Michigan Department of Environmental Quality

Air Quality Division

NESHAP, Subpart 6J Annual Heat Input Calculation & Subcategory Selection

GUIDANCE

How do I determine the percentage of fuel use on an annual heat input basis to select my boiler's NESHAP 6J subcategory?

Under NESHAP 6J, a boiler's fuel subcategory is determined, in part, based on the percentage of fuel consumed by the unit in the 12 month period preceding the required compliance demonstration (e.g. the required tune-up, energy assessment, or performance test). The fuel use must be evaluated on an annual heat input basis. This guide details how to calculate your annual heat input and determine the fuel type, fuel classification, and unit subcategory under NESHAP, Subpart 6J.

If the boiler is new or modified to switch fuels, then the fuel consumption is calculated using the maximum fuel use as authorized by:

- a permit by rule (permit exemption) fuel limitation found in Rule 282 of the Part 55 Air Pollution Control Rules) and the equipment maximum operating capacity; or
- the fuel and capacity limitations in a federally enforceable air use permit to install or renewable operating permit.

Follow the steps below to calculate fuel use on annual heat input basis and select a subcategory.

Step 1: Determine the High Heat Value (HHV) for Each Fuel
The rule provides several options to estimate HHV. You may obtain the data from your fuel supplier, use the calculation methodologies in the EPA greenhouse gas (GHG) reporting program (40 CFR part 98, subpart C), or from a site-specific performance test.

Step 2: Determine the Annual Fuel Consumption of Each Fuel
Add the total amount of each fuel consumed in the 12 months preceding the compliance demonstration (tune up or performance test). This step may not be needed if the unit is new or is modifying fuels. Contact an AQD permit engineer if you have a new source.

Step 3: Calculate the Annual Heat Input of Each Fuel
Multiply the total annual consumption by the HHV of each fuel to determine the annual heat input of each fuel.

Step 4: Total the Annual Heat Input from all Fuel Types
Add the calculated annual heat input for all fuel types.

Step 5: Total the Annual Heat Input from Each Fuel Classification
Identify the classification for each fuel according to definitions under 40 CFR 63.11200 Find the total annual heat input from each fuel classification by adding together the calculated annual heat input of each fuel with the same fuel classification.

Step 6: Determine the Percent Annual Heat Input of Each Fuel Classification
Divide the total annual heat input from each fuel classification by the total annual heat input from all fuel types, then multiply by 100%.

Step 7: Determine the Boiler or Heater's Fuel Subcategories
Compare the percentage of each fuel classification on an annual heat input basis to the fuel subcategories according to definitions under 40 CFR 63.11237.

When calculating the annual heat input value, it is important to select the correct 12 month period. The 12 month period will vary from affected source to affected source because it is the 12 month period preceding the last compliance demonstration (e.g. the later of any required tune-up, energy assessment, or performance test for the affected source). The following are a few compliance demonstration scenarios:

- **Existing 6J source without emission limits** – The annual heat input period would be driven by the date that the last required work practice (energy assessment or tune up) was performed. If the source completed the energy assessment on November 1, 2015 and the tune up on January 1, 2016, the time period to be used for calculating the annual heat input would be from January 1, 2015, through December 31, 2015.

- **Existing 6J source with emission limits** – The annual heat input period would be driven by the later of the dates the sources completes the energy assessment, performance test, or tune up. If the source completed the performance test last and it was completed on July 31, 2016, the time period to be used for calculating the annual heat input would be from July 31, 2015, through July 30, 2016.

- **New or modified source with a fuel change** – In light of the fact that there would be no preceding fuel use, the subcategory would be calculated using the limits provided in the rule or permit authorizing the construction, installation, or modification.

For sources with the authorization to switch fuels to a point that may prompt a subcategory change, the owner operator should continue to calculate the fuel use on a rolling twelve month annual heat input basis. This will help ensure that there are no unexpected fuel switches prompting a subcategory changes, notification obligations, or other compliance changes for the unit. Under NESHAP, Subpart 6J a source that switches subcategories must provide notice to EPA via CEDRI within 30 days of the subcategory change per 40 CFR 63.11225(h) and physical compliance with the new subcategory requirements is generally required within 180 days per 40 CFR 63.11210(g).

Definitions

To select the correct subcategory under NESHAP, Subpart 6J, you need to know the boiler's fuel use on an annual heat input basis. You must also understand the various terms as they are defined under the standard. This section is intended to clarify the various terms and definitions found in NESHAP, Subpart 6J that relate to selecting the appropriate subcategory.

To select the correct subcategory, refer to the definitions in 40 CFR 63.11237 and the subcategories listed in 40 CFR 63.11200. Be sure to review the definitions listed for use limitations, boiler equipment, and exemptions (e.g. coal. Distillate oil, gaseous fuel, liquid fuel, oxygen trim system, seasonal boiler, residential boiler, research and development boiler, etc.).

Biomass or bio-based solid fuel *means any biomass-based solid fuel that is not a solid waste. This includes, but is not limited to, wood residue; 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.*

Biomass subcategory *includes any boiler that burns any biomass and is not in the coal subcategory.*

Coal *means all solid fuels classifiable as anthracite, bituminous, sub-bituminous, or lignite by ASTM D388 (incorporated by reference, see §63.14), coal refuse, and petroleum coke. For the purposes of this subpart, this definition of "coal" includes synthetic fuels derived from coal, including but not limited to, solvent-refined coal, coal-oil mixtures, and coal-water mixtures. Coal derived gases are excluded from this definition.*

Coal subcategory includes any boiler that burns any solid fossil fuel and no more than 15 percent biomass on an annual heat input basis.

Fuel means fuel type as defined in 63.11237.

Fuel type as defined in 63.12237 means a category of fuel or fuel types that share a common name or classification. Examples of fuel types include, but are not limited to, bituminous coal, sub-bituminous coal, lignite, anthracite, coal refuse, petroleum coke, coke, tire derived fuel, distillate oil, biodiesel, vegetable oil, residual oil, used oil, biodiesel, biomass, natural gas, refinery gas, biogas, landfill gas, process gas, coal derived gas, regulated gas stream, other gas, etc.

Fuel classification itself is not defined in 63.12237; however, specific fuel classifications are defined in 63.12237. Examples of defined fuel classifications include, but are not limited to, biomass, biodiesel, gas, liquid, and coal.

Gaseous fuels includes, but is not limited to, natural gas, process gas, landfill gas, coal derived gas, refinery gas, hydrogen, and biogas.

Gas fired boiler as defined in 63.12237 means any boiler that burns gaseous fuels not combined with any solid fuels and burns liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or periodic testing on liquid fuel. Periodic testing of liquid fuel shall not exceed a combined total of 48 hours during any calendar year.

Liquid fuel includes, but is not limited to, distillate oil, residual oil, any form of liquid fuel derived from petroleum, used oil meeting the specification in 40 CFR 279.11, liquid biofuels, biodiesel, and vegetable oil, and comparable fuels as defined under 40 CFR 261.38.

Oil subcategory includes any boiler that burns any liquid fuel and is not in either the biomass or coal subcategories. Gas-fired boilers that burn liquid fuel only during periods of gas curtailment, gas supply interruptions, startups, or for periodic testing are not included in this definition. Periodic testing on liquid fuel shall not exceed a combined total of 48 hours during any calendar year.

Residual oil means crude oil, fuel oil that does not comply with the specifications under the definition of distillate oil, and all fuel oil numbers 4, 5, and 6, as defined by the American Society of Testing and Materials in ASTM D396–10 (incorporated by reference, see § 63.14(b)).

Solid fossil fuel includes, but is not limited to, coal, coke, petroleum coke, and tire derived fuel.

Solid fuel means any solid fossil fuel or biomass or bio-based solid fuel.

Subcategory itself is not defined in 63.11237; however, the NESHAP, Subpart 6J subcategories are identified in 40 CFR 63.11200 and tied to numerous specific definitions in 63.11237. There are 7 subcategories in NESHAP, Subpart 6J which are based on fuel use, use limitations, equipment design, and size. The NESHAP, Subpart 6J subcategories include:

1. Coal
2. Biomass
3. Oil
4. Seasonal boilers
5. Oil-fired boilers with heat input capacity of equal to or less than 5 million Btu/hr
6. Boilers with an oxygen trim system
7. Limited-use boilers.

Vegetable oil means oils extracted from vegetation.

Example Calculation

An existing boiler burns a coal blend fuel (35% bituminous and 65% sub-bituminous), wood chips (30% moisture), tire derived fuel and No. 2 fuel oil. There are no plans to change the fuel consumption of the boiler. Find the percentage of each fuel type on an annual heat input basis and determine the correlating fuel subcategory.

Step 1: Determine High Heat Value (HHV) for Each Fuel

In this case, there is no information from the fuel provider. The following high heat values can be obtained from 40 CFR part 98, subpart C:

Fuel type	Default High Heat Value
Bituminous coal	24.93 MM Btu/short ton
Subbituminous coal	17.25 MM Btu/short ton
Wood (dry basis)*	17.48 MM Btu/short ton
Tire derived fuel (Tires)	28.00 MM Btu/short ton
No. 2 fuel oil	0.138 MM Btu/gallon

Use the following formula to calculate a wet basis HHV for use in Equation C-1: HHVw = ((100 − M)/100)*HHVd where HHVw = wet basis HHV, M = moisture content (percent) and HHVd = dry basis HHV

The wood chips for this example have 30% moisture content. Therefore, the default high heat value of the wood on a dry basis must be adjusted using the specified formula.

High heat value of wood on wet basis$= \frac{100-30}{100} * 17.48$ MM Btu/short ton = 12.24 MM Btu/short ton

Step 2: Determine the Annual Fuel Consumption of Each Fuel

There are no plans to change the fuel consumption of the boiler so the fuel usage records for the previous 12 months should be referenced. For this example, the current month is May 2014 and the calculation is a preliminary calculation to preliminarily establish the subcategory and expected compliance demonstration dates. The fuel records in this example are as follows:

Month	Blended Coal (short tons)	Wood Chips (short tons)	Tire Derived Fuel (short tons)	No. 2 Fuel Oil (gallons)
April 2014	5.75	12.03	1.62	53.96
March 2014	4.20	9.96	2.07	125.79
February 2014	6.04	8.75	3.21	32.41
January 2014	8.43	0	3.05	213.54
December 2013	9.01	0	2.84	364.86
November 2013	7.93	0	1.85	379.85
October 2013	2.21	13.54	1.15	419.52
September 2013	4.44	12.50	2.34	43.81
August 2013	1.05	7.56	2.47	95.84
July 2013	0	7.98	1.92	224.37
June 2013	0	0	3.11	97.34
May 2013	3.02	14.50	2.04	82.10
Total:	**52.08**	**86.82**	**27.67**	**2133.39**

The records show the total blended coal burned, but the annual consumption of each coal type must be determined. In this case, the coal blend was 35% bituminous and 65% sub-bituminous for the entire year. Therefore, the following equation may be used to determine the annual consumption of each coal type. If the blend changed from month to month, then the percentage would have to be applied on a monthly basis.

Total of type X coal burned = Total coal burned $* \frac{percent\ of\ type\ X}{100\%}$

Total bituminous coal burned = 52.08 short tons $* \frac{35\%}{100\%}$ = 18.23 short tons

Total sub-bituminous coal burned = 52.08 short tons $* \frac{65\%}{100\%}$ = 33.85 short tons

Step 3: Calculate the Annual Heat Input of Each Fuel

Multiply the total annual consumption by the high heat value of each fuel to determine the annual heat input of each fuel.

Fuel Type	Total Annual Consumption (TAC)	High Heat Value (HHV)	Annual Heat Input =TAC * HHV
Bituminous coal	18.23 tons	24.93 MM Btu/short ton	454.47 MM Btu
Subbituminous coal	33.85 tons	17.25 MM Btu/short ton	583.91 MM Btu
Wood chips	86.82 tons	12.24 MM Btu/short ton	1,062.68 MM Btu
Tire derived fuel	27.67 tons	28.00 MM Btu/short ton	774.76 MM Btu
No. 2 fuel oil	2,133.39 gallons	00.138 MM Btu/gallon	294.41 MM Btu

Step 4: Total the Annual Heat Input from all Fuel Types

Add the calculated Annual Heat Input from all fuel types.

(454.47 + 583.91 + 1,062.67 + 774.76 + 294.41) MM Btu = 3,170.23 MM Btu

Step 5: Total the Annual Heat Input from Each Fuel Classification

Identify the classification for each fuel according to the definitions found in 40 CFR 63.11237 and subcategories found in 40 CFR 63.11200 and highlighted above. The following table identifies the fuels for this example placed in each classification defined in NESHAP, Subpart 6J:

Classification	Fuel Types
Solid fuel	Bituminous coal, sub-bituminous coal, wood chips, & tire derived fuel
Solid fossil fuel	Bituminous coal, sub-bituminous coal, and tire derived fuel
Coal	Bituminous coal & sub-bituminous coal
Biomass	Wood chips
Liquid Fuel	No. 2 fuel oil
Distillate Oil	No. 2 fuel oil

Find the total annual heat input from each fuel classification by adding together the calculated annual heat input of each fuel with the same fuel classification. The classifications for this example are Solid Fuel, Solid Fossil Fuel, Coal, Biomass, Liquid Fuel, and Distillate Oil. The Annual Heat Input for each fuel was found in Step 3.

The following table shows the annual heat input of the fuels in each classification. A fuel which does not fall under the classification is designated with an "X."

Classification	Bituminous Coal	Subbituminous Coal	Wood Chips	Tire Derived Fuel	No. 2 Fuel Oil	Total (MM Btu)
	Annual Heat Input (MM Btu)					
Solid Fuel	454.47	583.91	1062.68	774.76	X	**2,875.82**
Solid Fossil Fuel	454.47	583.91	X	774.76	X	**1,813.15**
Coal	454.47	583.91	X	X	X	**1,038.39**
Biomass	X	X	1,062.68	X	X	**1,062.68**
Liquid Fuel	X	X	X	X	294.41	**294.41**
Distillate Oil	X	X	X	X	294.41	**294.41**

Step 6: Determine the Percent Annual Heat Input of Each Fuel Classification

Divide the total annual heat input from each fuel classification by the total annual heat input from all fuel types, then multiply by 100%

Solid Fuels on an Annual Heat Basis $= \frac{2,875.82\ MM\ Btu}{3,170.23\ MM\ Btu} * 100\% = 90.7\%$

Solid Fossil Fuels on an Annual Heat Basis $= \frac{1,813.15\ MM\ Btu}{3,170.23\ MM\ Btu} * 100\% = 57.2\%$

Coal on an Annual Heat Basis $= \frac{1,038.39\ MM\ Btu}{3,170.23\ MM\ Btu} * 100\% = 32.8\%$

Biomass on an Annual Heat Basis $= \frac{1,062.68\ MM\ Btu}{3,170.23\ MM\ Btu} * 100\% = 33.5\%$

Liquid Fuel on an Annual Heat Basis $= \frac{294.41\ MM\ Btu}{3,170.23\ MM\ Btu} * 100\% = 9.3\%$

Distillate Oil on an Annual Heat Basis $= \frac{294.41\ MM\ Btu}{3,170.23\ MM\ Btu} * 100\% = 9.3\%$

Step 7: Determine the Boiler or Process Heater's Fuel Subcategories

Compare the percentage of each fuel classification on an annual heat input basis to the fuel subcategories identified 40 CFR 63.11200 when using the definitions found in 40 CFR 63.11237 .

Does this unit fall under the "coal subcategory"?
Coal subcategory includes any boiler that burns any solid fossil fuel and no more than 15 percent biomass on an annual heat input basis.
Answer: No**.** The unit burns 33.5% biomass on an annual heat input basis.

Does this unit fall under the "biomass subcategory"?
Biomass subcategory includes any boiler that burns any biomass and is not in the coal subcategory.

Answer: Yes. The unit burns 33.5% biomass on an annual heat input basis and is not in the coal subcategory.

Does this unit fall under the "seasonal" subcategory?

Seasonal boiler means a boiler that undergoes a shutdown for a period of at least 7 consecutive months (or 210 consecutive days) each 12-month period due to seasonal conditions, except for periodic testing. Periodic testing shall not exceed a combined total of 15 days during the 7-month shutdown. This definition only applies to boilers that would otherwise be included in the biomass subcategory or the oil subcategory.

Answer: <u>No</u>. For purposes of this example, the boiler does not meet the seasonal boiler definition.

Does this unit fall under the "oil-fired boilers with heat input capacity of equal to or less than 5 million Btu/hr"?

Oil subcategory includes any boiler that burns any liquid fuel and is not in either the biomass or coal subcategories. Gas-fired boilers that burn liquid fuel only during periods of gas curtailment, gas supply interruptions, startups, or for periodic testing are not included in this definition. Periodic testing on liquid fuel shall not exceed a combined total of 48 hours during any calendar year.

Answer: <u>No</u>. The unit is in the biomass subcategory.

Does this unit fall under the "boilers with an oxygen trim system that maintains an optimum air-to-fuel ratio that would otherwise be subject to a biennial tune-up"?

Oxygen trim system means a system of monitors that is used to maintain excess air at the desired level in a combustion device. A typical system consists of a flue gas oxygen and/or carbon monoxide monitor that automatically provides a feedback signal to the combustion air controller.

Answer: <u>No</u>. For purposes of this example, the boiler does have an oxygen trim system as defined under the standard.

Does this unit fall under the "limited-use boilers" subcategory?

Limited-use boiler means any boiler that burns any amount of solid or liquid fuels and has a federally enforceable average annual capacity factor of no more than 10 percent.

Answer: <u>No</u>. For purposes of this example, the boiler is not a limited use boiler with a federally enforceable limitation on use.

The annual heat input review has resulted in this boiler being a biomass subcategory boiler.