UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
AIR, WASTE, AND TOXICS

MAY 08 2014

MEMORANDUM

SUBJECT: HAP Potential to Emit Emission Factors for Biomass Boilers Located in Pacific Northwest Indian Country

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TO: Permit File

EPA Region 10 has compiled the attached list of hazardous air pollutant ("HAP") emission factors ("EFs") for use in determining the potential emissions, more commonly referred to as potential to emit ("PTE"), for biomass boilers located in Pacific Northwest Indian Country. The EFs are presented in units of pounds of pollutant per million British thermal units heat input or "lb/MMBtu." PTE generally represents the maximum capacity of a source to emit a pollutant under its physical and operational design taking into consideration restrictions that are federally enforceable. HAP PTE is used to determine applicability of the Title V operating permit program and the National Emission Standards for Hazardous Air Pollutants ("NESHAP") program.

The default EFs presented in the attachment reflect EPA AP-42's Table 1.6-3 (September 2003); a compilation of average EFs for biomass boilers employing either no controls or just particulate matter controls.[1] It is appropriate to employ one of these EFs to determine PTE for a particular pollutant when (a) no federal regulation or permit is limiting, and (b) a more representative emission factor is not available.

Only one federal regulation, the major source boiler NESHAP (40 CFR part 63, subpart DDDDD), restricts HAP emissions from biomass boilers, and only boilers (at major sources) with heat input capacity of 10 MMBtu per hour or greater are affected. For those affected boilers, emissions of 10 HAPs are limited.[2] And for those 10 HAPs, the attachment lists an EF for each corresponding limit. In general, it is appropriate to employ these EFs, in lieu of the default AP-42 EFs, to determine PTE for affected boilers given that the underlying limits are enforceable (and AP-42 EFs are not).

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[1] "Average" in this context means arithmetic average for a set of values upon which the EF is based. It is not meant to be descriptive of the relative quality of the EF.

[2] The major source boiler MACT limits emissions of the following HAPs: arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, selenium, mercury and hydrogen chloride.

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HAP Categories	EF (lb/MMBtu)
Trace Metal Compounds[1]	1.78E-03
Other Inorganic Compounds[2]	1.98E-02
Organic Compounds[3]	1.72E-02
TOTAL	3.87E-02

[1] See Table 1.

[2] See Table 2.

[3] See Table 3.

Table 1 - Trace Metal HAP EF

Trace Metal Compounds	EF (lb/MMBtu)
Antimony Compounds	7.90E-06
Arsenic Compounds (including arsine)[1]	2.20E-05
Beryllium Compounds[1]	1.10E-06
Cadmium Compounds[1]	4.10E-06
Chromium Compounds (including hexavalent)[1]	2.10E-05
Cobalt Compounds	6.50E-06
Lead Compounds (not elemental lead)[1]	4.80E-05
Manganese Compounds[1]	1.60E-03
Mercury Compounds[2]	3.50E-06
Nickel Compounds[1]	3.30E-05
Phophorus	2.70E-05
Selenium Compounds[1]	2.80E-06
SUBTOTAL	1.78E-03

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

[1] If boiler is subject to major source boiler MACT ("NESHAP DDDDD") total selected metals ("TSM") limit, do not use emission factors ("EF") listed in table for arsenic, beryllium, cadmium, chromium, lead, manganese, nickel and selenium. Instead, employ aggregate emission limits specified in table immediately below beginning on source's compliance date. Existing sources must comply with NESHAP DDDDD emission limits beginning January 31, 2016. New sources must comply by January 31, 2013, or upon startup, whichever is later.

Maximum Design Heat Input Capacity, X (MMBtu/hr)	Date Construction or Reconstruction Commenced, Y	NESHAP DDDDD TSM Emission Limit (lb/MMBtu)	Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP DDDDD…
X ≥ 10	Y ≤ 06/04/10	5.3E-05	Table 2, Row 2
	Y > 06/04/10	2.3E-05	Table 1, Row 2

[2] If boiler is subject to NESHAP DDDDD, 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 DDDDD emission limits beginning January 31, 2016. New sources must comply by January 31, 2013, or upon startup, whichever is later.

Maximum Design Heat Input Capacity, X (MMBtu/hr)	Date Construction or Reconstruction Commenced, Y	NESHAP DDDDD Mercury Emission Limit (lb/MMBtu)	Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP DDDDD…
X ≥ 10	Y ≤ 06/04/10	5.7E-06	Table 2, Row 1
	Y > 06/04/10	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]	1.90E-02
SUBTOTAL	1.98E-02

EF Basis: AP-42, September 2003. Table 1.6-3.

[1] If boiler is subject to NESHAP DDDDD, do not use hydrogen chloride 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 DDDDD emission limits beginning January 31, 2016. New sources must comply by January 31, 2013, or upon startup, whichever is later.

Maximum Design Heat Input Capacity, X (MMBtu/hr)	Date Construction or Reconstruction Commenced, Y	NESHAP DDDDD Hydrogen Chloride Emission Limit (lb/MMBtu)	Regulatory Citation 40 CFR 63.7500(a)(1) and NESHAP DDDDD…
X ≥ 10	Y ≤ 06/04/10	2.2E-02	Table 2, Row 1
	Y > 06/04/10	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[1,2]	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[1]	9.70E-05
4-Nitrophenol	1.10E-07
Pentachlorophenol	5.10E-08
Phenol	5.10E-05
Polychlorinated biphenyls (PCB)[3]	8.15E-09
Polycyclic Organic Matter (POM)[4]	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[1]	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[5]	1.72E-02

EF Basis: AP-42, September 2003. Table 1.6-3.

[1] designates a HAP that is subject individually to the 10 ton per year ("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.

[2] See Table 4 for list of individual dibenzofurans.

[3] See Table 5 for list of individual polychlorinated biphenyls ("PCBs").

[4] See Table 6 for list of individual 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

[5] 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[1]	9.10E-07
Acenaphthylene[1]	5.00E-06
Anthracene[1]	3.00E-06
Benzo(a)anthracene[1]	6.50E-08
Benzo(b)fluoranthene[1]	1.00E-07
Benzo(j,k)fluoranthene[1]	1.60E-07
Benzo(k)fluoranthene[1]	3.60E-08
Benzo(g,h,i)perylene[1]	9.30E-08
Benzo(a)pyrene[1]	2.60E-06
Benzo(e)pyrene[1]	2.60E-09
2-Chloronaphthalene	2.40E-09
Chrysene[1]	3.80E-08
Dibenzo(a,h)anthracene[1]	9.10E-09
Dibenzodioxins[2,3]	1.67E-06
Dibenzofurans[2,4]	1.87E-09
Fluoranthene[1]	1.60E-06
Fluorene[1]	3.40E-06
Indeno(1,2,3-cd)pyrene[1]	8.70E-08
2-Methylnaphthalene	1.60E-07
Naphthalene[1,2]	9.70E-05
Perylene	5.20E-10
Phenanthrene[1]	7.00E-06
Pyrene[1]	3.70E-06
SUBTOTAL	1.27E-04

EF Basis: AP-42, September 2003. Table 1.6-3.

[1] 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

[2] 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.

[3] See Table 7.

[4] 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.