - acceptable for use on units required to meet the 0.1 lb/10⁶ BTU provided the resultant emission rate conforms to the 0.1 lb/10⁶ BTU limit,
 3. wet scrubbers - acceptable for units required to meet the 0.1 lb/10⁶ BTU,
 4. multicyclone mechanical collector in series with wet scrubber - acceptable for units required to meet the 0.1 lb/10⁶ BTU.
4. BACT for particulate emissions from wood fired boilers is the following, at a minimum:
1. wood fired boilers with maximum design heat input capacity of less than 30 million BTU per hour, or a maximum design heat input capacity greater than 30 million BTU per hour but annual capacity factor less than or equal to 30%: 0.3 lb/10⁶ BTU,
 2. wood fired boilers with maximum design heat input capacity of 30 through 100 million BTU per hour and an annual capacity factor greater than 30%: 0.1 lb/10⁶ BTU.

6. REQUIREMENTS

1. Applicability

This boilerplate applies to construction, modification, reconstruction, or relocation of boilers fired by wood having a maximum design heat input capacity from 350,000 BTU per hour through 100 million BTU per hour. This boilerplate does not

apply to boilers subject to PSD or Nonattainment permitting regulations.

2. NSPS Applicability

NSPS Subpart Dc applies to construction, modification, or reconstruction of boilers after June 9, 1989, fired by wood having a maximum design heat input capacity from 10 million through 100 million BTU per hour. Although no specific provisions are specified for NSPS units less than 30 million BTU per hour (other than reporting and recordkeeping requirements), NSPS designation should appear on, and EPA notification should be made for all permits issued for those units with a maximum design heat input capacity greater than or equal to 10 million BTU per hour, and less than or equal to 100 million BTU per hour.

3. Permit limits

1. Permit limits are required for each criteria pollutant as specified by current agency policy, currently those having recommended emissions equal to or greater than 0.5 ton per year.

2. For units burning wood and gas, wood and oil, or wood, oil and gas, hourly emission limits are set at the highest calculated emission rate of that calculated for any fuel individually.

Annual emission limits are based on the permitted combination of fuel that produces the highest emission rate.

3. The gas and/or distillate oil fired boiler boilerplate procedures should be referenced, and can be combined, for wood fired boilers burning oil and/or gas, provided all conditions of this boilerplate are met.

4. Particulate matter emission limits in pounds per million BTU are required for all units at a minimum. Permit limits for units rated from 350,000 BTU per hour to less than 30 million BTU per hour must be set at $0.3 \text{ lb}/10^6$ at a minimum, and units from 30 million through 100 million BTU per hour must have permit limits no greater than $0.1 \text{ lb}/10^6$ BTU per hour. Units from 30 - 100 million BTU per hour may not have to meet the lower particulate standard if the calculated annual capacity factor is 30% or less.

5. If the unit's annual capacity factor is used to exempt it from an NSPS emission limit and/or monitoring requirements, the permit shall include a federally enforceable condition limiting the annual capacity factor to 30% or less.

6. Emission limits for toxic pollutants should be established and included in the permit in accordance with current agency policy.

4. Opacity

Visible emissions shall not exceed 20 percent opacity except during one six-minute period in any one hour in which visible emissions shall not exceed 27 percent opacity. This condition applies at all times except during startup, shutdown, or malfunction.

5. Toxic Pollutants

A toxic pollutant review may be required for wood fired boilers in accordance with approved agency policies and procedures. It may be necessary to perform a toxic pollutant review on a facility-wide basis. Toxic pollutant emission factors are cited in Section V of these procedures, and those specified toxic pollutants may be analyzed.

6. Fuel sampling

No wood fuel sampling is required other than the initial determination of "as fired" heat and moisture content.

7. Emissions Monitoring

Wood fired units having a maximum design heat input capacity of 30 million through 100 million BTU per hour shall install, calibrate, maintain, operate and record the output of a Continuous Emission Monitoring System (CEMS) for measuring the opacity of the emissions discharged to the atmosphere. The opacity CEMS shall be operated in accordance with the applicable procedures under Performance Specification 1 (Appendix B of 40 CFR 60). The span value of the opacity CEMS shall be between 60 and 80 percent. Units required to have opacity monitors shall conduct a CEMS performance evaluation.

8. Emissions/Compliance Testing

1. A three hour opacity test (total time of observations greater than 3 hours, thirty 6-minute averages) is required for all wood fired units with a maximum design heat input capacity of 30 million BTU per hour or greater, and is the responsibility of the owner or operator. The test must be performed by a certified EPA Method 9 visible emissions evaluator within 60 days after achieving maximum operation but no later than 180 days after initial startup. Testing must be done while the unit is firing wood only. Test results are to be submitted within 45 days after test completion.

Continuous Opacity Monitoring System (COMS) data may be used in lieu of Method 9 observation data. Notification to DEQ must be made 30 days before any performance test that the COMS will be used to determine compliance.

2. Particulate emissions testing conforming to EPA Methods 1-5 is required for all units having a maximum design heat input capacity of 30 million BTU per hour or greater.
3. Emissions testing for nitrogen oxides and volatile organic compounds is at the permit engineer's discretion for units in non-attainment areas which have a maximum design heat input capacity of 10 million BTU per hour or greater. Testing for nitrogen oxides should be done concurrently with testing for particulate emissions and/or opacity when required.
4. For wood fired units claiming the 30% annual capacity factor exemption, a 24-hour firing rate capacity demonstration corresponding to the requirements of 40 CFR 60.45c(b), is required.

9. Training, Operation, and Maintenance

All boiler operators should receive training in the operation of the boiler, and if applicable, training in the operation of pollution control equipment and/or continuous emission monitoring systems. Training shall consist of review and familiarization of the manufacturer's operating instructions, at minimum. In addition, the permittee must maintain written operation and maintenance procedures on site.

10. Notification

1. The owner or operator of all facilities subject to this boilerplate must submit notification of the following:
 1. the date of construction or reconstruction,
 2. the anticipated date of startup,
 3. the actual date of startup,
 4. the anticipated date of emissions tests,
 5. the anticipated date of the continuous emissions monitor performance evaluation, if applicable,
2. Each notification submitted shall also contain the following:
 1. the design heat input capacity of the affected facility and identification of fuels to be combusted in the affected facility,
 2. if applicable, a copy of any Federally enforceable requirement that limits the annual capacity factor for any fuel or mixture of fuels,
 3. the annual capacity factor at which the owner or operator anticipates operating the affected facility based on all fuels fired and based on each individual fuel fired.

Each notification shall be submitted to the DEQ Regional Office. Copies of notifications, except those outlined in

J.1.d. and e. above, should be mailed to the Chief Air Enforcement Branch (3AT20), U. S. Environmental Protection Agency, Region III, 1650 Arch Street, Philadelphia, PA 19103-2029 if the affected unit has a maximum design heat input capacity of 10 million through 100 million BTU per hour.

11. Recordkeeping

1. All facilities operating wood fired boilers must maintain the following records on site for the most recent five year period:
 1. [hourly,] daily, monthly, and annual records of wood consumed,
 2. a statement of the time, place, and nature of training provided to each boiler operator,
 3. a boiler operation and maintenance procedure.

12. Reporting

One copy of emissions testing data shall be submitted to the DEQ Regional Office. One copy of the CEMS performance evaluation reports shall be submitted to the DEQ Regional Office. If there are any facility or air pollution control equipment failures or malfunctions that cause excess emissions for more than one hour, the owner shall notify DEQ by facsimile, telephone or telegraph of the failure or malfunction and within two weeks, provide a written statement giving all pertinent facts. When the condition has been corrected, the owner shall notify DEQ.

Excess emission reports for any calendar quarter for which there are excess emissions from any unit with a maximum design heat input capacity of 30 million BTU per hour or greater shall be sent to the DEQ Regional Office with a copy mailed to the EPA, Air Enforcement Branch (3AT20), Region III, 841 Chestnut Street, Philadelphia, PA 19107. These excess emission reports shall conform to the requirements of § 60.48c(c) of NSPS Subpart Dc.

13. Modeling

Modeling analysis is required for criteria and toxic pollutants in accordance with current agency policy.

14. Permit Approval

Approval authority is given to the Regional Office. Signatory authority shall be in accordance with DEQ's delegation of authority.

ATTACHMENT A - EXAMPLE CALCULATIONS

Boiler Boiler and heat exchange cyclone burner W/B&W 3 Drum Boiler located at a furniture manufacturing facility

Fuel wood waste - green/dry mix, 35% moisture

Fuel usage 3.5 T/hr; 25,000 T/yr

Heat value 8,500 BTU/lb (dry basis); 4,500 BTU/lb (as fired)

Sulfur 0

Ash 1%

Heat Capacity 31.5 x 10⁶ BTU/hr input

Steam Rating 20,000 lb/hr

Controls One multiclone Fly Ash Arrestor MT-SA-40-9CYTXD in series with one Warren Environmental Cyclonic-800 scrubber for particulate control.

Op. Schedule 24 hr/d, 7 d/wk, 52 wk/yr - 8760 hr/yr

SCC Number 1-02-009-06

Em. Factors AP-42, Section 1-6 (dated 10/96), factors will be used for all pollutants.

Pollutant	lb/T
TSP	8.8
PM-10	use 8.8
CO	13.6
SO ₂	0.15
NO _x	1.5
VOC	0.22

Toxic pollutant review is not required for this unit since it is rated less than any cut-off size specified for the toxic pollutants in the Wood Fired Boiler Boilerplate Procedures.

Uncontrolled Emissions

PM 31.5 x 10⁶ BTU/hr) 4500 BTU/lb) 2000 lb/T * 8.8 lb/T = 30.8 lb/hr

 30.8 lb/hr * 8760 hr/yr) 2000 lb/T = 134.9 T/yr

PM-10 30.8 lb/hr, 134.9 T/yr

CO 3.5 T/hr * 13.6 lb/T = 47.6 lb/hr

 47.6 lb/hr * 8760 hr/yr) 2000 lb/T = 208.5 T/yr

SO₂ 3.5 T/hr * 0.15 lb/T = 0.53 lb/hr

 0.53 lb/hr * 8760 hr/yr) 2000 lb/T = 2.3 T/yr

NO_x 3.5 T/hr * 1.5 lb/T = 5.25 lb/hr

 5.25 lb/hr * 8760 hr/yr) 2000 lb/T = 23.0 T/yr

VOC 3.5 T/hr * 0.22 lb/T = 0.77 lb/hr

 0.77 lb/hr * 8760 hr/yr) 2000 lb/T = 3.4 T/yr

Annual Capacity Factor

25,000 T wood/yr * 4500 BTU/lb * 2000 lb/T = 225 x 10⁹ BTU/yr actual heat input

31,500,000 BTU/hr input * 8760 hr/yr = 275.9 x 10⁹ BTU/yr potential

$$\frac{\text{Annual Capacity}}{\text{Factor}} = \frac{\text{Actual}}{\text{Potential}} = \frac{225 \times 10^9 \text{ BTU/yr}}{275.9 \times 10^9 \text{ BTU/yr}} = 0.816$$

heat input

0.816 > 0.3 and 31.5 x 10⁶ > 30 x 10⁶ BTU/hr, therefore, NSPS limit of 0.1 lb/10⁶ BTU applies for particulate matter emissions.

Expected Emissions

PM	0.1 lb/10 ⁶ BTU 0.1 lb/10 ⁶ BTU/hr * 31.5 x 10 ⁶ BTU/hr = 3.2 lb/hr 225 x 10 ⁹ Btu/yr * 0.1 lb/10 ⁶ BTU) 2000 lb/T = 11.3 T/yr
PM-10	3.2 lb/hr, 11.3 T/yr
CO	47.6 lb/hr 25,000 T/yr * 13.6 lb/T) 2000 lb/T = 170 T/yr
SO ₂	0.5 lb/hr 25,000 T/yr * 0.15 lb/T) 2000 lb/T = 1.9 T/yr
NO _x	5.3 lb/hr 25,000 T/yr * 1.5 lb/T) 2000 lb/T = 18.8 T/yr
VOC	0.77 lb/hr 25,000 T/yr * 0.22 lb/T) 2000 lb/T = 2.8 T/yr

Recommended Emissions

PM	0.1 lb/10 ⁶ BTU, 11.3 T/yr
PM-10	0.1 lb/10 ⁶ BTU, 11.3 T/yr
CO	47.6 lb/hr, 170 T/yr
SO ₂	0.5 lb/hr, 1.9 T/yr
NO _x	5.3 lb/hr, 18.8 T/yr
VOC	0.77 lb/hr, 2.8 T/yr

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