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GREET MODEL EMISSION FACTORS FOR COAL- AND BIOMASS-FIRED BOILERS

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GREET-EmissionFactorSummary_R1.1.docx

ACRONYMS AND ABBREVIATIONS

ANL	Argonne National Laboratory
CFR	U.S. Code of Federal Regulations
CO	carbon monoxide
CO ₂	carbon dioxide
EPA	U.S. Environmental Protection Agency
ERT	electronic reporting tool
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation
ICI	industrial, commercial and institutional [boilers and process heaters]
lb/MMBtu	pounds per million British thermal units
MACT	maximum achievable control technology
MWe	megawatts (electric)
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
O ₂	molecular oxygen
OTM	Other Test Method
PM	particulate matter
PM10	PM with aerodynamic diameter of 10 micrometers and smaller
PM2.5	PM with aerodynamic diameter of 2.5 micrometers and smaller
SO ₂	sulfur dioxide
THC	total hydrocarbons
TNMHC	total non-methane hydrocarbons
VOC	volatile organic compounds

1. SUMMARY

Argonne National Laboratory is updating the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model. New boiler air pollutant emission factors were developed for the following pollutants:

- Particulate matter (PM), specifically particles with aerodynamic diameter of 10 and 2.5 micrometers and smaller (PM₁₀ and PM_{2.5}, respectively);
- Carbon monoxide (CO);
- Volatile organic compounds (VOC), expressed as total non-methane hydrocarbons;
- Nitrogen oxides (NO_x), expressed as nitrogen dioxide (NO₂); and
- Sulfur dioxide (SO₂).

The new boiler emission factors are summarized in Tables 1 and 2 for biomass and coal, respectively.

Table 1: GREET emission factors for coal-fired boilers.
 g/MMBtu of fuel (higher heating value)

Year of operation	Pollutant	Coal		Bituminous coal		Subbituminous coal		Lignite		Waste coal	
		Industrial Boiler	IGCC Turbines	Industrial Boiler	IGCC Turbines	Industrial Boiler	IGCC Turbines	Industrial Boiler	IGCC Turbines	Industrial Boiler	IGCC Turbines
Year 2005	VOC	0.33	Unknown	0.32	Unknown	0.36	Unknown	0.33	Unknown	0.33	Unknown
	CO	18	Unknown	16	Unknown	23	Unknown	18	Unknown	18	Unknown
	NOx	209	Unknown	222	Unknown	156	Unknown	209	Unknown	209	Unknown
	PM10	17	Unknown	43	Unknown	13	Unknown	17	Unknown	17	Unknown
	PM2.5	13	Unknown	19	Unknown	12	Unknown	13	Unknown	13	Unknown
	SOx	272	Unknown	272	Unknown	272	Unknown	272	Unknown	272	Unknown
Year 2010	VOC	0.47	Unknown	0.45	Unknown	1.3	Unknown	0.47	Unknown	0.47	Unknown
	CO	25	Unknown	26	Unknown	21	Unknown	25	Unknown	25	Unknown
	NOx	160	Unknown	157	Unknown	190	Unknown	160	Unknown	160	Unknown
	PM10	16	Unknown	15	Unknown	18	Unknown	16	Unknown	16	Unknown
	PM2.5	13	Unknown	12	Unknown	21	Unknown	13	Unknown	13	Unknown
	SOx	279	Unknown	274	Unknown	308	Unknown	279	Unknown	279	Unknown
Year 2015	VOC	0.053	Unknown	0.053	Unknown	0.053	Unknown	0.053	Unknown	0.053	Unknown
	CO	29	Unknown	26	Unknown	44	Unknown	29	Unknown	73	Unknown
	NOx	177	Unknown	25	Unknown	177	Unknown	177	Unknown	253	Unknown
	PM10	2.6	Unknown	2.6	Unknown	2.6	Unknown	2.6	Unknown	2.6	Unknown
	PM2.5	2.4	Unknown	2.4	Unknown	2.4	Unknown	2.4	Unknown	2.4	Unknown
	SOx	56	Unknown	22	Unknown	56	Unknown	56	Unknown	91	Unknown

Small data set - 3 or 4 data points

Very small data set - 1 or 2 data points

Biomass all years all fuels

Specific Test Year, Specific Boiler Size - Biomass or Coal

Specific Test Year, All Boiler Sizes - Biomass or Coal

Specific Test Year, All Boiler Sizes - Specific Fuel like Wood, Bituminous, etc.

Table 1: GREET emission factors for coal-fired boilers.

Year of operation	Pollutant	Anthracite		Coal				Bituminous coal			
		Industrial Boiler	IGCC Turbines	< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr	< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr
Year 2005	VOC	0.33	Unknown	0.33	0.33	0.32	0.36	0.32	0.32	0.32	0.32
	CO	41	Unknown	18	56	19	13	16	56	15	10
	NOx	209	Unknown	209	209	195	218	222	222	195	248
	PM10	17	Unknown	82	58	12	22	82	58	40	24
	PM2.5	13	Unknown	46	44	10	19	46	44	35	19
	SOx	272	Unknown	272	272	272	272	272	272	272	272
Year 2010	VOC	0.47	Unknown	0.47	0.65	0.44	1.1	0.45	0.65	0.39	1.2
	CO	25	Unknown	25	61	32	16	26	61	30	17
	NOx	160	Unknown	160	177	186	151	157	177	186	143
	PM10	16	Unknown	104	29	14	15	104	21	14	15
	PM2.5	19	Unknown	67	21	13	11	67	19	12	11
	SOx	279	Unknown	279	223	507	220	274	223	527	223
Year 2015	VOC	0.053	Unknown	0.053	0.053	0.053	0.053	0.05	0.05	0.05	0.05
	CO	29	Unknown	29	31	29	29	26	31	26	26
	NOx	177	Unknown	177	177	177	177	25	25	25	25
	PM10	2.6	Unknown	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	PM2.5	2.4	Unknown	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
	SOx	56	Unknown	56	56	56	56	22	22	22	22

Table 1: GREET emission factors for coal-fired boilers.

Year of operation	Pollutant	Subbituminous coal				Lignite			
		< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr	< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr
Year 2005	VOC	0.36	0.36	0.36	0.36	0.33	0.33	0.33	0.33
	CO	23	23	117	17	18	56	19	13
	NOx	156	156	156	156	209	209	195	218
	PM10	13	13	9	20	82	58	12	22
	PM2.5	12	12	8	18	46	44	10	19
	SOx	272	272	272	272	272	272	272	272
Year 2010	VOC	1.33	1.33	1.9	0.78	0.47	0.65	0.44	1.1
	CO	21	21	94	30	25	61	32	16
	NOx	190	190	204	181	160	177	186	151
	PM10	18	58	25	16	104	29	14	15
	PM2.5	21	27	24	13	67	21	13	11
	SOx	279	279	923	207	279	223	507	220
Year 2015	VOC	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
	CO	44	31	44	44	29	31	29	29
	NOx	177	177	177	177	177	177	177	177
	PM10	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	PM2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
	SOx	56	56	56	56	56	56	56	56

Table 1: GREET emission factors for coal-fired boilers.

Year of operation	Pollutant	Waste coal				Anthracite			
		< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr	< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr
Year 2005	VOC	0.33	0.33	0.32	0.36	0.33	0.33	0.32	0.36
	CO	18	56	19	13	41	41	41	41
	NOx	209	209	195	218	209	209	195	218
	PM10	82	13	12	22	82	58	12	22
	PM2.5	46	12	10	19	46	44	10	19
	SOx	272	272	272	272	272	272	272	272
Year 2010	VOC	0.47	0.65	0.44	1.1	0.47	0.65	0.44	1.1
	CO	25	61	32	16	25	61	32	16
	NOx	160	177	186	151	160	177	186	151
	PM10	104	29	14	15	104	29	14	15
	PM2.5	67	21	13	11	19	19	19	19
	SOx	279	223	507	220	279	223	507	220
Year 2015	VOC	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
	CO	73	73	73	73	29	31	29	29
	NOx	253	253	253	253	177	177	177	177
	PM10	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	PM2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
	SOx	91	91	91	91	56	56	56	56

Table 2: GREET emission factors for biomass-fired boilers.
 g/MMBtu of fuel (higher heating value)

Year of operation	Pollutant	Biomass	Bagasse	Wood	Biomass, all types of biomass				Biomass from cellulosic ethanol plants			
					< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr	< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr
Year 2005	VOC	91	96	0.20	91	0.20	211	80	91	91	91	91
	CO	225	892	153	225	169	174	675	225	225	225	225
	NOx	127	98	133	127	166	94	98	127	127	127	127
	PM10	23	43	20	23	63	25	28	23	23	23	23
	PM2.5	19	34	17	19	55	19	22	19	19	19	19
	SOx	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Year 2010	VOC	7.1	95	1.5	7.1	5.7	1.5	12.3	7.1	7.1	7.1	7.1
	CO	162	394	148	162	136	129	172	162	162	162	162
	NOx	95	95	95	95	111	95	81	95	95	95	95
	PM10	18	27	17	35	14	16	15	18	18	18	18
	PM2.5	14	21	14	31	9.2	13	14	14	14	14	14
	SOx	1.6	1.6	1.6	1.6	2.8	3.3	2.9	1.6	1.6	1.6	1.6
Year 2015	VOC	1.3	1.3	0.56	1.3	0.56	1.3	1.4	1.3	1.3	1.3	4.1
	CO	18	79	18	18	153	18	49.0	18	18	18	2.4
	NOx	78	78	79	78	78	127	56.2	78	78	78	70
	PM10	1.8	1.8	1.81	1.8	3.1	1.8	1.5	1.8	1.8	1.8	1.7
	PM2.5	1.5	1.5	1.53	1.5	2.3	1.5	1.3	1.5	1.5	1.5	1.5
	SOx	2.5	2.5	0.32	2.5	2.5	2.5	2.5	2.5	2.5	2.5	9.2

Small data set - 3 or 4 data points
 Very small data set - 1 or 2 data points
 Biomass all years all fuels
 Specific Test Year, Specific Boiler Size - Biomass or Coal
 Specific Test Year, All Boiler Sizes - Biomass or Coal
 Specific Test Year, All Boiler Sizes - Specific Fuel like Wood, Bituminous, etc.

Table 2: GREET emission factors for biomass-fired boilers.

Year of operation	Pollutant	Bagasse				Wood			
		< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr	< 10 MMBtu/hr	10 to 100 MMBtu/hr	100 - 250 MMBtu/hr	> 250 MMBtu/hr
Year 2005	VOC	96	96	211	80	0.2	0.20	0.20	0.20
	CO	892	892	714	984	153	169	150	181
	NOx	98	98	98	98	133	166	94	133
	PM10	43	43	50	40	20	63	16	6.0
	PM2.5	34	34	39	31	17	55	13	5.4
	SOx	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
Year 2010	VOC	95	95	215	85	1.5	5.7	0.5	2.4
	CO	394	394	1176	328	148	136	106	130
	NOx	95	111	95	81	95	111	95	81
	PM10	27	27	39	15	35	12	16	28
	PM2.5	21	21	30	12	31	12	14	24
	SOx	1.6	2.8	3.3	2.9	1.6	2.8	3.3	2.9
Year 2015	VOC	1.3	0.56	1.3	1.4	0.56	0.56	0.56	0.6
	CO	79	153	79	79	18	153	18	53.2
	NOx	78	78	127	56	79	127	79	52.8
	PM10	1.8	3.1	1.8	1.5	1.8	3.1	1.8	1.5
	PM2.5	1.5	2.3	1.5	1.3	1.5	2.3	1.5	1.3
	SOx	2.5	2.5	2.5	2.5	0.32	0.32	0.32	0.32

2. DATA COLLECTION

Data were collected from the following sources:

- U.S. Environmental Protection Agency's (EPA's) compilation of emissions data for industrial, commercial and institutional (ICI) boilers and process heaters collected during development of the "Boiler MACT" rules (40 CFR 63 Subparts DDDDD and JJJJJJ). Specifically, the Microsoft Access emissions and survey results database Version 8 was used (<http://www3.epa.gov/airtoxics/boiler/boilerpg.html>, accessed June 16, 2015).
- Electronic Reporting Tool (ERT) performance test reports downloaded from EPA's WebFIRE website, as of June 25, 2015. Reports matching source classification codes for coal- or biomass-fired boilers (<http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission#>, accessed June 25, 2015). Approximately 200 ERT reports were selected for review based on source classification codes. Each report was screened for applicable data, which then were extracted into a database.
- Source test reports and permit information obtained for selected biomass-fired units requested via personal contacts with state and local regulatory agencies.

The data from all the above sources were compiled into a consolidated database for subsequent analysis.

The focus of the data collection was on ICI boilers, including electricity generation boilers with a generation capacity of less than 25 MWe. Contacts with regulatory agencies were focused on biomass-fired boilers, particularly those which may fire cellulosic ethanol and/or byproducts such as corn stover. Collection of data for larger electricity generation boilers was beyond the scope of the current work.

The data source for each record is provided with the data summary in Appendix A.

3. EMISSION FACTOR DEVELOPMENT AND DATA QUALITY REVIEW

3.1 General

The data for each pollutant were compiled into separate workbooks for data quality review and emission factor analysis. Data quality review for the Boiler MACT and WebFIRE data was limited to review for appropriateness of test methods used and examination of statistical outliers. Complete source test reports obtained from regulatory agencies were additionally screened for any data quality issues identified by the authors and general report completeness.

For much of the compiled data, emissions in units of lb/MMBtu (higher heating value basis) were provided in the source data (e.g., in EPA's Boiler MACT database). In instances where emissions were provided only in other units (typically as concentration or mass emission rate), the emission factor was calculated by using either reported heat input rates and mass emission rates (emission factor = mass emission rate/heat input rate) or by using pollutant concentration, F factor and O₂ (or CO₂) concentration following EPA Method 19. Where an F-factor was provided in the data record, that value was used; otherwise, F factors for the closest fuel category listed in Table 19-2 of Method 19¹ or the Emission Factor Documentation for AP-42 Section 1.8² were used. Data records with insufficient data for calculating results in emission factor units were not used.

For each data set, average emissions from each unit were used for emission factor analysis. Each set of unit averages was examined for statistical outliers using Dixon's test. Where data were otherwise robust (i.e., a large number of units, no process configuration differences explaining outlier behavior) outliers were censored for emission factor analysis.

A template for emission factor subcategories following the GREET model's current configuration was provided by ANL. Emission factors were subcategorized following GREET model template requirements, i.e., by fuel subtypes, boiler sizes and time periods in each of three time periods: 2005 (source tests performed in 2005 and prior); 2010 (source tests performed from 2006 through 2010); and 2015 (source tests performed from 2011 through 2015).

When the dataset for a subcategory consisted of four or fewer data points (unit averages), the arithmetic mean was used to represent the emission factor for that subcategory. If there were five or more data points (unit averages), they were examined for goodness of fit to a normal or lognormal distribution. Where the data fit a normal distribution, the arithmetic mean was used to represent the emission factor for that data set. Where the data fit a lognormal distribution, the geometric mean was used. The standard deviation of the untransformed data was used as an indicator of data dispersion in both cases. Where available, the emission factors for each subcategory were drawn from the available data. Where there are no data available for a subcategory, emission factors from the next upward tier was substituted. E.g., where there are data for only one boiler size group, those data were substituted for all size groups. Data substitutions are noted in the emission factor summaries provided in Tables 1 and 2.

Additionally, for future reference, potential emission factor subcategories within each fuel category (i.e., biomass and coal) were evaluated based on significance of differences and uncertainties, according to furnace type, emissions controls, fuel subtypes and boiler size. Where differences were not found to be significant based on Student's t-test results (at 95% confidence), data were

¹ Available at <http://www.epa.gov/ttnemc01/promgate/m-19.pdf>. Accessed September 2015.

² F-Factor for bagasse was obtained from this data source. Available at <http://www.epa.gov/ttnchie1/ap42/ch01/bgdocs/b01s08.pdf>. Accessed September 2015.

aggregated to provide a more robust emission factor. In general, differences among emissions controls were found to be significant but differences among furnace types, boiler size groups and fuel subtypes were not (in some cases because of an insufficient number of units in a subgroup). This analysis was not used for populating the GREET model template, but may be of use for future emission factor subcategory analysis.

3.2 PM10 and PM2.5

Emission factors for PM10 and PM2.5, defined as the sums of filterable PM10 or filterable PM2.5 plus condensable PM, were derived from the available test data. The available data include measurement results for "total PM", filterable PM, filterable PM10 and/or PM2.5, condensable PM, and total PM10 and/or total PM2.5. Where direct measurements of filterable PM10 and/or filterable PM2.5 along with condensable PM were measured (e.g., using EPA Methods 201A and 202 or OTM 27 and OTM 28), these results were combined to report PM10 and/or PM2.5.

The majority of units reported only total PM, filterable PM and/or condensable PM. In cases where two out of three of these are reported, the third was calculated. E.g., where total PM and condensable PM are reported, condensable PM was subtracted from total PM to determine filterable PM. In some instances, the differences were less than zero; therefore, data quality was considered inadequate for emission factor development and these data were not used.

Only a small fraction of the units reported direct measurements of PM10 and/or PM2.5. To estimate the filterable PM10 and filterable PM2.5 fractions for these units, size distribution factors were applied to filterable PM. Condensable PM was then added to the filterable PM10 and/or PM2.5 fractions to estimate PM10 and/or PM2.5. Size distribution factors for different fuels and emissions controls were derived from emission factors given in EPA's Compilation of Air Pollutant Emission Factors (AP-42), except in some instances (one for PM10 and five for PM2.5) where the compiled data were judged to be more representative (complete and newer data). The size distribution factor for the nearest match with the most stringent PM emissions control of each unit was then applied to the filterable PM data for that unit.

3.3 NO_x

NO_x emission factors were developed without need for additional data manipulation.

3.4 SO₂

SO₂ emission factors were developed without need for additional data manipulation.

3.5 CO

CO emission factors were developed without need for additional data manipulation.

3.6 VOC

For purposes of this analysis, VOC is defined as total non-methane hydrocarbons (TNMHC), on a propane mass equivalent basis. TNMHC was determined either from direct measurements (typically from direct measurements of total hydrocarbons (THC) and methane by subtracting methane concentration from THC concentration, or from cryo-trap analytical methods which remove methane prior to analysis. Where direct measurements of THC and methane or TNMHC were not available, VOC was determined by applying a VOC fraction to THC (propane equivalent) results.

Most of the THC data were provided as propane mass equivalent in the source data. For instances where THC data are reported in other equivalent bases (e.g., carbon, methane or hexane equivalent), mass results were converted to propane equivalent based on molecular weight.

VOC fractions were derived by averaging the ratio of TNMHC to THC for each boiler furnace type or furnace type group (e.g., stoker, fuel cell, pulverized, "other", etc.) based on the available data.

3.7 Comparison with Emission Limits

An objective of this effort was to assure that emission factors do not exceed applicable emission limits. This was primarily of concern with respect to estimation of 2015 emission factors, for which new emission limits for CO and filterable PM apply under the Boiler MACT rules. Emission factors developed for the GREET summary were compared with emission limits specified in U.S. New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants (Appendix B summarizes emission limits). None of the 2015 emission factors exceeded applicable emission limits, thus no data substitutions were necessary.

APPENDIX A EMISSION FACTOR DATA SUMMARY

Coal Fired Boilers

PM10_Coal_all

Row Labels	Count of Average of PM10_Total_Standardized	Average of Average of PM10_Total_Standardized	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
1 (<=2005)	27	0.068335582	-3.309545628	0.036532769	16.5710	Lognormal
2 (2006-2010)	63	0.055564177	-3.365369199	0.034549258	15.6713	Lognormal
3 (>2010)	2	0.005710293	-5.197363178	0.00553113	2.5901	
Grand Total	92	0.058228527	-3.388812151	0.033748742	15.3082	

PM2.5_Coal_all

Row Labels	Count of Average of PM2.5_Total_Standardized	Average of Average of PM2.5_Total_Standardized	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
2 (2006-2010)	71	0.042238363	-3.560837071	0.028415029	12.8888	Lognormal
1 (<=2005)	27	0.054964965	-3.529560885	0.029317787	13.2983	Lognormal
3 (>2010)	2	0.00537715	-5.252278012	0.005235578	2.4390	
Grand Total	100	0.044937321	-3.586221319	0.027702813	12.5658	

Coal_PM10_Fuel_Year

Row Labels	GREET Year Category	Count of Average of PM10_Total_Standardized	Average of Average of PM10_Total_Standardized	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
Bituminous	2 (2006-2010)	49	0.054680168	-3.381837025	0.033984966	15.4153	Lognormal
Bituminous	1 (<=2005)	16	0.095037467	-2.940855533	0.05282052	43.1082	Normal
Bituminous/Sub-bituminous	2 (2006-2010)	1	0.0097725	-4.62818296	0.0097725	4.4327	
Coal	3 (>2010)	2	0.005710293	-5.197363178	0.00553113	2.5901	
Sub-bituminous	2 (2006-2010)	13	0.062418649	-3.206158642	0.040511936	18.3759	Lognormal
Sub-bituminous	1 (<=2005)	11	0.029496476	-3.84582213	0.021368826	13.3794	Normal
Grand Total		92	0.058228527	-3.388812151	0.033748742	15.3082	

Coal_PM2.5_Fuel_Year

Row Labels	GREET Year Category	Count of Average of PM2.5_Total_Standardized	Average of Average of PM2.5_Total_Standardized	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
Anthracite	2 (2006-2010)	1	0.041320769	-3.186390029	0.041320769	18.7428	
Bituminous	2 (2006-2010)	55	0.041798041	-3.604889722	0.027190443	12.3334	Lognormal
Bituminous	1 (<=2005)	16	0.075162846	-3.188482141	0.041234412	18.7036	Lognormal
Bituminous/Sub-bituminous	2 (2006-2010)	1	0.0104	-4.565949473	0.0104	4.7174	
Coal	3 (>2010)	2	0.00537715	-5.252278012	0.005235578	2.4390	
Sub-bituminous	2 (2006-2010)	14	0.046307913	-3.342725558	0.035340504	21.0049	Normal
Sub-bituminous	1 (<=2005)	11	0.025586229	-4.025675422	0.017851363	11.6057	Normal
Grand Total		100	0.044937321	-3.586221319	0.027702813	12.5658	

Coal_all_PM10_BoilerSize_Year

Average of Average of PM10_Total_Standar								
Row Labels	GREET Boiler Size Category	GREET Year Category	Count of Average of P	dized	Average of LN of EF	Geo Mean EF (If EF to use(g/MMBtu)		
Bituminous	B (100 to 250)	2 (2006-2010)	24	0.052477103	-3.467348073	0.03119966	14.1519	Lognormal
Bituminous	B (100 to 250)	1 (<=2005)	7	0.08796466	-2.994360126	0.050068654	39.9001	Normal
Bituminous	A (>250)	2 (2006-2010)	17	0.050848366	-3.392297482	0.033631321	15.2549	Lognormal
Bituminous	A (>250)	1 (<=2005)	4	0.052170667	-3.309043982	0.036551101	23.6642	
Bituminous	C (10 to 100)	2 (2006-2010)	7	0.046510592	-3.336344502	0.035566734	21.0968	Normal
Bituminous	C (10 to 100)	1 (<=2005)	4	0.128679167	-2.787550728	0.061571836	58.3678	
Bituminous	D (<10)	2 (2006-2010)	1	0.229881396	-1.470191771	0.229881396	104.2724	
Bituminous	D (<10)	1 (<=2005)	1	0.181447521	-1.706788806	0.181447521	82.3031	
Bituminous/Sub-bituminous	A (>250)	2 (2006-2010)	1	0.0097725	-4.62818296	0.0097725	4.4327	
Coal	Unknown	3 (>2010)	2	0.005710293	-5.197363178	0.00553113	2.5901	
Sub-bituminous	B (100 to 250)	2 (2006-2010)	3	0.056048484	-3.584784227	0.027742653	25.4231	
Sub-bituminous	B (100 to 250)	1 (<=2005)	7	0.020935832	-4.252033781	0.014235253	9.4963	Normal
Sub-bituminous	A (>250)	2 (2006-2010)	8	0.048193998	-3.352892008	0.034983036	15.8680	Lognormal
Sub-bituminous	A (>250)	1 (<=2005)	4	0.044477602	-3.134951741	0.043501853	20.1747	
Sub-bituminous	C (10 to 100)	2 (2006-2010)	2	0.1288725	-2.051286801	0.128569354	58.4555	
Grand Total			92	0.058228527	-3.388812151	0.033748742	15.3082	

Coal_all_PM2.5_BoilerSize_Year

			Average of Average of PM2.5_Total_Standar					
Row Labels	GREET Boiler Size Category	GREET Year Category	Count of Average of P	rdized2	Average of LN of EF	Geo Mean EF (If EF to use(g/MMBtu)		
Anthracite	A (>250)	2 (2006-2010)	1	0.041320769	-3.186390029	0.041320769	18.7428	
Bituminous	A (>250)	2 (2006-2010)	20	0.035745872	-3.745071253	0.023633945	10.7202	Lognormal
Bituminous	A (>250)	1 (<=2005)	4	0.04125548	-3.529072875	0.029332098	18.7132	
Bituminous	B (100 to 250)	2 (2006-2010)	27	0.042110747	-3.612843803	0.026975026	12.2357	Lognormal
Bituminous	B (100 to 250)	1 (<=2005)	7	0.077587148	-3.119378871	0.044184604	35.1929	Normal
Bituminous	C (10 to 100)	2 (2006-2010)	7	0.042605954	-3.416455928	0.032828576	19.3257	Normal
Bituminous	C (10 to 100)	1 (<=2005)	4	0.098015318	-3.196255581	0.040915121	44.4590	
Bituminous	D (<10)	2 (2006-2010)	1	0.148742974	-1.905535468	0.148742974	67.4686	
Bituminous	D (<10)	1 (<=2005)	1	0.102412313	-2.278748328	0.102412313	46.4534	
Bituminous/Sub-bituminous	A (>250)	2 (2006-2010)	1	0.0104	-4.565949473	0.0104	4.7174	
Coal	Unknown	3 (>2010)	2	0.00537715	-5.252278012	0.005235578	2.4390	
Sub-bituminous	A (>250)	2 (2006-2010)	8	0.03912312	-3.5296244	0.029315925	13.2975	Lognormal
Sub-bituminous	A (>250)	1 (<=2005)	4	0.040605306	-3.227680502	0.039649359	18.4182	
Sub-bituminous	B (100 to 250)	2 (2006-2010)	4	0.053710135	-3.234566619	0.039377267	24.3625	
Sub-bituminous	B (100 to 250)	1 (<=2005)	7	0.017003899	-4.481672519	0.011314474	7.7128	Normal
Sub-bituminous	C (10 to 100)	2 (2006-2010)	2	0.060242639	-2.811448068	0.060117875	27.3256	
Grand Total			100	0.044937321	-3.586221319	0.027702813	12.5658	

PM10_Coal_Size_Year

Row Labels	Count of Average of PM10_Total_Standardized	Average of Average of PM10_Total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
A (>250)	34	0.048421758	-3.37930468	0.034071137	15.4544	
1 (<=2005)	8	0.048324134	-3.221997862	0.039875313	21.9194	Normal
2 (2006-2010)	26	0.048451796	-3.427706778	0.032461296	14.7242	Lognormal
B (100 to 250)	41	0.05341218	-3.529157653	0.029329611	13.3037	
1 (<=2005)	14	0.054450246	-3.623196953	0.02669719	12.1096	Lognormal
2 (2006-2010)	27	0.052873923	-3.480396534	0.030795197	13.9685	Lognormal
C (10 to 100)	13	0.084464293	-2.969783694	0.051314409	23.2758	
1 (<=2005)	4	0.128679167	-2.787550728	0.061571836	58.3678	
2 (2006-2010)	9	0.064813238	-3.050776124	0.047322182	29.3988	Normal
D (<10)	2	0.205664459	-1.588490289	0.204233713	93.2878	
1 (<=2005)	1	0.181447521	-1.706788806	0.181447521	82.3031	
2 (2006-2010)	1	0.229881396	-1.470191771	0.229881396	104.2724	
Unknown	2	0.005710293	-5.197363178	0.00553113	2.5901	
3 (>2010)	2	0.005710293	-5.197363178	0.00553113	2.5901	
Grand Total	92	0.058228527	-3.388812151	0.033748742	15.3082	

PM2.5_Coal_Size_Year

Row Labels	Count of Average of PM2.5_Total_Standardized	Average of Average of PM2.5_Total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
A (>250)	38	0.037028061	-3.629415086	0.026531699	12.0346	
1 (<=2005)	8	0.040930393	-3.378376689	0.034102769	18.5657	Normal
2 (2006-2010)	30	0.035987439	-3.696358659	0.024813717	11.2553	Lognormal
B (100 to 250)	45	0.044754845	-3.637609086	0.026315186	11.9364	
1 (<=2005)	14	0.047295523	-3.800525695	0.022359015	10.1419	Lognormal
2 (2006-2010)	31	0.043607442	-3.564033844	0.028324338	12.8477	Lognormal
C (10 to 100)	13	0.062368325	-3.255623843	0.03855676	17.4890	
1 (<=2005)	4	0.098015318	-3.196255581	0.040915121	44.4590	
2 (2006-2010)	9	0.046525217	-3.282009737	0.03755271	21.1035	Normal
D (<10)	2	0.125577644	-2.092141898	0.123422494	56.9610	
1 (<=2005)	1	0.102412313	-2.278748328	0.102412313	46.4534	
2 (2006-2010)	1	0.148742974	-1.905535468	0.148742974	67.4686	
Unknown	2	0.00537715	-5.252278012	0.005235578	2.4390	
3 (>2010)	2	0.00537715	-5.252278012	0.005235578	2.4390	
Grand Total	100	0.044937321	-3.586221319	0.027702813	12.5658	

Table 1A. Particulate Matter (PM10) Emission Factors (Unit Averages) for Coal Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	REET Boiler Size Category ¹	Boiler Furnace Type	PM Controls 1	PM Controls 2	PM Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
HIPuuneneSugarMill/Boiler 1	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	12	0.092	41.886	3.735
HIPuuneneSugarMill/Boiler 1	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.125	56.865	4.041
HIPuuneneSugarMill/Boiler 3	Bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	12	0.065	29.409	3.381
HIPuuneneSugarMill/Boiler 3	Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.071	32.190	3.472
IAADMCornProcessingCR/EU-530	Bituminous	1 (<=2005)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.006	2.846	1.046
IACentralIAPower/EP1 Unit 1 PC Boiler	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.229	104.050	4.645
IAGrainProcessing/Boiler #1	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	2	0.162	73.536	4.298
IAIAStateUnivPowerPlant/B1	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.008	3.764	1.326
IAIAStateUnivPowerPlant/B2	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.020	8.911	2.187
IAIAStateUnivPowerPlant/B4	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.062	28.274	3.342
IAJohnDeereDubuque/Boiler 1	Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.083	37.799	3.632
IAUofIowa/EP7 Boiler 11/1	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.372	2.593
IAUofIowa/EP7 Boiler 11/2	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.037	16.677	2.814
ILAbbottAbbottPark/Unit 5AP	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	6	0.110	49.918	3.910
ILCornProductsInt/B10	Bituminous	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	6	0.008	3.440	1.235
ILPolyOne/B1	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.008	3.728	1.316
ILPrairiePowerPearl/B1	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	WPS?	None	None	DRAFT BMACT data (version 8).accdb	3	0.048	21.822	3.083
INAlcoaWarrick/Unit #2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.041	18.394	2.912
INAlcoaWarrick/Unit #3	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.042	19.056	2.947
INBungeDecatur/B&W (1SP1)	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.038	17.085	2.838
INBungeDecatur/Keeler (2SP1)	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.044	20.170	3.004
INNotreDame/B-4	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.027	12.347	2.513
MDNewPage-Luke/No. 25	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.035	15.717	2.755
MITBSimonPowerPlant/Unit 1/2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.008	3.492	1.251
MNDESPHansONyman/EU003	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.109	49.230	3.897
MNWausauPaper-Brainerd/EU 002	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.275	124.624	4.825
MOIP&LMissouriCity/Unit 1	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.349	2.591
NCBlueRidgePaper/G11037	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.067	30.391	3.414
NCBlueRidgePaper/G11038	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.046	20.979	3.044
NCBlueRidgePaper/G11039	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.090	40.785	3.708
NCBlueRidgePaper/G11040	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.057	25.968	3.257
NCCampLejeuneMCB/A-HP-1700-01	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.228	103.419	4.639
NCCampLejeuneMCB/A-HP-1700-03	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.119	53.970	3.988
NCMCASCherryPoint/CP-152-BOIL-02	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.084	38.198	3.643
NCTysonHarmony/TYS-ES-21	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.036	16.124	2.780
OHBataviaTransmissions/Boiler 2 (B002)	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	2	0.004	1.701	0.531
OHUofCincinnati/B108	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	2	0.004	1.719	0.541
OHUofCincinnati/B108	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	1	0.004	2.007	0.697
OHUSEnrichmentCorpPiketon/X-600 Boiler No. 1	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.075	34.133	3.530
PAPennState/31	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.018	8.310	2.117
SCSonocoHartsville/Boiler Number 9	Bituminous	1 (<=2005)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.153	1.817
TNCargillMemphis/Stoker Boiler 8001	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	2	0.144	65.319	4.179
TNEastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.009	4.302	1.459
TNViskase/Boiler 1	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	12.991	2.564
VAINVISTAWaynesboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.227	103.182	4.636
VASmurfitStoneWestpt/PB08/2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.007	3.305	1.195
VAUniversityofVirginia/71103-1-01R	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	6	0.015	6.698	1.902
VAUniversityofVirginia/71103-1-02R	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.379	1.853
VAUniversityofVirginia/71103-1-05	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.066	29.933	3.399
WIBlountGeneratingStation/Boiler 7	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.260	1.834
WICapitolHPMadison/600328	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.118	53.469	3.979
WICapitolHPMadison/600340	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.118	53.677	3.983
WIGPGreenBay2818/B25 - Stoker Boiler #5	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	6	0.054	24.712	3.207
WIGPGreenBay2818/B28 - Stoker Boiler #8	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	6	0.071	32.174	3.471
WIMilwaukeePowerPlant/Boiler B21	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.023	10.614	2.362
WIMilwaukeePowerPlant/Boiler B22	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.021	9.465	2.248
WIMilwaukeePowerPlant/Boiler B23	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.018	8.172	2.101
WINorthernWisconsinCenterCippewaFalls/600618	Bituminous	1 (<=2005)	D (<10)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.181	82.303	4.410
WIThIlmanyPapersNicoletMill/B23	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.651	1.732
WIUWOshkosh/600425	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.324	2.590
WIUWRiverFalls/B0001854	Bituminous	2 (2006-2010)	D (<10)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.230	104.272	4.647
WIWausauRhine/B26	Bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.017	7.575	2.025

Table 1A. Particulate Matter (PM10) Emission Factors (Unit Averages) for Coal Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	PM Controls 1	PM Controls 2	PM Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
WIWinnebagoMHI/600426	Bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.052	23.581	3.160
WVATKRocketCenter/NB2766 W-17479-W (Boiler 17	Bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	6	0.062	28.301	3.343
WVPPGMartinsville/R011-Boiler 3/2	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.008	3.586	1.277
IAADMCornProcessingCR/EU-501B/2	Bituminous/Sub-bituminous	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	2	0.010	4.433	1.489
AR_AEP John W. Turk Jr. Power Plant/ARR000017764	Coal	3 (>2010)	Unknown	Spreader Stoker	FF	None	None	Webfire Report	3	0.004	1.946	0.666
PA_Fayette Thermal/033	Coal	3 (>2010)	Unknown	Fluidized Bed	FF	None	None	Webfire Report	3	0.007	3.234	1.174
IAArchersDanielsMidlandDesMoines/Asea Boiler #1	Sub-bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.005	2.256	0.813
IACargillEddyville/1.001	Sub-bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.067	30.407	3.415
IAMuscatinePowerandWater/Unit 7	Sub-bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.199	1.824
IAMuscatinePowerandWater/Unit 7	Sub-bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	6	0.055	24.804	3.211
IDAmalgamatedSugarCoTwinFalls/S-B1	Sub-bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.030	13.552	2.607
IDTASCONampa/Babcock and Wilcox (B&W) #1	Sub-bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.372	1.681
IDTASCONampa/Riley Boiler	Sub-bituminous	1 (<=2005)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.035	15.957	2.770
IDTASCOPaul/Babcock and Wilcox (B&W) Boiler	Sub-bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.130	59.055	4.078
IDTASCOPaul/Erie City Boiler	Sub-bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.146	66.270	4.194
MNADMMankato/ASEA Boiler #5	Sub-bituminous	1 (<=2005)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	1	0.030	13.753	2.621
MNAmericanCrystalCrookston/Boiler 1	Sub-bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.667	0.511
MNAmericanCrystalCrookston/Boiler 2	Sub-bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	2	0.003	1.185	0.170
MNAmericanCrystalCrookston/Boiler 3	Sub-bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	2	0.028	12.633	2.536
MNAmericanCrystalEastGF/Boiler 1	Sub-bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.021	9.559	2.258
MNAmericanCrystalEastGF/Boiler 2	Sub-bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	2	0.064	28.951	3.366
MNAmericanCrystalMoorhead/Boiler 1	Sub-bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.035	15.907	2.767
MNAmericanCrystalMoorhead/Boiler 2	Sub-bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.035	15.958	2.770
MNNorthshoreMining/Unit 1 (EU 001)	Sub-bituminous	1 (<=2005)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.035	16.001	2.773
MNNorthshoreMining/Unit 2 (EU 002)	Sub-bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.030	13.668	2.615
MNNorthshoreMining/Unit 2 (EU 002)	Sub-bituminous	1 (<=2005)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.053	23.936	3.175
MNOrderofStBenedict/EU001 Boiler 1	Sub-bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.120	54.448	3.997
MNOrderofStBenedict/EU002 Boiler 2	Sub-bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.138	62.463	4.135
MOMallinckrodt/Boiler 6	Sub-bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.033	14.959	2.705
WINewPageBiron/B24	Sub-bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	1	0.014	6.277	1.837

Notes:

- ¹The boiler size category units are MMBtu/hr.
- ²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
- ³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.
- ⁴Unit averages are based on higher heating value.

Conversion Factor:

453.592 g/lb

Abbreviations:

- | | | | |
|---------------------------------|----------------------------|---------------------------------------|--------------------------------|
| EP - electrostatic precipitator | HHV - higher heating value | MC- mechanical collector | VS - venturi scrubber |
| FF - fabric filter | lb - pound | MMBtu - million british thermal units | WPS - wet particulate scrubber |
| g - grams | LN - natural logarithm | PM - particulate matter | |

Source File:

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Table 2A. Particulate Matter (PM2.5) Emission Factors (Unit Averages) for Coal Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	PM Controls 1	PM Controls 2	PM Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
PAKimberlyClarkChester/Boiler #10 (ID 035)	Anthracite	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.041	18.743	2.931
HI Puunene Sugar Mill/Boiler 1	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	12	0.071	31.980	3.465
HI Puunene Sugar Mill/Boiler 1	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.092	41.652	3.729
HI Puunene Sugar Mill/Boiler 3	Bituminous	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	12	0.048	21.947	3.089
HI Puunene Sugar Mill/Boiler 3	Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.053	24.119	3.183
IAADM Corn Processing CR/EU-530	Bituminous	1 (<=2005)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.005	2.403	0.877
IA Central IA Power/EP1 Unit 1 PC Boiler	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.157	71.213	4.266
IA Grain Processing/Boiler #1	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	2	0.104	47.320	3.857
IA IA State Univ Power Plant/B1	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.008	3.653	1.295
IA IA State Univ Power Plant/B2	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.019	8.803	2.175
IA IA State Univ Power Plant/B4	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.042	18.925	2.941
IA John Deere Dubuque/Boiler 1	Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.068	30.740	3.426
IA Roquette America/Circulating Fluidized Bed Boiler (121)	Bituminous	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.007	2.964	1.087
IA U of Iowa/EP7 Boiler 11/1	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.028	12.911	2.558
IA U of Northern Iowa/Boiler #3	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.027	12.087	2.492
IL Abbott Abbott Park/Unit 5AP	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	6	0.108	49.023	3.892
IL Bunge Danville/CFB Boiler	Bituminous	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.017	7.893	2.066
IL Corn Products Int/B10	Bituminous	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	6	0.007	3.029	1.108
IL Poly One/B1	Bituminous	2 (2006-2010)	B (100 to 250)	Fluidized Bed	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.007	3.181	1.157
IL Prairie Power Pearl/B1	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	WPS?	None	None	DRAFT BMACT data (version 8).accdb	3	0.039	17.592	2.867
IN Alco Warrick/Unit #2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.036	16.130	2.781
IN Alco Warrick/Unit #3	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.040	18.369	2.911
IN Bunge Decatur/B&W (1SP1)	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.031	14.051	2.643
IN Bunge Decatur/Keeler (2SP1)	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.042	19.199	2.955
IN Notre Dame/B-4	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.028	12.580	2.532
IN Tate Lyle Sagamore/31B1	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.040	18.087	2.895
MD New Page-Luke/No. 25	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.033	14.802	2.695
MITBSimon Power Plant/Unit 1/2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.995	0.691
MN DESPHans ONyman/EU003	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.070	31.677	3.456
MN Wausau Paper-Brainerd/EU 002	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.271	122.731	4.810
MO IP&L Missouri City/Unit 1	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.024	10.829	2.382
NC Blue Ridge Paper/G11037	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.054	24.588	3.202
NC Blue Ridge Paper/G11038	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.036	16.103	2.779
NC Blue Ridge Paper/G11039	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.066	29.946	3.399
NC Blue Ridge Paper/G11040	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.042	19.158	2.953
NCCampLejeune MCB/A-HP-1700-01	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.219	99.148	4.597
NCCampLejeune MCB/A-HP-1700-03	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.102	46.193	3.833
NC MCAS Cherry Point/CP-152-BOIL-02	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.068	30.986	3.434
NC Miller Coors/ES-2 Coal/No. 2 & 6 Fuel Oil Boiler	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.044	19.955	2.993
NCTyson Harmony/TYS-ES-21	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.033	15.177	2.720
NC UNCCogen/ES-001	Bituminous	2 (2006-2010)	A (>250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.010	4.468	1.497
OH Batavia Transmissions/Boiler 2 (B002)	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	2	0.003	1.338	0.291
OH Morton Salt Rittman/B002 - Coal-Fired Boiler #2	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.010	4.432	1.489
OH U of Cincinnati/B108	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	2	0.003	1.503	0.407
OH U of Cincinnati/B108	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	1	0.004	1.832	0.605
OH USEnrichment Corp Piketon/X-600 Boiler No. 1	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.056	25.550	3.241
PA Penn State/31	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.017	7.800	2.054
SC Sonoco Hartsville/Boiler Number 9	Bituminous	1 (<=2005)	B (100 to 250)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.617	1.726
TN Cargill Memphis/Stoker Boiler 8001	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.106	47.864	3.868
TN Eastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.009	3.900	1.361
TN Viskase/Boiler 1	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.026	11.971	2.483
VA IN VISTA Wayneboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.238	107.849	4.681
VA Smurfit Stone Westpt/PB08/2	Bituminous	2 (2006-2010)	A (>250)	Pulverized Coal	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.006	2.680	0.986
VA University of Virginia/7103-1-01R	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	6	0.015	6.694	1.901
VA University of Virginia/7103-1-02R	Bituminous	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.195	1.824
VA University of Virginia/7103-1-05	Bituminous	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	FF	None	DRAFT BMACT data (version 8).accdb	3	0.065	29.628	3.389
WI Blount Generating Station/Boiler 7	Bituminous	2 (2006-2010)	B (100 to 250)	Pulverized Coal	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.276	1.663

Biomass Fired Boilers

Bio_PM10_All

Row Labels	GREET Boiler Size Category	GREET Year Category	Count of Average of P	Average of Average of PM10_Total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	EF to use
Bagasse	A (>250)	1 (<=2005)	2	0.087439659	-2.43812261	0.08732464	39.6619	
Bagasse		2 (2006-2010)	1	0.03217525	-3.436557756	0.03217525	14.5944	
Bagasse	B (100 to 250)	1 (<=2005)	1	0.1113307	-2.195250228	0.1113307	50.4987	
Bagasse		2 (2006-2010)	1	0.086045567	-2.452878278	0.086045567	39.0296	
Biomass	B (100 to 250)	2 (2006-2010)	1	0.012213333	-4.405227028	0.012213333	5.5399	
Biomass	C (10 to 100)	2 (2006-2010)	2	0.094491885	-2.938688789	0.052935092	42.8608	
Cellulosic Ethanol	A (>250)	3 (>2010)	1	0.003647697	-5.613659404	0.003647697	1.6546	
Deinking residuals	C (10 to 100)	1 (<=2005)	1	0.028879395	-3.544626921	0.028879395	13.0995	
Deinking residuals		2 (2006-2010)	1	0.006768029	-4.995545403	0.006768029	3.0699	
Paper	B (100 to 250)	2 (2006-2010)	1	0.05374985	-2.923414403	0.05374985	24.3805	
Wood	A (>250)	1 (<=2005)	1	0.013266667	-4.322500655	0.013266667	6.0177	
Wood		2 (2006-2010)	8	0.060952414	-3.372464726	0.034304981	27.6475	Normal
Wood		3 (>2010)	7	0.003230363	-5.901560785	0.002735172	1.4653	Normal
Wood	B (100 to 250)	1 (<=2005)	3	0.035692306	-3.846934	0.02134508	16.1897	
Wood		2 (2006-2010)	9	0.081210216	-3.339644796	0.035449547	16.0796	Lognormal
Wood	C (10 to 100)	1 (<=2005)	7	0.138932799	-2.340026821	0.096325055	63.0188	Normal
Wood		2 (2006-2010)	7	0.057474865	-3.625578079	0.026633697	12.0808	Lognormal
Wood		3 (>2010)	1	0.006771253	-4.995069148	0.006771253	3.0714	
Wood	D (<10)	2 (2006-2010)	2	0.076916667	-2.569251	0.076592892	34.8888	
Wood	Unknown	1 (<=2005)	4	0.036703029	-3.625399579	0.026638451	16.6482	
Wood		2 (2006-2010)	4	0.203005911	-2.5324399	0.079464897	92.0819	
Wood		3 (>2010)	2	0.005312351	-5.385140986	0.004584194	2.4096	
Grand Total			67	0.068135209	-3.609342935	0.027069628	12.2786	

Bio_PM10_Biomass

Row Labels	GREET Year Category	Count of Average of PM10_Total_Standardized2	Average of Average of PM10_Total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	EF to use
A (>250)	1 (<=2005)	3	0.062715328	-3.066248625	0.046595625	28.4472	
	2 (2006-2010)	9	0.057754951	-3.379586173	0.034061547	15.4500	Lognormal
	3 (>2010)	7	0.003230363	-5.901560785	0.002735172	1.4653	Normal
B (100 to 250)	1 (<=2005)	4	0.054601904	-3.434013057	0.032257231	24.7670	
	2 (2006-2010)	11	0.075377349	-3.35590077	0.034877939	15.8204	Lognormal
C (10 to 100)	1 (<=2005)	7	0.138932799	-2.340026821	0.096325055	63.0188	Normal
	2 (2006-2010)	9	0.06570087	-3.472936015	0.031025805	14.0731	Lognormal
	3 (>2010)	1	0.006771253	-4.995069148	0.006771253	3.0714	
D (<10)	2 (2006-2010)	2	0.076916667	-2.569251	0.076592892	34.8888	
Unknown	1 (<=2005)	4	0.036703029	-3.625399579	0.026638451	16.6482	
	2 (2006-2010)	4	0.203005911	-2.5324399	0.079464897	92.0819	
	3 (>2010)	2	0.005312351	-5.385140986	0.004584194	2.4096	
Grand Total		63	0.070984349	-3.567440167	0.02822802	12.8040	

Biomass_PM10

Row Labels	Standardized fuel	Count of Average of PM10_Total_Standardized2	Average of Average of PM10_Total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	Type of Distribution	EF to use(g/MMBtu)
1 (<=2005)	Bagasse	3	0.095403339	-2.357165149	0.09468827	N/A	43.2742
1 (<=2005)	Wood	15	0.082645686	-3.116339248	0.044319113	Lognormal	20.1028
2 (2006-2010)	Bagasse	2	0.059110408	-2.944718017	0.052616895	N/A	26.8120
2 (2006-2010)	Wood	30	0.086223076	-3.256127637	0.03853734	Lognormal	17.4802
3 (>2010)	Wood	10	0.00400085	-5.707627662	0.003320541	Normal	1.8148
Grand Total		60	0.071180282	-3.574435432			

Biomass_PM10

Standardized fuel (Multiple Items) Bagasse, cellulosic ethanol, wood

Row Labels	Count of Average of PM10_Total_Standardized2	Average of Average of PM10_Total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	Type of Distribution	EF to use(g/MMBtu)
1 (<=2005)	18	0.084771962	-2.989810231	0.050296981	Lognormal	22.8143
2 (2006-2010)	32	0.084528534	-3.236664536	0.039294743	Lognormal	17.8238
3 (>2010)	11	0.003968745	-5.699085093	0.003349028	Normal	1.8002
Grand Total	61	0.07007319	-3.607865333			

Bio_PM2.5_All

Row Labels	GREET Boiler Size Category	GREET Year Category	Count of Average of PM2.5_total_Standardized2	Average of Average of PM2.5_total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
Bagasse	B (100 to 250)	2 (2006-2010)	1	0.0654377	-2.726656734	0.0654377	29.6820	
		1 (<=2005)	1	0.086421767	-2.448515706	0.086421767	39.2002	
	A (>250)	2 (2006-2010)	1	0.02569825	-3.661332383	0.02569825	11.6565	
		1 (<=2005)	2	0.067844423	-2.692003149	0.0677451	30.7737	
Biomass	B (100 to 250)	2 (2006-2010)	1	0.009861708	-4.619095942	0.009861708	4.4732	
	C (10 to 100)	2 (2006-2010)	2	0.081286611	-3.052740189	0.04722933	36.8710	
Cellulosic Ethanol	A (>250)	3 (>2010)	1	0.003372414	-5.692126389	0.003372414	1.5297	
Deinking residuals	C (10 to 100)	2 (2006-2010)	1	0.006847667	-4.983847317	0.006847667	3.1060	
		1 (<=2005)	1	0.028701288	-3.550813281	0.028701288	13.0187	
Paper	B (100 to 250)	2 (2006-2010)	1	0.04493605	-3.102514911	0.04493605	20.3826	
Wood	Unknown	2 (2006-2010)	4	0.182776628	-2.678195709	0.068686974	82.9060	
		1 (<=2005)	4	0.03190693	-3.772977798	0.022983521	14.4727	
		3 (>2010)	2	0.004344735	-5.547986228	0.003895294	1.9707	
		2 (2006-2010)	9	0.062782318	-3.508299368	0.029947801	13.5841	Lognormal
	A (>250)	1 (<=2005)	3	0.028254398	-4.018287203	0.017983741	12.8160	
		2 (2006-2010)	8	0.051959838	-3.454999026	0.031587335	23.5686	Normal
		1 (<=2005)	1	0.011960208	-4.426170146	0.011960208	5.4251	
		3 (>2010)	7	0.002838301	-6.036120914	0.002390815	1.2874	Normal
	C (10 to 100)	2 (2006-2010)	6	0.027185313	-4.18142795	0.015276678	12.3310	Normal
		1 (<=2005)	7	0.120988055	-2.502128601	0.081910458	54.8792	Normal
		3 (>2010)	1	0.005174678	-5.263978217	0.005174678	2.3472	
	D (<10)	2 (2006-2010)	2	0.069333333	-2.67643739	0.068807854	31.4490	
Grand Total			66	0.055880959	-3.793090021			

Bio_PM2.5

Row Labels	Count of Average of PM2.5_total_Standardized 2	Average of Average of PM2.5_total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	EF to use(g/MMBtu)	
A (>250)	19	0.032047059	-4.387597233	0.012430561	5.6384	
1 (<=2005)	3	0.049216351	-3.270058815	0.038004192	22.3241	
2 (2006-2010)	9	0.049041884	-3.477924955	0.030871404	14.0030	Lognormal
3 (>2010)	7	0.002838301	-6.036120914	0.002390815	1.2874	Normal
B (100 to 250)	15	0.054101682	-3.561588287	0.028393692	12.8792	
1 (<=2005)	4	0.042796241	-3.625844329	0.026626606	19.4120	
2 (2006-2010)	11	0.058212752	-3.538222453	0.029064945	13.1836	Lognormal
C (10 to 100)	16	0.07361101	-3.373307906	0.034276068	15.5474	
1 (<=2005)	7	0.120988055	-2.502128601	0.081910458	54.8792	Normal
2 (2006-2010)	8	0.040710638	-3.89925601	0.020256977	9.1884	Lognormal
3 (>2010)	1	0.005174678	-5.263978217	0.005174678	2.3472	
D (<10)	2	0.069333333	-2.67643739	0.068807854	31.4490	
2 (2006-2010)	2	0.069333333	-2.67643739	0.068807854	31.4490	
Unknown	10	0.08674237	-3.690066648	0.024970338	11.3263	
1 (<=2005)	4	0.03190693	-3.772977798	0.022983521	14.4727	
2 (2006-2010)	4	0.182776628	-2.678195709	0.068686974	82.9060	
3 (>2010)	2	0.004344735	-5.547986228	0.003895294	1.9707	
Grand Total	62	0.058133643	-3.758300637	0.023323342	10.5793	

Biomass_PM2.5

Row Labels	Standardized fuel	Count of Average of PM2.5_total_Standardized 2	Average of Average of PM2.5_total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	Type of Distribution	EF to use(g/MMBtu)
2 (2006-2010)	Bagasse	2	0.045567975	-3.193994558	0.041007736	N/A	20.6693
2 (2006-2010)	Wood	29	0.069434642	-3.46099696	0.031398443	Lognormal	14.2421
1 (<=2005)	Bagasse	3	0.074036871	-2.610840668	0.073472752	N/A	33.5825
1 (<=2005)	Wood	15	0.071417834	-3.272522877	0.037910662	Lognormal	17.1960
3 (>2010)	Wood	10	0.003373225	-5.861279707	0.002847597	Normal	1.5301
Grand Total		59	0.058166965	-3.76762819			

Standardized fuel (Multiple Items) Bagasse, cellulosic ethanol, wood

Biomass_PM2.5

Row Labels	Count of Average of PM2.5_total_Standardized 2	Average of Average of PM2.5_total_Standardized2	Average of LN of EF	Geo Mean EF (lb/MMBtu)	Type of Distribution	EF to use(g/MMBtu)
2 (2006-2010)	31	0.067894857	-3.443770998	0.031943997	Lognormal	14.4895
1 (<=2005)	18	0.07185434	-3.162242509	0.042330708	Lognormal	19.2009
3 (>2010)	11	0.003373151	-5.845902133	0.002891725	Normal	1.5300
Grand Total	60	0.057253723	-3.79970316			

Table 2A. Particulate Matter (PM10) Emission Factors (Unit Averages) for Biomass Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Standardized fuel	Fuel SubType	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	PM Controls 1	PM Controls 2	PM Controls 3	Reference File Name ^{2,3,4}	Number of Runs	Unit Average ⁵ (lb/MMBtu HHV)	Unit Average ⁵ (g/MMBtu HHV)	Unit Average ⁵ LN(g/MMBtu HHV)
HIPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.086	39.030	3.664
HIPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	6	0.111	50.499	3.922
HIPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	1	0.032	14.594	2.681
HIPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	100% Wet, 0% Dry	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	12	0.092	41.696	3.730
HIPuuneneSugarMill/Boiler 3/2	Bagasse	Bagasse	95% Wet, 0% Dry	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	8	0.083	37.628	3.628
ARLeolaLumberMill/SN-01B	Biomass	Biomass	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	WEP	None	DRAFT BMACT data (version 8).accdb	3	0.016	7.357	1.996
MNHibbing/Unit 4A	Biomass	Biomass	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.540	1.712
NDCargillWestFargo/Foster Wheeler Boiler (EU43)	Biomass	Biomass	0% Wet, 100% Dry	2 (2006-2010)	C (10 to 100)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.173	78.365	4.361
WIGPGreenBay2818/B10 - Wastepaper Sludge-Fired Boiler 10	Deinking residuals	Deinking residuals	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.007	3.070	1.122
WIGPGreenBay2818/B10 - Wastepaper Sludge-Fired Boiler 10	Deinking residuals	Deinking residuals	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.099	2.573
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Fuel Cell	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.152	1.817
CASierraPacificLincoln/McBurney Boiler	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.033	14.900	2.701
IDPotlatch/PB-1 CE	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fuel Cell	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.008	3.799	1.335
IDPotlatch/PB-2 Riley	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.999	0.693
IDStimsonLumberCoPriestRiver/HFB-1 (EPI)	Hog Fuel	Wood	0% Wet, 100% Dry	2 (2006-2010)	Unknown	Fluidized Bed	MC	EP	None	DRAFT BMACT data (version 8).accdb	1	0.077	35.004	3.555
IDStimsonLumberCoPriestRiver/HFB-1 (EPI)	Hog Fuel	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Fluidized Bed	MC	EP	None	DRAFT BMACT data (version 8).accdb	1	0.038	17.196	2.845
LAWeyerhaeuserDodson/ES-017 WFB	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.035	15.972	2.771
MNFibrominn/EU-001	Hog Fuel	Wood	20% Wet, 80% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	6	0.099	45.033	3.807
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Fuel Cell	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.011	4.891	1.587
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Dutch Oven/Pile Burner	MC	None	None	DRAFT BMACT data (version 8).accdb	2	0.046	20.914	3.040
WABoiseKettleFallsLumber/B1	Hog Fuel	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Fuel Cell	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.005	2.274	0.822
WABoiseKettleFallsPlywood/B1	Hog Fuel	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	EFB	None	DRAFT BMACT data (version 8).accdb	3	0.016	7.452	2.009
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Dutch Oven/Pile Burner	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.190	86.195	4.457
WASimpsonDoorCompany/EU-1	Hog Fuel	Wood	0% Wet, 100% Dry	2 (2006-2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.269	122.131	4.805
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Dutch Oven/Pile Burner	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.003	1.328	0.284
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Dutch Oven/Pile Burner	EP	None	None	DRAFT BMACT data (version 8).accdb	6	0.005	2.371	0.863
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	Wet Biomass	3 (>2010)	A (>250)	Unknown	FF	None	None	Source Test	3	0.004	1.655	0.504
PAProctorGambleMehoopanyPA/Boiler #3 (O33A)	Paper	Paper	0% Wet, 100% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.054	24.381	3.194
ALBoiseWhitePaperJackson/102-0001-Z013	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.181	82.281	4.410
ALWestFraserMaplesville/Boiler-1	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.078	35.380	3.566
ARAnthonyForestProducts/SN-12	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fuel Cell	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.087	39.420	3.674
ARGBPMorrilton/SN-04	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.023	10.586	2.360
ARWestFraserHuttig/SN-24	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.205	92.896	4.531
CA_DTE Stockton, LLC/CA	Wood	Wood	Unknown	3 (>2010)	Unknown	Unknown	MC	EP	None	Webfire Report	3	0.003	1.192	0.176
CARoseburgWeed/Boiler	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.022	9.891	2.292
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	Unknown	3 (>2010)	A (>250)	Bubbling Fluidized Bed	EC	FF	None	Source Test	3	0.002	0.870	-0.139
GA_Graphic Packaging International/B005	Wood	Wood	Unknown	3 (>2010)	A (>250)	Stoker	FF	None	None	Webfire Report	6	0.004	1.741	0.554
GAGPMadisonPly/800 Wood Waste Boiler	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.020	9.252	2.225
GATempleInlandRome/WF	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Fluidized Bed	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.015	6.786	1.915
IDBAFRexburg/Kipper Boiler	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	Unknown	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.461	209.306	5.344
IDChilcoLakeSawmill/HFB1	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EFB	None	None	DRAFT BMACT data (version 8).accdb	3	0.024	10.818	2.381
IDPotlatchForestProductsCorpPostFalls/Sanderdust Fired Boiler	Wood	Wood	0% Wet, 100% Dry	2 (2006-2010)	Unknown	Dutch Oven/Susp. Burner	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.886	0.635
MEBoralexStratton/Boiler #1/2	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	2	0.004	1.855	0.618
MNDESPHansONYman/EU007	Wood	Wood	90% Wet, 0% Dry	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.013	6.018	1.795
MNHill/Boiler 1	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	D (<10)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.070	31.691	3.456
MNHill/Boiler 2	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	D (<10)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.084	38.087	3.640
NCHickoryChairCompany/WFB-1	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.225	102.221	4.627
NCSeaboardLumber/ES-3	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fluidized Bed	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.045	20.279	3.010
NCStanleyFurniture/FB-2	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	6	0.289	131.173	4.877
NCStanleyFurniture/FB-3	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.230	104.337	4.648
NH_Burgess Bio Power/Boiler #1 (EU01)	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Bubbling Fluidized Bed	FF	None	None	Source Test	3	0.007	3.205	1.165
ORBBSMMedford/B1	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.007	3.184	1.158
ORInterforPacificGilchrist/B-1	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.059	26.730	3.286
ORInterforPacificGilchrist/B-2	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.045	20.393	3.015
TXAnthonyForestProd-ATL/EP 10.1 Superior	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.076	34.496	3.541
TXAnthonyForestProd-ATL/EP 11.1 Hurst	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.090	40.671	3.706
TXwestfraser/Boiler-1	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	WPS	None	DRAFT BMACT data (version 8).accdb	3	0.046	20.781	3.034
VA_Altavista Power Station/Unit 001	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Spreader Stoker	MC	FF	None	Source Test	6	0.002	0.804	-0.218
VA_Altavista Power Station/Unit 002	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Spreader Stoker	MC	FF	None	Source Test	6	0.001	0.467	-0.761
VA_Dominion - Southampton Power Station/Unit 001	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Stoker	FF	None	None	Source Test	2	0.004	1.759	0.565
VA_Dominion - Southampton Power Station/Unit 002	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Stoker	FF	None	None	Source Test	2	0.003	1.411	0.344
WAGraysHarborPaper/No. 6 Boiler (EU2)	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Dutch Oven/Pile Burner	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.206	93.286	4.536
WAGraysHarborPaper/No. 8 Boiler (EU1)	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.111	50.487	3.922
WI_Gundersen Health Systems/B31	Wood	Wood	Unknown	3 (>2010)	C (10 to 100)	Unknown	MC	EP	None	Source Test	3	0.007	3.071	1.122
WI_Rockland Flooring Company, LLC/B04/S07	Wood	Wood	Unknown	3 (>2010)	Unknown	Unknown	MC	FF	None	Webfire Report	3	0.008	3.627	1.288
WIDomtar2814/B11, S11	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.031	14.208	2.654
WIThilmanyLLC/B07	Wood	Wood	91% Wet, 9% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	2	0.220	99.602	4.601

Notes:
¹The boiler size category units are MMBtu/hr.
²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.
⁴Source test reports were obtained from the permitting agency through a public records request.
⁵Unit averages are based on higher heating value.

Conversion Factor:
453.592 g/lb

Abbreviations:
EC - efficient combustion
EFB - eletrified filter bed
EP - electrostatic precipitator
FF - fabric filter
g - grams
HHV - higher heating value
lb - pound
LN - natural logarithm
MC - mechanical collector
MMBtu - million british thermal units
PM - particualte matter
VS - venturi scrubber
WEP - wet electrostatic precipitator
WPS - wet particulate scrubber

Source File:
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Table 2A. Particulate Matter (PM2.5) Emission Factors (Unit Averages) for Biomass Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Standardized fuel	Fuel SubType	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	PM Controls 1	PM Controls 2	PM Controls 3	Reference File Name ^{2,3,4}	Number of Runs	Unit Average ⁵ (lb/MMBtu HHV)	Unit Average ⁵ (g/MMBtu HHV)	Unit Average ⁵ LN(g/MMBtu HHV)
HiPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.065	29.682	3.391
HiPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	6	0.086	39.200	3.669
HiPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	1	0.026	11.657	2.456
HiPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	100% Wet, 0% Dry	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	12	0.072	32.438	3.479
HiPuuneneSugarMill/Boiler 3/2	Bagasse	Bagasse	95% Wet, 0% Dry	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	8	0.064	29.109	3.371
ARLeolaLumberMill/SN-01B	Biomass	Biomass	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	WEP	None	DRAFT BMACT data (version 8).accdb	3	0.015	6.862	1.926
MNHibbing/Unit 4A	Biomass	Biomass	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.010	4.473	1.498
NDCargillWestFargo/Foster Wheeler Boiler (EU43)	Biomass	Biomass	0% Wet, 100% Dry	2 (2006-2010)	C (10 to 100)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.147	66.880	4.203
WIGPGreenBay2818/B10 - Wastepaper Sludge-Fired Boiler 10	Deinking residuals	Deinking residuals	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.007	3.106	1.133
WIGPGreenBay2818/B10 - Wastepaper Sludge-Fired Boiler 10	Deinking residuals	Deinking residuals	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Fluidized Bed	FF	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.019	2.566
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Fuel Cell	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.622	1.727
CASierraPacificLincoln/McBurney Boiler	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.032	14.714	2.689
IDPotlatch/PB-1 CE	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fuel Cell	MC	EP	None	DRAFT BMACT data (version 8).accdb	6	0.006	2.619	0.963
IDPotlatch/PB-2 Riley	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.694	0.527
IDStimsonLumberCoPriestRiver/HFB-1 (EPI)	Hog Fuel	Wood	0% Wet, 100% Dry	2 (2006-2010)	Unknown	Fluidized Bed	MC	EP	None	DRAFT BMACT data (version 8).accdb	1	0.057	26.051	3.260
IDStimsonLumberCoPriestRiver/HFB-1 (EPI)	Hog Fuel	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Fluidized Bed	MC	EP	None	DRAFT BMACT data (version 8).accdb	1	0.031	13.910	2.633
LAWeyerhaeuserDodson/ES-017 WFB	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.128	2.575
MNFibrominn/EU-001	Hog Fuel	Wood	20% Wet, 80% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	FF	None	None	DRAFT BMACT data (version 8).accdb	6	0.097	43.970	3.784
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Fuel Cell	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.010	4.627	1.532
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Dutch Oven/Pile Burner	MC	None	None	DRAFT BMACT data (version 8).accdb	2	0.041	18.515	2.919
WABoiseKettleFallsLumber/B1	Hog Fuel	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Fuel Cell	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.957	0.672
WABoiseKettleFallsPlywood/B1	Hog Fuel	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	EFB	None	DRAFT BMACT data (version 8).accdb	3	0.013	5.849	1.766
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Dutch Oven/Pile Burner	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.145	65.582	4.183
WASimpsonDoorCompany/EU-1	Hog Fuel	Wood	0% Wet, 100% Dry	2 (2006-2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.242	109.596	4.697
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Dutch Oven/Pile Burner	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.003	1.164	0.152
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Dutch Oven/Pile Burner	EP	None	None	DRAFT BMACT data (version 8).accdb	6	0.005	2.221	0.798
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	Wet Biomass	3 (>2010)	A (>250)	Unknown	FF	None	None	Source Test	3	0.003	1.530	0.425
PAProctorGambleMehoopanyPA/Boiler #3 (Q33A)	Paper	Paper	0% Wet, 100% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.045	20.383	3.015
ALBoiseWhitePaperJackson/102-0001-Z013	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.144	65.345	4.180
ALWestFraserMaplesville/Boiler-1	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.060	27.264	3.306
ARAnthonyForestProducts/SN-12	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fuel Cell	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.073	32.917	3.494
ARGBPMorrilton/SN-04	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.018	8.295	2.116
CA_DTE Stockton, LLC/CA	Wood	Wood	Unknown	3 (>2010)	Unknown	Unknown	MC	EP	None	Webfire Report	3	0.002	1.098	0.093
CARoseburgWeed/Boiler	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.019	8.427	2.131
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	Unknown	3 (>2010)	A (>250)	Bubbling Fluidized Bed	EC	FF	None	Source Test	3	0.002	0.802	-0.220
GA_Graphic Packaging International/B005	Wood	Wood	Unknown	3 (>2010)	A (>250)	Stoker	FF	None	None	Webfire Report	6	0.004	1.687	0.523
GAGPMadisonPly/800 Wood Waste Boiler	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.021	9.360	2.236
GATempleInlandRome/WF	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Fluidized Bed	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.015	7.010	1.947
IDBAFRexburg/Kipper Boiler	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	Unknown	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.428	194.279	5.269
IDChilcoLakeSawmill/HFB1	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	EFB	None	None	DRAFT BMACT data (version 8).accdb	3	0.020	8.963	2.193
IDPotlatchForestProductsCorpPostFalls/Sanderdust Fired Boiler	Wood	Wood	0% Wet, 100% Dry	2 (2006-2010)	Unknown	Dutch Oven/Susp. Burner	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.004	1.699	0.530
MEBoralexStratton/Boiler #1/2	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	2	0.005	2.041	0.714
MNDESPHansONyman/EU007	Wood	Wood	90% Wet, 0% Dry	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.425	1.691
MNHill/Boiler 1	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	D (<10)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.061	27.584	3.317
MNHill/Boiler 2	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	D (<10)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.078	35.314	3.564
NCHickoryChairCompany/WFB-1	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.198	89.816	4.498
NCSeaboardLumber/ES-3	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Fluidized Bed	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.034	15.621	2.749
NCStanleyFurniture/FB-2	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	6	0.252	114.311	4.739
NCStanleyFurniture/FB-3	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.203	91.972	4.521
NH_Burgess Bio Power/Boiler #1 (EU01)	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Bubbling Fluidized Bed	FF	None	None	Source Test	3	0.007	2.985	1.094
ORBBSMMedford/B1	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	C (10 to 100)	Stoker/SlopedGrate/Other	EP	None	None	DRAFT BMACT data (version 8).accdb	3	0.006	2.621	0.964
ORInterforPacificGilchrist/B-1	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.052	23.774	3.169
ORInterforPacificGilchrist/B-2	Wood	Wood	0% Wet, 100% Dry	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.040	18.249	2.904
TXAnthonyForestProd-ATL/EP 10.1 Superior	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.067	30.286	3.411
TXAnthonyForestProd-ATL/EP 11.1 Hurst	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	None	None	DRAFT BMACT data (version 8).accdb	3	0.078	35.429	3.568
TXwestfraser/Boiler-1	Wood	Wood	100% Wet, 0% Dry	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	MC	WPS	None	DRAFT BMACT data (version 8).accdb	3	0.036	16.492	2.803
VA_Altavista Power Station/Unit 001	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Spreader Stoker	MC	FF	None	Source Test	6	0.002	0.749	-0.290
VA_Altavista Power Station/Unit 002	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Spreader Stoker	MC	FF	None	Source Test	6	0.001	0.413	-0.883
VA_Dominion - Southhampton Power Station/Unit 001	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Stoker	FF	None	None	Source Test	2	0.003	1.199	0.181
VA_Dominion - Southhampton Power Station/Unit 002	Wood	Wood	Wet Biomass	3 (>2010)	A (>250)	Stoker	FF	None	None	Source Test	2	0.003	1.177	0.163
WAGraysHarborPaper/No. 6 Boiler (EU2)	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Dutch Oven/Pile Burner	MC	VS	None	DRAFT BMACT data (version 8).accdb	3	0.154	69.744	4.245
WAGraysHarborPaper/No. 8 Boiler (EU1)	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	A (>250)	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	3	0.083	37.814	3.633
WI_Gundersen Health Systems/B31	Wood	Wood	Unknown	3 (>2010)	C (10 to 100)	Unknown	MC	EP	None	Source Test	3	0.005	2.347	0.853
WI_Rockland Flooring Company, LLC/B04/S07	Wood	Wood	Unknown	3 (>2010)	Unknown	Unknown	MC	FF	None	Webfire Report	3	0.006	2.844	1.045
WIDomtar2814/B11, S11	Wood	Wood	100% Wet, 0% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	EP	None	DRAFT BMACT data (version 8).accdb	3	0.031	13.864	2.629
WIThlmányLLC/B07	Wood	Wood	91% Wet, 9% Dry	2 (2006-2010)	B (100 to 250)	Stoker/SlopedGrate/Other	MC	WPS?	None	DRAFT BMACT data (version 8).accdb	2	0.163	74.140	4.306

Notes:
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³Webfire Reports were obtained from http://cfpub.epa.gov/webfire/index.cfm?action=fire_searchERTSubmission. The report can be located using the facility name and state seen under Unit ID.
⁴Source test reports were obtained from the permitting agency through a public records request.
⁵Unit averages are based on higher heating value.

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Abbreviations:
EC - efficient combustion
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lb - pound
LN - natural logarithm
MC - mechanical collector
MMBtu - million british thermal units
LN - natural logarithm
PM - particulate matter
VS - venturi scrubber
WEP - wet electrostatic precipitator
WPS - wet particulate scrubber

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COAL-FIRED BOILERS - NO_x

Test Year Category	Fuel Type	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bituminous	B (100 to 250)	2	213	177	195	25	5.27	194	N/A	195
1 (<=2005)	Bituminous	A (>250)	2	378	118	248	183	5.35	212	N/A	248
1 (<=2005)	Sub-Bituminous	A (>250)	1	156	156	156	#DIV/0!	5.05	156	N/A	156
2 (2006 to 2010)	Bituminous	B (100 to 250)	14	462	113	206	109	5.23	186	Lognormal	186
2 (2006 to 2010)	Bituminous	C (10 to 100)	2	215	138	177	55	5.15	172	N/A	177
2 (2006 to 2010)	Bituminous	A (>250)	11	298	53	143	73	4.83	125	Normal	143
2 (2006 to 2010)	Sub-Bituminous	B (100 to 250)	2	298	110	204	133	5.20	181	N/A	204
2 (2006 to 2010)	Sub-Bituminous	A (>250)	3	293	107	181	99	5.11	165	N/A	181
Grand Total			37	461.973101	52.8159651	184.0530972	93.90775039	5.097783184			

COAL-FIRED BOILERS - NO_x

Test Year Category	Fuel Type	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bituminous	4	377.81	118.41	221.57	111.20	5.31	203	N/A	222
1 (<=2005)	Sub-Bituminous	1	156.32	156.32	156.32	#DIV/0!	5.05	156	N/A	156
2 (2006 to 2010)	Bituminous	27	461.97	52.82	178.35	95.12	5.06	157	Lognormal	157
2 (2006 to 2010)	Sub-Bituminous	5	297.85	106.57	190.40	97.02	5.14	171	Normal	190
3 (>2010)	Bituminous	1	24.60	24.60	24.60	#DIV/0!	3.20	25	N/A	25
3 (>2010)	Waste Coal	2	305.42	200.19	252.80	74.41	5.51	247	N/A	253
Grand Total		40	461.97	24.60	183.50	95.79	5.07			

COAL-FIRED BOILERS - NO_x

Fuel Type (Multiple Items) Bituminous, subbituminous, waste coal

Test Year Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	5	377.81	118.41	208.52	100.63	5.26	192	Normal	209
2 (2006 to 2010)	32	461.97	52.82	180.23	93.93	5.07	160	Lognormal	160
3 (>2010)	3	305.42	24.60	176.73	141.87	4.74	115	N/A	177
Grand Total		40	461.97	24.60	183.50	95.79	5.07		

COAL-FIRED BOILERS - NOx

Fuel Type (Multiple Items) Bituminous, subbituminous, waste coal

Test Year Category	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	B (100 to 250)	2	212.86	177.19	195.03	25.22	5.27	194	N/A	195
1 (<=2005)	A (>250)	3	377.81	118.41	217.52	140.11	5.25	191	N/A	218
2 (2006 to 2010)	B (100 to 250)	16	461.97	110.17	206.14	106.90	5.22	186	Lognormal	186
2 (2006 to 2010)	C (10 to 100)	2	215.25	137.88	176.56	54.71	5.15	172	N/A	177
2 (2006 to 2010)	A (>250)	14	297.86	52.82	151.15	76.70	4.89	133	Normal	151
Grand Total		37	461.97	52.82	184.05	93.91	5.10			

Table 3A. Oxides of Nitrogen Emission Factors (Unit Averages) for Coal Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	NOx Controls 1	NOx Controls 2	NOx Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
ILPrairiePowerPearl/B1	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.833	378	5.93
HIPuuneneSugarMill/Boiler 3	Bituminous	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.261	118	4.77
OKGPMuskogeeMill/B-4	Sub-Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.345	156	5.05
OHAppletonIdeas/Boiler 4 (B003)	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.469	213	5.36
HIPuuneneSugarMill/Boiler 1	Bituminous	1 (<=2005)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.391	177	5.18
INPurdueUniverisity/Boiler 5	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	LNB	None	None	DRAFT BMACT data (version 8).acddb	3	0.127	58	4.05
TNEastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	LNB	OFA	None	DRAFT BMACT data (version 8).acddb	6	0.300	136	4.91
MITBSimonPowerPlant/Unit 1/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	LNB	SNCR	None	DRAFT BMACT data (version 8).acddb	3	0.268	122	4.80
ILBungeDanville/CFB Boiler	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.133	60	4.10
NCUNCCogen/ES-001	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.396	180	5.19
INAlcoaWarrick/Unit #3	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.366	166	5.11
OKGPMuskogeeMill/B-2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.657	298	5.70
VASmurfitStoneWestpt/PB08/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	9	0.270	122	4.81
WVATKRocketCenter/NB2766 W-17479-W (Boiler 17)	Bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.387	175	5.17
HIPuuneneSugarMill/Boiler 3	Bituminous	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	12	0.445	202	5.31
ILCornProductsInt/B10	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	SNCR	None	None	DRAFT BMACT data (version 8).acddb	3	0.116	53	3.97
IAADMCornProcessingCR/EU-501B/2	Bituminous, Sub-Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.283	128	4.86
AZCatalystPaperSnowflake/Power Boiler #2 Coal	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.646	293	5.68
OKGPMuskogeeMill/B-3	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.235	107	4.67
OKGPMuskogeeMill/B-4	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.318	144	4.97
WVPPGMartinsville/R011-Boiler 3/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	LNB	None	None	DRAFT BMACT data (version 8).acddb	3	0.383	174	5.16
ILPolyOne/B1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.271	123	4.81
IAUofNorthernIowa/Boiler #3	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.649	294	5.68
NCMillerCoors/ES-2 Coal/No. 2 & 6 Fuel Oil Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	1.018	462	6.14
NYMortonSalt/EU01	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.505	229	5.43
VAINVISTAWaynesboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.354	160	5.08
INNotreDame/B-4	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.899	408	6.01
OHMortonSaltRittman/B002 - Coal-Fired Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.249	113	4.73
HIPuuneneSugarMill/Boiler 1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	12	0.432	196	5.28
TNCargillMemphis/Stoker Boiler 8001	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	OFA	None	None	DRAFT BMACT data (version 8).acddb	3	0.402	182	5.21
VACogentrixHopewell/1A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	OFA	None	None	DRAFT BMACT data (version 8).acddb	3	0.302	137	4.92
VACogentrixPortsmouth/2A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	OFA	None	None	DRAFT BMACT data (version 8).acddb	3	0.259	117	4.77
VACogentrixHopewell/2A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	OFA	None	None	DRAFT BMACT data (version 8).acddb	3	0.355	161	5.08
VACogentrixPortsmouth/1A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	OFA	None	None	DRAFT BMACT data (version 8).acddb	3	0.295	134	4.90
IAArchersDanielsMidlandDesMoines/Asea Boiler #1	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.243	110	4.70
KYISPCchemicals/OAA (Riley)	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.657	298	5.70
VAUniversityofVirginia/7103-1-01R	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	FGR	OFA	None	DRAFT BMACT data (version 8).acddb	3	0.304	138	4.93
ILAbbottAbbottPark/Unit 5AP	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.475	215	5.37
AR_AEP John W. Turk Jr. Power Plant/ARR000017764	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	SCR	None	None	Webfire Report	3	0.054	25	3.20
PA_Fayette Thermal/O33	Waste Coal	3 (>2010)	Unknown	Fluidized Bed	None	None	None	Webfire Report	3	0.673	305	5.72
PA_Greensburg Thermal LLC/O31	Waste Coal	3 (>2010)	Unknown	Fluidized Bed	Unknown	Unknown	Unknown	Webfire Report	3	0.441	200	5.30

Notes:

¹The boiler size category units are MMBtu/hr.

²DRAFT BMACT data (version 8).acddb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.

³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.

⁴Unit averages are based on higher heating value.

Conversion Factor:

453.592 g/lb

Abbreviations:

FGR - flue gas recirculation

g - grams

HHV - higher heating value

lb - pound

LN - natural logarithm

LNB - low NO_x burner

MMBtu - million british thermal units

NO_x - oxides of nitrogen

OFA - over fire air

SCR - selective catalytic reduction

SNCR - selective non catalytic reduction

Source File:

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BIOMASS-FIRED BOILERS - NO_x

Test Year Category	Standardized Fuel	GREET Boiler Size Cat	Count of Unit Average	Max of Unit Average	Min of Unit Average	Average of Unit Average	StdDev of Unit Average	Average of Unit Average	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bagasse	A (>250)	1	97.59029915	97.59029915	97.59029915	#DIV/0!	4.580778094	98	N/A	98
1 (<=2005)	Wood	B (100 to 250)	1	94	94	94	#DIV/0!	4.54	94	N/A	94
1 (<=2005)	Wood	C (10 to 100)	2	207	124	166	59	5.08	160	N/A	166
2 (2006 to 2010)	Wood	B (100 to 250)	5	100	85	95	6	4.55	95	Normal	95
2 (2006 to 2010)	Wood	C (10 to 100)	9	560	53	179	213	4.71	111	Lognormal	111
2 (2006 to 2010)	Wood	A (>250)	8	141	30	81	36	4.31	74	Normal	81
3 (>2010)	Cellulosic Ethanol	A (>250)	1	69.93364259	69.93364259	69.93364259	#DIV/0!	4.247546829	70	N/A	70
3 (>2010)	Wood	C (10 to 100)	2	143	111	127	22	4.84	126	N/A	127
3 (>2010)	Wood	A (>250)	4	67.131616	23.03202559	52.78037706	20.08814778	3.886993676	49	N/A	53
Grand Total			33	560.3744434	23.03202559	114.8709284	118.2704457	4.494650313			

BIOMASS-FIRED BOILERS - NO_x

Fuel SubType (Multiple Items) Bagasse, Hog Fuel, N/A, Wood

Test Year Category	GREET Boiler Size Cat	Count of Unit Average	Max of Unit Average	Min of Unit Average	Average of Unit Average	StdDev of Unit Average	Average of Unit Average	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	B (100 to 250)	1	94	94	94	#DIV/0!	4.54	94	N/A	94
1 (<=2005)	C (10 to 100)	2	207	124	166	59	5.08	160	N/A	166
1 (<=2005)	A (>250)	1	98	98	98	#DIV/0!	4.58	98	N/A	98
2 (2006 to 2010)	B (100 to 250)	5	100	85	95	6	4.55	95	Normal	95
2 (2006 to 2010)	C (10 to 100)	9	560	53	179	213	4.71	111	Lognormal	111
2 (2006 to 2010)	A (>250)	8	141	30	81	36	4.31	74	Normal	81
3 (>2010)	C (10 to 100)	2	143	111	127	22	4.84	126	N/A	127
3 (>2010)	A (>250)	5	69.93364259	23.03202559	56.21103017	19.01307877	3.959104306	52	Normal	56
Grand Total			33	560.3744434	23.03202559	114.8709284	118.2704457	4.494650313	N/A	

BIOMASS-FIRED BOILERS - NO_x

Test Year Category	Standardized Fuel	Count of Unit Average	Max of Unit Average	Min of Unit Average	Average of Unit Average	StdDev of Unit Average	Average of Unit Average	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bagasse	1	98	98	98	#DIV/0!	4.58	98	N/A	98
1 (<=2005)	Wood	5	207	93	133	47	4.84	127	Normal	133
2 (2006 to 2010)	Wood	24	560	30	124	135	4.55	95	Lognormal	95
3 (>2010)	Wood	7	143	23	79	39	4.24	70	Normal	79
Grand Total			37	560.3744434	23.03202559	116.1549231	111.5630534	4.532994958		

BIOMASS-FIRED BOILERS - NO_x
Standardized Fuel (Multiple Items) Bagasse, cellulosic ethanol, wood

Test Year Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	6	207	93	127	44	4.80	122	Normal	127
2 (2006 to 2010)	24	560	30	124	135	4.55	95	Lognormal	95
3 (>2010)	8	143	23	78	36	4.24	70	Normal	78
Grand Total	38	560.3744434	23.03202559	114.9385736	110.3002685	4.525483165			

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Unit ID	Fuel Subtype	Standardized Fuel Subtype	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	NOx Controls 1	NOx Controls 2	NOx Controls 3	Reference File Name ^{2,3,4}	Number of Runs	Unit Average ⁵ (lb/MMBtu HHV)	Unit Average ⁵ (g/MMBtu HHV)	Unit Average ⁵ LN(g/MMBtu HHV)
HIPuuneneSugarMill/Boiler 3/2	Bagasse	Bagasse	1 (<= 2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	8	0.215	98	4.58
ARPotlatchForestWarren/Wellons Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.158	72	4.27
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	9	0.188	85	4.45
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.213	96	4.57
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.197	90	4.49
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	1 (<= 2005)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.207	94	4.54
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.202	92	4.52
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.221	100	4.61
IDPotlatch/PB-1 CE	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.171	78	4.35
MSGPNewAugusta/AA-015 Power Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.129	58	4.07
LAWeyerhaeuserDodson/ES-017 WFB	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.220	100	4.60
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	3 (>2010)	A (>250)	Unknown	SNCR	None	None	Source Test Report	3	0.154	70	4.25
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	3 (>2010)	A (>250)	Fluidized Bed	EC	SCR	None	Source Test Report	4	0.051	23	3.14
ME_Colby College/B101 and B102	Wood	Wood	3 (>2010)	C (10 to 100)	Chiptec biomass gasification boiler	None	None	None	Source Test Report	3	0.315	143	4.96
GATempleInlandRome/WF	Wood	Wood	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.217	99	4.59
ARAnthonyForestProducts/SN-12	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.144	65	4.18
GAADMLocation551/630- Wellons	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.136	62	4.12
VA_Altavista Power Station/Unit 001	Wood	Wood	3 (>2010)	A (>250)	Stoker/SlopedGrate/Other	OFA	SNCR	None	Source Test Report	3	0.132	60	4.09
VA_Altavista Power Station/Unit 002	Wood	Wood	3 (>2010)	A (>250)	Stoker/SlopedGrate/Other	OFA	SNCR	None	Source Test Report	3	0.135	61	4.11
GA_Graphic Packaging International/B005	Wood	Wood	3 (>2010)	A (>250)	Stoker	None	None	None	Webfire Report	24	0.148	67	4.21
ARGBPMorrilton/SN-04	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.312	141	4.95
GAGPMadisonPly/800 Wood Waste Boiler	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.163	74	4.30
MSGPNewAugusta/AA-015 Power Boiler	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.133	60	4.10
MSIPVicksburg/Power Boiler-AA-006	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.258	117	4.76
MEBORalexStratton/Boiler #1/2	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	OFA	SCR	None	DRAFT BMACT data (version 8).accdb	3	0.066	30	3.40
ARWestFraserHuttig/SN-24	Wood	Wood	1 (<= 2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.274	124	4.82
ARWestFraserHuttig/SN-24	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.211	96	4.56
ORColumbiaForestKlamathFalls/BLR-N	Wood	Wood	1 (<= 2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.206	93	4.54
ORColumbiaForestKlamathFalls/BLR-S	Wood	Wood											

¹The boiler size category units are MMBtu/hr.
²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.
⁴Source test reports were obtained from the permitting agency through a public records request.
⁵Unit averages are based on higher heating value.

453.592 g/lb

EC - efficient combustion	lb - pound	NO _x - oxides of nitrogen	SNCR - selective non catalytic reduction
g - grams	LN - natural logarithm	OFA - over fire air	
HHV - higher heating value	MMBtu - million british thermal units	SCR - selective catalytic reduction	

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COAL-FIRED BOILERS - SO2

Row Labels	Fuel Type	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bituminous	A (>250)	1	272.3250986	272.3250986	272.3250986	#DIV/0!	5.606996568	272	N/A	272
2 (2006 to 2010)	Bituminous	B (100 to 250)	14	2336	222	741	681	6.27	527	Lognormal	527
2 (2006 to 2010)	Bituminous	C (10 to 100)	2	428	19	223	289	4.51	91	N/A	223
2 (2006 to 2010)	Bituminous	A (>250)	10	583.2022283	6.107082407	223.0890797	185.5461689	4.915342787	136	Normal	223
2 (2006 to 2010)	Sub-Bituminous	B (100 to 250)	3	2273	78	923	1182	6.04	420	N/A	923
2 (2006 to 2010)	Sub-Bituminous	A (>250)	2	280.7151578	133.0164201	206.865789	104.438779	5.263906531	193	N/A	207
Grand Total			32	2336.167776	6.107082407	515.611754	614.6566614	5.630348748			

COAL-FIRED BOILERS - SO2

Row Labels	Fuel Type	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bituminous	1	272	272	272	#DIV/0!	5.61	272	N/A	272
2 (2006 to 2010)	Bituminous	26	2336	6	502	571	5.61	274	Lognormal	274
2 (2006 to 2010)	Sub-Bituminous	5	2273	78	636	925	5.73	308	Lognormal	308
3 (>2010)	Bituminous	2	25	19	22	4	3.09	22	N/A	22
3 (>2010)	Waste Coal	2	140	41	91	70	4.33	76	N/A	91
Grand Total		36	2336.167776	6.107082407	464.5828086	596.9322997	5.416743976			

COAL-FIRED BOILERS - SO2

Fuel Type (Multiple Items) Bituminous, subbituminous, waste coal

Row Labels	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	1	272	272	272	#DIV/0!	5.61	272	N/A	272
2 (2006 to 2010)	31	2336	6	523	623	5.63	279	Lognormal	279
3 (>2010)	4	140	19	56	57	3.71	41	N/A	56
Grand Total		36	2336.167776	6.107082407	464.5828086	596.9322997	5.416743976		

COAL-FIRED BOILERS - SO2

Fuel Type (Multiple Items) Bituminous, subbituminous, waste coal

Row Labels	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	A (>250)	1	272.3250986	272.3250986	272.3250986	#DIV/0!	5.606996568	272	N/A	272
2 (2006 to 2010)	B (100 to 250)	17	2336	78	773	746	6.23	507	Lognormal	507
2 (2006 to 2010)	C (10 to 100)	2	428	19	223	289	4.51	91	N/A	223
2 (2006 to 2010)	A (>250)	12	583.2022283	6.107082407	220.3851979	170.8780917	4.973436744	145	Normal	220
Grand Total		32	2336.167776	6.107082407	515.611754	614.6566614	5.630348748			

Table 4A. Sulfur Dioxide Emission Factors (Unit Averages) for Coal Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	SO ₂ Controls 1	SO ₂ Controls 2	SO ₂ Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
ILPrairiePowerPearl/B1	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	WGS?	None	None	DRAFT BMACT data (version 8).accdb	3	0.600	272	5.61
TNEastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	FGD	None	None	DRAFT BMACT data (version 8).accdb	6	0.405	184	5.21
ILCornProductsInt/B10	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	LI	None	None	DRAFT BMACT data (version 8).accdb	3	0.217	99	4.59
INPurdueUniverisity/Boiler 5	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	LI	None	None	DRAFT BMACT data (version 8).accdb	3	0.288	131	4.87
NCUNCCogen/ES-001	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	LI	None	None	DRAFT BMACT data (version 8).accdb	3	0.165	75	4.31
ILBungeDanville/CFB Boiler	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.729	331	5.80
OKGPMuskogeeMill/B-2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.670	304	5.72
MITBSimonPowerPlant/Unit 1/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.969	440	6.09
WVATKRocketCenter/NB2766 W-17479-W (Boiler 17)	Bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.286	583	6.37
INAlcoaWarrick/Unit #3	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	WGS?	None	None	DRAFT BMACT data (version 8).accdb	3	0.177	80	4.38
VASmurfitStoneWestpt/PB08/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	WGS?	None	None	DRAFT BMACT data (version 8).accdb	7	0.013	6	1.81
ILPolyOne/B1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	LI	None	None	DRAFT BMACT data (version 8).accdb	3	0.720	327	5.79
IAUofNortnerIowa/Boiler #3	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	3.989	1,810	7.50
NCMillerCoors/ES-2 Coal/No. 2 & 6 Fuel Oil Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.500	227	5.42
VAINVESTAWaynesboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.753	341	5.83
WVPPGMartinsville/R011-Boiler 3/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.815	823	6.71
INNotreDame/B-4	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	2	3.452	1,566	7.36
OHMortonSaltRittman/B002 - Coal-Fired Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	5.150	2,336	7.76
VACogentrixHopewell/2A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.248	566	6.34
VACogentrixPortsmouth/1A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.132	514	6.24
VACogentrixHopewell/1A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	SD	None	None	DRAFT BMACT data (version 8).accdb	3	0.489	222	5.40
VACogentrixPortsmouth/2A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	SD	None	None	DRAFT BMACT data (version 8).accdb	3	0.506	230	5.44
VACogentrixHopewell/2A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	SD	None	None	DRAFT BMACT data (version 8).accdb	3	0.494	224	5.41
VACogentrixPortsmouth/1A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	SD	None	None	DRAFT BMACT data (version 8).accdb	3	0.724	329	5.79
TNCargillMemphis/Stoker Boiler 8001	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	WGS	None	None	DRAFT BMACT data (version 8).accdb	3	1.881	853	6.75
ILAbbottAbbottPark/Unit 5AP	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.943	428	6.06
VAUniversityofVirginia/7103-1-01R	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	SD	None	None	DRAFT BMACT data (version 8).accdb	3	0.042	19	2.96
IAADMCCornProcessingCR/EU-501B/2	Bituminous, Sub-Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	LI	None	None	DRAFT BMACT data (version 8).accdb	3	0.234	106	4.67
OKGPMuskogeeMill/B-3	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.293	133	4.89
OKGPMuskogeeMil/B-4	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.619	281	5.64
IAArchersDanielsMidlandDesMoines/Asea Boiler #1	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.172	78	4.36
KYISPCchemicals/OAA (Riley)	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	5.012	2,273	7.73
MOMallinckrodt/Boiler 6	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.919	417	6.03
AR_AEP John W. Turk Jr. Power Plant/ARR000017764	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	SD	None	None	Webfire Report	3	0.043	19	2.97
UT_Bonanza Power Plant/Unknown	Bituminous	3 (>2010)	Unknown	Unknown	Unknown	Unknown	Unknown	Webfire Report	9	0.055	25	3.21
PA_Fayette Thermal/033	Waste Coal	3 (>2010)	Unknown	Fluidized Bed	LI	FGD	None	Webfire Report	2	0.310	140	4.94
PA_Greensburg Thermal LLC/031	Waste Coal	3 (>2010)	Unknown	Fluidized Bed	Unknown	Unknown	Unknown	Webfire Report	3	0.090	41	3.71

Notes:
¹The boiler size category units are MMBtu/hr.
²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.
⁴Unit averages are based on higher heating value.

Conversion Factor:
453.592 g/lb

Abbreviations:
FGD - flue gas desulfurization
g - grams
HHV - higher heating value
lb - pound
LI - limestone injection
LN - natural logarithm
MMBtu - million british thermal units
SD - spray dryer
SO₂ - sulfur dioxide
WGS - wet gas scrubber

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BIOMASS-FIRED BOILERS - SO2

Row Labels	Standardized Fuel	GREET Boiler Size	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
2 (2006 to 2010)	Wood	B (100 to 250)	4	9.71	0.37	3.32	4.40	0.38	1.46	N/A	3.32
2 (2006 to 2010)	Wood	C (10 to 100)	4	5.75	0.83	2.80	2.15	0.79	2.20	N/A	2.80
2 (2006 to 2010)	Wood	A (>250)	8	9.10	0.11	2.87	3.20	0.30	1.35	Normal	2.87
3 (>2010)	Cellulosic Ethanol	A (>250)	1	9.19	9.19	9.19	#DIV/0!	2.22	9.19	N/A	9.19
3 (>2010)	Wood	A (>250)	3	0.69	0.14	0.32	0.32	-1.45	0.23	N/A	0.32
Grand Total			20	9.712667606	0.108725371	2.88015403	3.276464536	0.246639041			

BIOMASS-FIRED BOILERS - SO2

Standardized Fuel (All)

Row Labels	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
2 (2006 to 2010)	B (100 to 250)	4	9.71	0.37	3.32	4.40	0.38	1.46	N/A	3.32
2 (2006 to 2010)	C (10 to 100)	4	5.75	0.83	2.80	2.15	0.79	2.20	N/A	2.80
2 (2006 to 2010)	A (>250)	8	9.10	0.11	2.87	3.20	0.30	1.35	Normal	2.87
3 (>2010)	A (>250)	4	9.19	0.14	2.54	4.44	-0.53	0.59	N/A	2.54
Grand Total		20	9.712667606	0.108725371	2.88015403	3.276464536	0.246639041			

BIOMASS-FIRED BOILERS - SO2

Row Labels	Standardized Fuel	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
2 (2006 to 2010)	Wood	16	9.71	0.11	2.97	3.10	0.44	2	Lognormal	1.56
3 (>2010)	Wood	3	0.69	0.14	0.32	0.32	-1.45	0	N/A	0.32
Grand Total		19	9.712667606	0.108725371	2.547949998	3.000301466	0.14286547			

BIOMASS-FIRED BOILERS - SO2

Standardized Fuel (Multiple Items) Cellulosic ethanol, wood

Row Labels	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN(g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
2 (2006 to 2010)	16	9.71	0.11	2.97	3.10	0.44	1.56	Lognormal	1.56
3 (>2010)	4	9.19	0.14	2.54	4.44	-0.53	0.59	N/A	2.54
Grand Total	20	9.71	0.11	2.88	3.28	0.25	1.28	Lognormal	1.28

Table 4B. Oxides of Sulfur Emission Factors (Unit Averages) for Biomass Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Subtype	Standardized Fuel Subtype	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	SO ₂ Controls 1	SO ₂ Controls 2	SO ₂ Controls 3	Reference File Name ^{2,3,4}	Number of Runs	Unit Average ⁵ (lb/MMBtu HHV)	Unit Average ⁵ (g/MMBtu HHV)	Unit Average ⁵ LN(g/MMBtu HHV)
ARPotlatchForestWarren/Wellons Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0137	6.22	1.83
MSGPNewAugusta/AA-015 Power Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0063	2.87	1.06
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0010	0.46	-0.78
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0060	2.74	1.01
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	2	0.0008	0.37	-1.00
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	2	0.0018	0.83	-0.19
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	VS	None	None	DRAFT BMACT data (version 8).accdb	9	0.0214	9.71	2.27
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	3 (>2010)	A (>250)	Unknown	FGD	None	None	Source Test Report	3	0.0203	9.19	2.22
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	3 (>2010)	A (>250)	Fluidized Bed	DSI	None	None	Source Test Report	4	0.0015	0.69	-0.36
CAThermalEnergyDev/BLR1	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	LI	DSI	None	DRAFT BMACT data (version 8).accdb	12	0.0127	5.75	1.75
GATempleInlandRome/WF	Wood	Wood	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0201	9.10	2.21
GAGPMadisonPly/800 Wood Waste Boiler	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.0047	2.13	0.76
MSGPNewAugusta/AA-015 Power Boiler	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0037	1.68	0.52
MEBoralexStratton/Boiler #1/2	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.0002	0.11	-2.22
ARAnthonyForestProducts/SN-12	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0037	1.67	0.51
ARWestFraserHuttig/SN-24	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.0065	2.94	1.08
VA_Altavista Power Station/Unit 001	Wood	Wood	3 (>2010)	A (>250)	Stoker/SlopedGrate/Other	SD	None	None	Source Test Report	3	0.0003	0.14	-1.99
VA_Altavista Power Station/Unit 002	Wood	Wood	3 (>2010)	A (>250)	Stoker/SlopedGrate/Other	SD	None	None	Source Test Report	3	0.0003	0.14	-1.99
ARGBPMorrilton/SN-04	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	VS	None	None	DRAFT BMACT data (version 8).accdb	3	0.0012	0.53	-0.64
MSIPVicksburg/Power Boiler-AA-006	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	WGS?	None	None	DRAFT BMACT data (version 8).accdb	3	0.0007	0.33	-1.10

Notes:
¹The boiler size category units are MMBtu/hr.
²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.
⁴Source test reports were obtained from the permitting agency through a public records request.
⁵Unit averages are based on higher heating value.

Conversion Factor:
453.592 g/lb

Abbreviations:
DSI - dry sorbent injection
FGD - flue gas desulfurization
g - grams
HHV - higher heating value
lb - pound
LI - limestone injection
LN - natural logarithm
MMBtu - million british thermal units
SD - spray dryer
SO₂ - sulfur dioxide
VS - venturi scrubber
WGS - wet gas scrubber

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COAL-FIRED BOILERS - CO

Test Year Category	Fuel Type	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Anthracite	A (>250)	1	40.55	40.55	40.55	#DIV/0!	3.70	41	N/A	41
1 (<=2005)	Bituminous	B (100 to 250)	11	157.9	0.5	36.7	47.1	2.7	15	Lognormal	15
1 (<=2005)	Bituminous	C (10 to 100)	5	100.2	25.8	55.8	33.0	3.9	48	Normal	56
1 (<=2005)	Bituminous	A (>250)	12	28.33	2.58	13.32	9.46	2.33	10	Lognormal	10
1 (<=2005)	Sub-Bituminous	B (100 to 250)	2	218.1	16.3	117.2	142.7	4.1	60	N/A	117
1 (<=2005)	Sub-Bituminous	A (>250)	6	1653.20	1.21	284.37	670.65	2.84	17	Lognormal	17
2 (2006 to 2010)	Bituminous	B (100 to 250)	27	484.2	1.5	67.7	100.8	3.4	30	Lognormal	30
2 (2006 to 2010)	Bituminous	C (10 to 100)	5	142.6	19.1	61.0	55.6	3.8	43	Normal	61
2 (2006 to 2010)	Bituminous	A (>250)	17	75.16	4.60	23.39	19.28	2.85	17	Lognormal	17
2 (2006 to 2010)	Sub-Bituminous	B (100 to 250)	3	240.9	19.6	94.4	126.9	3.9	47	N/A	94
2 (2006 to 2010)	Sub-Bituminous	A (>250)	7	89.09	0.84	30.42	32.74	2.69	15	Normal	30
3 (>2010)	Bituminous	C (10 to 100)	5	82.4	3.3	30.5	31.1	2.9	19	Normal	31
Grand Total			101	1653.20	0.51	59.45	173.24	3.08			

COAL-FIRED BOILERS - CO

GREET Boiler Size

Category (All)

Test Year Category	Fuel Type	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Anthracite	1	40.55	40.55	40.55	#DIV/0!	3.70	41	N/A	41
1 (<=2005)	Bituminous	28	157.92	0.51	30.09	35.83	2.76	16	Lognormal	16
1 (<=2005)	Sub-Bituminous	8	1653.20	1.21	242.58	574.60	3.15	23	Lognormal	23
2 (2006 to 2010)	Bituminous	49	484.16	1.53	51.66	79.49	3.25	26	Lognormal	26
2 (2006 to 2010)	Sub-Bituminous	10	240.93	0.84	49.62	72.45	3.04	21	Lognormal	21
3 (>2010)	Bituminous	22	129.88	3.34	42.65	40.88	3.26	26	Lognormal	26
3 (>2010)	Sub-Bituminous	12	103.95	5.41	44.45	35.56	3.38	29	Normal	44
3 (>2010)	Waste Coal	2	88.75	58.21	73.48	21.60	4.27	72	N/A	73
Grand Total		132	1653.20	0.51	56.59	152.60	3.16			

COAL-FIRED BOILERS - CO

Fuel Type	(Multiple Items)	Anthracite, bituminous, subbituminous, waste coal
REET Boiler Size		
Category	(All)	

Test Year Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	37	1653.20	0.51	76.32	270.19	2.87	18	Lognormal	18
2 (2006 to 2010)	59	484.16	0.84	51.32	77.74	3.22	25	Lognormal	25
3 (>2010)	36	129.88	3.34	44.96	38.26	3.36	29	Lognormal	29
Grand Total	132	1653.20	0.51	56.59	152.60	3.16			

COAL-FIRED BOILERS - CO

Fuel Type	(Multiple Items)	Anthracite, bituminous, subbituminous, waste coal
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Test Year Category	REET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	B (100 to 250)	13	218.11	0.51	49.10	66.76	2.92	19	Lognormal	19
1 (<=2005)	C (10 to 100)	5	100.24	25.80	55.78	33.04	3.88	48	Normal	56
1 (<=2005)	A (>250)	19	1653.20	1.21	100.35	376.20	2.56	13	Lognormal	13
2 (2006 to 2010)	B (100 to 250)	30	484.16	1.53	70.41	101.39	3.46	32	Lognormal	32
2 (2006 to 2010)	C (10 to 100)	5	142.56	19.15	60.98	55.58	3.76	43	Normal	61
2 (2006 to 2010)	A (>250)	24	89.09	0.84	25.44	23.43	2.80	16	Lognormal	16
3 (>2010)	C (10 to 100)	5	82.40	3.34	30.55	31.07	2.93	19	Normal	31
Grand Total		101	1653.20	0.51	59.45	173.24	3.08			

Table 5A. Carbon-monoxide Emission Factors (Unit Averages) for Coal Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Standardized Boiler Furnace Type	HAP Controls 1	HAP Controls 2	HAP Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
PAKimberlyClarkChester/Boiler #10 (1D 035)	Anthracite	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.089	40.6	3.70
OHMortonSaltRittman/B002 - Coal-Fired Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	ACI	None	None	DRAFT BMACT data (version 8).acddb	3	0.012	5.5	1.71
PAPHGlatfelter/PB5	Bituminous	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.061	27.8	3.33
ILBungeDanville/CFB Boiler	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.041	18.4	2.91
ILCornProductsInt/B10	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.027	12.4	2.52
INPurdueUniversity/Boiler 5	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	9	0.026	11.9	2.47
NCUNCCogen/ES-001	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.034	15.5	2.74
ILPrairiePowerPearl/B1	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.006	2.6	0.95
NCBlueRidgePaper/G11037	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.062	28.3	3.34
NCBlueRidgePaper/G11038	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.013	6.0	1.78
NCBlueRidgePaper/G11039	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.013	5.8	1.75
NCBlueRidgePaper/G11040	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.011	5.1	1.63
OKGPMuskogeeMill/B-2	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.022	10.0	2.30
TNDuPontOldHickoryPlant/#20 Boiler	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.015	6.6	1.88
VAGPBigIsland2703/PWR04 - No. 4 Power Boiler	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.028	12.6	2.54
VASmurfitStoneWestpt/PB08/1	Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.046	20.7	3.03
FLSmurfit-Stone/7PB	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.013	5.7	1.75
ILDukeEnergyTuscola/Unit 1	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.078	35.2	3.56
ILDukeEnergyTuscola/Unit 3	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.062	28.2	3.34
INAlcoaWarrick/Unit #2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.036	16.2	2.78
INAlcoaWarrick/Unit #3	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.017	7.9	2.07
INNewEnergy/Riley Boiler	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.010	4.6	1.53
MDNewPage-Luke/No. 25	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.109	49.3	3.90
MITBSimonPowerPlant/Unit 1/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.065	29.6	3.39
OKGPMuskogeeMill/B-2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.106	48.1	3.87
TNEastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.015	6.7	1.90
VASmurfitStoneWestpt/PB08/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	9	0.020	9.0	2.20
SCInternationalPaperEastover/No. 1 Power Boiler	Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.021	9.7	2.27
WVATKRocketCenter/NB2766 W-17479-W (Boiler 17)	Bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.166	75.2	4.32
HIPuuneneSugarMill/Boiler 3	Bituminous	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.054	24.7	3.21
HIPuuneneSugarMill/Boiler 3	Bituminous	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	12	0.052	23.6	3.16
IAUofIowa/EP7 Boiler 11/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.057	25.9	3.25
ILPolyOne/B1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.032	14.5	2.68
VAPhilipMorrisMC/PC	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.017	7.6	2.02
VAPhilipMorrisPark500/B2	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.001	0.5	-0.67
VAPhilipMorrisPark500/B3	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.007	3.3	1.20
IAUofNorthernIowa/Boiler #3	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.018	8.0	2.08
INTatLyleSagamore/31B1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	12	0.006	2.6	0.95
MASaintGobain/EU-523-01	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	2	0.129	58.7	4.07
MOAnheuserBusch/Boiler 1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.109	49.4	3.90
MOAnheuserBusch/Boiler 5	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.086	38.9	3.66
NCMillerCoors/ES-2 Coal/No. 2 & 6 Fuel Oil Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.015	6.8	1.91
PADomtarJohnsonburg/#81 Coal Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.057	25.7	3.25
VAINVESTAWaynesboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.034	15.6	2.74
VAPhilipMorrisPark500/B3	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.014	6.2	1.83
WVPPGMartinsville/R011-Boiler 3/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.108	49.0	3.89
KYISPCchemicals/OAA (Riley)	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.107	48.7	3.89
OHAppletonIdeas/Boiler 2 (B002)	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.038	17.2	2.84
OHAppletonIdeas/Boiler 4 (B003)	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.016	7.4	2.01
SCClemson/O4-B04	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.079	36.0	3.58
WIFlambeauRiverPaper/B24	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.086	39.2	3.67
WIThilmanyPapersNicoletMill/B23	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.176	79.9	4.38
WVDuPontWashingtonWorks/P05	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.014	6.1	1.81
IAUofIowa/EP6 Boiler 10	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.082	37.0	3.61
INNotreDame/B-4	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.003	1.5	0.42
MIMortonSaltManistee/No. 6 Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	1.067	484.2	6.18
MOColumbiaPowerPlant/Boiler Unit 6	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.054	24.5	3.20
OHAKronThermalEnergy/Boiler #32 (B001)	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.021	9.3	2.23
TNCargillMemphis/Stoker Boiler 8001	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.460	208.5	5.34
VACogentrixHopewell/1A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.498	225.8	5.42
VACogentrixHopewell/2A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.102	46.5	3.84
VACogentrixHopewell/2A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.123	55.8	4.02
VACogentrixPortsmouth/1A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.163	74.0	4.30
VACogentrixPortsmouth/1A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.203	91.9	4.52
VACogentrixPortsmouth/2A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.288	130.5	4.87
VAUniversityofVirginia/7103-1-05	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.127	57.5	4.05
HIPuuneneSugarMill/Boiler 1	Bituminous	1 (<=2005)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.348	157.9	5.06
HIPuuneneSugarMill/Boiler 1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).acddb	12	0.166	75.5	4.32
ILWesternILUniv/Boiler #2	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.180	81.5	4.40
NCNC_DukeUniversity_Durham/7754-01	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.071	32.3	3.48
NCNC_DukeUniversity_Durham/7754-02	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.057	25.8	3.25
NYCargillWatkinsGlen/Erie 1	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.221	100.2	4.61
OHBataviaTransmissions/Boiler 2 (B002)	Bituminous	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.086	39.0	3.66
ILAbbottAbbottPark/Unit 5AP	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.045	20.4	3.02
MNADMCornDivision/Coal Boiler #1 EU049	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	1	0.210	95.3	4.56
OHCampbellsSoupCo/B001	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	2	0.314	142.6	4.96
VAUniversityofVirginia/7103-1-01R	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.042	19.1	2.95
VAUniversityofVirginia/7103-1-02R	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.061	27.5	3.31
IAADMCornProcessingCR/EU-501A	Bituminous, Sub-B1	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.025	11.3	2.43
IAADMCornProcessingCR/EU-501B/1	Bituminous, Sub-B1	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.015	7.0	1.94
IAADMCornProcessingCR/EU-502A	Bituminous, Sub-B1	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.018	8.2	2.10
IAADMCornProcessingCR/EU-502B	Bituminous, Sub-B1	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.042	18.9	2.94
IAADMCornProcessingCR/EU-530	Bituminous, Sub-B1	1 (<=2005)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	3	0.007	3.1	1.14
IAADMCornProcessingCR/EU-501B/2	Bituminous, Sub-B2	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).acddb	6	0.020	9.2	2.22

Table 5A. Carbon-monoxide Emission Factors (Unit Averages) for Coal Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Standardized Boiler Furnace Type	HAP Controls 1	HAP Controls 2	HAP Controls 3	Reference File Name ^{2,3}	Number of Runs	Unit Average ⁴ (lb/MMBtu HHV)	Unit Average ⁴ (g/MMBtu HHV)	Unit Average ⁴ LN(g/MMBtu HHV)
AR_AEP John W. Turk Jr. Power Plant/ARR000017764	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	ACI	None	None	Webfire Report	3	0.014	6.1	1.82
KY_Griffin Industries, LLC/EU-03	Bituminous	3 (>2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.068	30.8	3.43
PA_Norfolk Southern Railway Company/031-033	Bituminous	3 (>2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.057	25.8	3.25
GA_Mt. Vernon Hills/EU04	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.040	18.3	2.91
GA_Mt. Vernon Mills/EU03	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.022	9.8	2.28
VA_Portsmouth Genco, LLC/001 and 002	Bituminous	3 (>2010)	Unknown	Fluidized Bed	None	None	None	Webfire Report	6	0.271	122.9	4.81
GA_Mount Vernon Mills, Inc./EU01&EU02	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.014	6.3	1.83
GA_University of Georgia Central Steam Plant/B005	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.101	45.7	3.82
ID_Brigham Young University Idaho/065-00011	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	4	0.082	37.1	3.61
UT_Brigham Young University/Unknown	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.073	33.3	3.51
UT_BYU 2/Unknown	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.157	71.4	4.27
UT_BYU 5/Unknown	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	3	0.039	17.8	2.88
OH_Wausau Paper Towel & Tissue, LLC/B001	Bituminous	3 (>2010)	Unknown	Pulverized Coal	None	None	None	Webfire Report	3	0.286	129.9	4.87
OH_Wausau Paper Towel & Tissue, LLC/B002	Bituminous	3 (>2010)	Unknown	Pulverized Coal	None	None	None	Webfire Report	3	0.189	85.7	4.45
OH_Wausau Paper Towel & Tissue, LLC/B004	Bituminous	3 (>2010)	Unknown	Pulverized Coal	None	None	None	Webfire Report	4	0.019	8.7	2.17
IL_Prairie State Generating Company LLC/Unknown	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	11	0.029	13.0	2.57
PA_Saint Vincent Archabbey - Seminary - College/032	Bituminous	3 (>2010)	C (10 to 100)	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	3	0.023	10.3	2.34
PA_Saint Vincent Archabbey-Seminary-College/031	Bituminous	3 (>2010)	C (10 to 100)	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	3	0.007	3.3	1.20
NE_Central Utility Plant/Unknown	Bituminous	3 (>2010)	C (10 to 100)	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.182	82.4	4.41
Georgia_Imperial Savannah, L.P./Georgia EPA, APB	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	3	0.029	13.3	2.58
IN_Saint Joseph's College/10300225	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	12	0.262	118.7	4.78
KY_Barton Brands of Kentucky/09	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	3	0.105	47.5	3.86
GA_Caraustar Industries, Inc./CB01	Sub-Bituminous	3 (>2010)	Unknown	Pulverized Coal	None	None	None	Webfire Report	9	0.108	49.1	3.89
MT_Malmstrom Air Force Base Heating Plant/Air Quality Permit #1427-09	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	Webfire Report	6	0.229	103.9	4.64
MN_Southern Minnesota Beet Sugar Cooperative/EU001	Sub-Bituminous	3 (>2010)	Unknown	Pulverized Coal	Unknown	Unknown	Unknown	Webfire Report	6	0.167	75.6	4.33
AK_Clear Air Force Station Power Plant Alaska/Alaska	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	9	0.171	77.7	4.35
WI_Mendota Mental Health Heating Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.024	10.7	2.37
WI_UW Eau Claire Heating Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.098	44.3	3.79
WI_UW LaCrosse Heating Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.075	33.9	3.52
WI_UW Oshkosh Heating Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.040	18.0	2.89
WI_UW River Falls Power Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	3	0.207	94.0	4.54
WI_UW Stevens Point Heating Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.012	5.4	1.69
WI_UW Stout Power Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.030	13.5	2.60
WI_UW Superior Power Plant/Unknown	Sub-Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	Unknown	Unknown	Unknown	Webfire Report	6	0.016	7.2	1.98
PA_Fayette Thermal/033	Waste Coal	3 (>2010)	Unknown	Fluidized Bed	None	None	None	Webfire Report	3	0.196	88.8	4.49
PA_Greensburg Thermal LLC/031	Waste Coal	3 (>2010)	Unknown	Fluidized Bed	Unknown	Unknown	Unknown	Webfire Report	3	0.128	58.2	4.06
IDTASCOPaul/Erie City Boiler	Sub-Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.016	7.3	1.99
OKGPMuskogeeMill/B-3	Sub-Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.003	1.2	0.19
OKGPMuskogeeMill/B-4	Sub-Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.012	5.3	1.66
WYGeneralChemical/GR-2-L (C BOILER)	Sub-Bituminous	1 (<=2005)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.025	11.5	2.44
AZCatalystPaperSnowflake/Power Boiler #2 Coal	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.002	0.8	-0.17
OKGPMuskogeeMill/B-3	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.022	9.9	2.29
OKGPMuskogeeMill/B-4	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.029	13.3	2.59
WYFMCGreenRiver/NS-1A	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Pulverized Coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.018	8.1	2.09
IACarrollEddyville/1.001	Sub-Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	3.645	1,653.2	7.41
IAMuscatinePowerandWater/Unit 7	Sub-Bituminous	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.061	27.8	3.32
IAMuscatinePowerandWater/Unit 7	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.069	31.2	3.44
WYFMCGranger/UIN-14	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.133	60.5	4.10
WYFMCGranger/UIN-15	Sub-Bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.196	89.1	4.49
NEADMLincoln/EU26 Coal Boiler	Sub-Bituminous	1 (<=2005)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.036	16.3	2.79
IAArchersDanielsMidlandDesMoines/Asea Boiler #1	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.050	22.7	3.12
IDTASCOPaul/Babcock and Wilcox (B&W) Boiler	Sub-Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.481	218.1	5.38
KYISPChemicals/OAA (Riley)	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.043	19.6	2.98
NDMinnDakFarmers/Babcock and Wilcox Boiler #5	Sub-Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.531	240.9	5.48

Notes:
¹The boiler size category units are MMBtu/hr.
²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSsubmission>. The report can be located using the facility name and state seen under Unit ID.
⁴Unit averages are based on higher heating value.

Conversion Factor:
453.592 g/lb

Abbreviations:
ACI - activated carbon injection
g - grams
HAP - hazardous air pollutant
HHV - higher heating value
lb - pound
LN - natural logarithm
MMBtu - million british thermal units

Source File:
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BIOMASS-FIRED BOILERS - CO

Row Labels	Standardized Fuel	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bagasse	B (100 to 250)	2	1206	223	714	695	6.3	518	N/A	714
1 (<=2005)	Bagasse	A (>250)	11	6721	139	1762	1950	6.9	984	Lognormal	984
1 (<=2005)	Wood	B (100 to 250)	15	1028	18	257	285	5.0	150	Lognormal	150
1 (<=2005)	Wood	C (10 to 100)	17	1950	24	313	464	5.1	169	Lognormal	169
1 (<=2005)	Wood	A (>250)	3	262	109	181	77	5.1	170	N/A	181
2 (2006 to 2010)	Bagasse	B (100 to 250)	1	1176	1176	1176	#DIV/0!	7.1	1176	N/A	1176
2 (2006 to 2010)	Bagasse	A (>250)	6	1297	45	648	607	5.8	328	Lognormal	328
2 (2006 to 2010)	Wood	B (100 to 250)	11	367	36	130	95	4.7	106	Lognormal	106
2 (2006 to 2010)	Wood	C (10 to 100)	33	1423	6	246	302	4.9	136	Lognormal	136
2 (2006 to 2010)	Wood	A (>250)	14	1240	36	244	359	4.9	130	Lognormal	130
3 (>2010)	Bagasse	A (>250)	1	79	79	79	#DIV/0!	4.4	79	N/A	79
3 (>2010)	Cellulosic Ethanol	A (>250)	1	2	2	2	#DIV/0!	0.9	2	N/A	2
3 (>2010)	Wood	C (10 to 100)	4	515	9	153	242	4.0	54	N/A	153
3 (>2010)	Wood	A (>250)	4	122	8	53	54	3.4	30	N/A	53
Grand Total			123	6721	2	402	783	5.1			

BIOMASS-FIRED BOILERS - CO

Standardized Fuel (Multiple Items) Bagasse, cellulosic ethanol, wood

Row Labels	GREET Boiler Size Category	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	B (100 to 250)	17	1206	18	311	352	5.2	174	Lognormal	174
1 (<=2005)	C (10 to 100)	17	1950	24	313	464	5.1	169	Lognormal	169
1 (<=2005)	A (>250)	14	6721	109	1423	1838	6.5	675	Lognormal	675
2 (2006 to 2010)	B (100 to 250)	12	1176	36	217	315	4.9	129	Lognormal	129
2 (2006 to 2010)	C (10 to 100)	33	1423	6	246	302	4.9	136	Lognormal	136
2 (2006 to 2010)	A (>250)	20	1297	36	365	470	5.1	172	Lognormal	172
3 (>2010)	C (10 to 100)	4	515	9	153	242	4.0	54	N/A	153
3 (>2010)	A (>250)	6	122	2	49	49	3.1	23	Normal	49
Grand Total		123	6721	2	402	783	5.1			

BIOMASS-FIRED BOILERS - CO

Row Labels	Standardized Fuel	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bagasse	13	6721	139	1601	1834	6.8	892	Lognormal	892
1 (<=2005)	Wood	46	1950	18	277	374	5.0	153	Lognormal	153
2 (2006 to 2010)	Bagasse	7	1297	45	723	589	6.0	394	Lognormal	394
2 (2006 to 2010)	Wood	69	8968	6	482	1493	5.0	148	Lognormal	148
3 (>2010)	Bagasse	1	79	79	79	#DIV/0!	4.4	79	N/A	79
3 (>2010)	Wood	11	515	0	76	150	2.9	18	Lognormal	18
Grand Total		147	8968	0	495	1231	5.1			

BIOMASS-FIRED BOILERS - CO

Standardized Fuel (Multiple Items) Bagasse, cellulosic ethanol, wood

Row Labels	Count of Unit Average (g/MMBTU)	Max of Unit Average (g/MMBTU)	Min of Unit Average (g/MMBTU)	Average of Unit Average (g/MMBTU)	StdDev of Unit Average (g/MMBTU)	Average of Unit Average LN (g/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	59	6721	18	569	1054	5.4	225	Lognormal	225
2 (2006 to 2010)	76	8968	6	504	1433	5.1	162	Lognormal	162
3 (>2010)	13	515	0	71	139	2.9	18	Lognormal	18
Grand Total	148	8968	0	492	1227	5.0			

Table 5B. Carbon-monoxide Emission Factors (Unit Averages) for Biomass Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Subtype	Standardized Fuel Subtype	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	HAP Controls 1	HAP Controls 2	HAP Controls 3	Reference File Name ^{2,3,4}	Number of Runs	Unit Average ⁵ (lb/MMBtu HHV)	Unit Average ⁵ (g/MMBtu HHV)	Unit Average ⁵ LN(g/MMBtu HHV)
FLosceolaFarms/Boiler No. 3	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	4.180	1,895.9	7.55
FLosceolaFarms/Boiler No. 6	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	7.833	3,553.2	8.18
FLSugarCaneGrowersCoop/Boiler No. 1	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.962	890.1	6.79
FLSugarCaneGrowersCoop/Boiler No. 8	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	27	0.894	405.3	6.00
FLUSSugarCorp/Boiler No. 1	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	5.379	2,440.0	7.80
FLUSSugarCorp/Boiler No. 2	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	6	14.817	6,721.0	8.81
FLUSSugarCorp/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	19	3.539	1,605.3	7.38
FLUSSugarCorp/Boiler No. 7	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	28	0.307	139.1	4.93
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.334	151.7	5.02
HIPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	1.654	750.5	6.62
FLSugarCaneGrowersCoop/Boiler No. 8	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	2.859	1,296.7	7.17
FLUSSugarCorp/Boiler No. 4	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	2.240	1,015.8	6.92
FLUSSugarCorp/Boiler No. 7	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	0.257	116.7	4.76
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	33	0.317	143.9	4.97
HIPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	2.800	1,270.3	7.15
TXRGVSG/Boiler No. 6	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.098	44.6	3.80
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	3 (>2010)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	9	0.174	78.9	4.37
FLSugarCaneGrowersCoop/Boiler No. 3	Bagasse	Bagasse	1 (<=2005)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.491	222.7	5.41
HIPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	1 (<=2005)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	9	2.659	1,206.3	7.10
HIPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	2 (2006 to 2010)	B (100 to 250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	2.592	1,175.7	7.07
HIPuuneneSugarMill/Boiler 3/2	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	None	None	None	DRAFT BMACT data (version 8).accdb	8	1.830	829.9	6.72
IDStimsonLumberCoPriestRiver/HFB-1 (EPI)	Hog Fuel	Wood	1 (<=2005)	Unknown	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.138	62.4	4.13
WABoiseKettleFallsLumber/B1	Hog Fuel	Wood	1 (<=2005)	Unknown	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.381	173.0	5.15
ARAnthonyTimberlandBeirne/Boiler #1 (SN-13A)	Hog Fuel	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.205	92.9	4.53
IDStimsonLumberCoPriestRiver/HFB-2 (Wellons)	Hog Fuel	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.192	87.0	4.47
WAInterforPacificPortAngeles/BLR-3012	Hog Fuel	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.171	77.6	4.35
WASimpsonDoorCompany/EU-1	Hog Fuel	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.100	45.3	3.81
WASimpsonDoorCompany/Hog Fuel Boiler	Hog Fuel	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	2.311	1,048.3	6.95
ORStimsonLumberTillamook/Boiler 1	Hog Fuel	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.344	155.8	5.05
WAPortAngelesHardwood/1	Hog Fuel	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.117	53.0	3.97
WASimpsonDoorCompany/EU-1	Hog Fuel	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.074	33.4	3.51
ORStimsonLumberTillamook/Boiler 1	Hog Fuel	Wood	Unknown	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	2	0.413	187.4	5.23
ARPotlatchForestWarren/Wellons Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.224	101.7	4.62
MSGPNewAugusta/AA-015 Power Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.080	36.3	3.59
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.095	43.1	3.76
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	9	0.140	63.3	4.15
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.202	91.6	4.52
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.119	54.1	3.99
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	12	0.269	121.8	4.80
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.078	35.6	3.57
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.270	122.3	4.81
ARGPGurdonPlyLumber/SN-01 No. 1 Wood Residue Fired Boiler	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.252	114.2	4.74
ARGPGurdonPlyLumber/SN-02 No. 2 Wood Residue Fired Boiler	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.266	120.6	4.79
ARWeyerhaeuserDierksMill/SN-32	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.643	291.8	5.68
LABoiseCascadeOakdale/B-1	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.136	515.2	6.24
LAWeyerhaeuserDodson/ES-017 WFB	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.340	154.1	5.04
MSWeyerhaeuser1398/Boiler No. 1	Hog Fuel	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	2.267	1,028.1	6.94
LAWeyerhaeuserDodson/ES-017 WFB	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.210	95.4	4.56
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.321	145.8	4.98
IDPotlatch/PB-1 CE	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.538	243.9	5.50
MSWeyerhaeuserBruce/AA-001 No. 1 Boiler	Hog Fuel	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	1.733	786.2	6.67
WABoiseKettleFallsPlywood/B1	Hog Fuel	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	4.298	1,949.6	7.58
ALWestervelt/Teaford - Unit 003	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	9	0.124	56.1	4.03
IDPotlatch/PB-2 Riley	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.357	161.8	5.09
MSGPBaySprings/AA-001 (Boiler No. 1)	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.428	194.3	5.27
MSGPBaySprings/AA-003 (Boiler No. 2)	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.459	208.3	5.34
MSWeyerhaeuserBruce/AA-001 No. 1 Boiler	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.530	694.0	6.54
GAPCAValdosta/1005	Hog Fuel/Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	2.733	1,239.8	7.12
LAHoodIndustries/EQT001 (wood-fired boiler No. 1)	Hog Fuel/Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.965	437.6	6.08
LAHoodIndustries/EQT001 (wood-fired boiler No. 1)	Hog Fuel/Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.862	844.6	6.74
LAHoodIndustries/EQT002 (wood-fired boiler No. 2)	Hog Fuel/Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.862	844.6	6.74
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	3 (>2010)	A (>250)	Unknown	None	None	None	Source Test Report	3	0.005	2.4	0.89
OKPanPacificProducts/EU 100	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.437	198.1	5.29
WIAshland/B20	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.416	188.8	5.24
GATempleInlandThomson/BW-B001/1	Wood	Wood	1 (<=2005)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.607	275.1	5.62
GATempleInlandThomson/BW-B001/1	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.014	6.2	1.83
OHSauderWoodArchbold/B008	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.425	192.9	5.26
OHSauderWoodArchbold/B009	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.393	178.4	5.18
TXDibollTemple-Inland/PB-44	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.054	24.6	3.20
IDPotlatchForestProductsCorpPostFalls/Sanderdust Fired Boiler	Wood	Wood	1 (<=2005)	Unknown	Dutch Oven/Susp. Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	2.482	1,125.9	7.03
ORColumbiaForestKlamathFalls/BLR-N	Wood	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.065	29.4	3.38
ORColumbiaForestKlamathFalls/BLR-S	Wood	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.456	206.9	5.33
WIAlgoma/B03	Wood	Wood	1 (<=2005)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.162	73.5	4.30
ORColumbiaForestKlamathFalls/BLR-N	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.247	111.9	4.72
ORColumbiaForestKlamathFalls/BLR-S	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	1.537	697.4	6.55
GATempleInlandThomson/BW-B001/2	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	BF	None	None	DRAFT BMACT data (version 8).accdb	3	0.291	132.1	4.88
GATempleInlandRome/WF	Wood	Wood	2 (2006 to 2010)	A (>250)	Fluidized Bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.080	36.5	3.60
ARGBPMorrilton/SN-04	Wood	Wood	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.240	108.9	4.69
SCInternationalPaperEastover/No. 2 Power Boiler	Wood	Wood	1 (<=2005)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.577	261.6	5.57
ARGBPMorrilton/SN-04	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.509	230.8	5.44
GAGPMadisonPly/800 Wood Waste Boiler	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.965	891.5	6.79
GATempleInlandRome/PB4	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.106	48.1	3.87
KYNNewPage-Wickliffe/B09	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.257	116.4	4.76
MEBoralexStratton/Boiler #1/2	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.355	160.9	5.08
MSGPNewAugusta/AA-015 Power Boiler													

Table 5B. Carbon-monoxide Emission Factors (Unit Averages) for Biomass Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Subtype	Standardized Fuel Subtype	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	HAP Controls 1	HAP Controls 2	HAP Controls 3	Reference File Name ^{2,3,4}	Number of Runs	Unit Average ⁵ (lb/MMBtu HHV)	Unit Average ⁵ (g/MMBtu HHV)	Unit Average ⁵ LN(g/MMBtu HHV)
IDChilcoLakeSawmill/HFB1	Wood	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.040	18.1	2.90
IDMoyieSprings Lumber420/HFB1	Wood	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.477	669.8	6.51
ORBlueHeronPaper/G Boiler	Wood	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.114	51.6	3.94
IDChilcoLakeSawmill/HFB1	Wood	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.516	234.0	5.46
LAGPLogansportPly/EQT-0009	Wood	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.274	124.3	4.82
OHAkronThermalEnergy/Unit #2 (B004)	Wood	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.101	45.7	3.82
ARAnthonyForestProducts/SN-16	Wood	Wood	1 (<=2005)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.433	196.2	5.28
ARAnthonyForestProducts/SN-12	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.523	237.2	5.47
GAADMLocation551/630- Wellons	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.287	130.3	4.87
ALWestervelt/Wellons - Unit 001	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	2	0.274	124.3	4.82
ARDelticTimberWaldo/Wood Fired Boiler No. 1 (SN-13)	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.162	73.6	4.30
ARDelticTimberWaldo/Wood Fired Boiler No. 2 (SN-14)	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.217	98.6	4.59
ARWestFraserHuttig/SN-24	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.053	23.9	3.18
IDRileyCreekLumber/HFB1	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.126	57.4	4.05
IDRileyCreekLumber/HFB2	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.026	465.4	6.14
MIWhitePineElectric/IBW Boiler	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.117	52.9	3.97
TXAnthonyForestProd-ATL/EP 10.1 Superior	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.240	108.9	4.69
TXAnthonyForestProd-ATL/EP 11.1 Hurst	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.186	84.5	4.44
TXwestfraser/Boiler-1	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.456	206.6	5.33
ALManningtonWoodFloors/BB01	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	1.066	483.7	6.18
ALWestervelt/Wellons - Unit 001	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.489	221.8	5.40
ARDelticTimberOla/Wood Fired Boiler at Ola Mill (SN-13)	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.505	229.1	5.43
ARWestFraserHuttig/SN-24	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.464	210.6	5.35
GAADMLocation551/B115A- North Hurst	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.179	81.2	4.40
GAADMLocation551/B115B-South Hurst	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.212	95.9	4.56
GARayonierBaxley/PB02	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	9	0.275	124.6	4.82
INConsolidatedGrainandBarge/P17B	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.071	32.2	3.47
LAHuntPollock/EQT0005	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.476	216.1	5.38
MSShuqualakLumber/Boiler 4 (AA-108)	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	1	0.096	43.5	3.77
ORBBSMMedford/B1	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	3.138	1,423.4	7.26
ARWestFraserHuttig/SN-24	Wood	Wood	3 (>2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	9	1.135	514.9	6.24
ORDouglasCounty/HOG FUEL BOILER	Wood	Wood	2 (2006 to 2010)	Unknown	Fuel Cell	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.129	58.7	4.07
ARIdahoTimber/Wood Fired Boiler	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	2.321	1,053.0	6.96
MEBoralexAshland/Boiler #1	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.257	116.5	4.76
MEBoralexFortFairfield/Boiler #1	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	6	0.503	228.2	5.43
MSArmstrongVicksburg/Hurst Boiler #1	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	19.453	8,823.6	9.09
MSArmstrongVicksburg/Hurst Boiler #2	Wood	Wood	2 (2006 to 2010)	Unknown	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	19.771	8,968.1	9.10
TXGPClevelandPlyLumber/GRP-SBOIL	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.309	140.2	4.94
WIFlambeauRiverPaper/B24	Wood	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.301	136.4	4.92
WIFlambeauRiverPaper/B24	Wood	Wood	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.240	109.1	4.69
MESDWarrenSomerset/No1 Power Boiler	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.199	90.4	4.50
MNAndersonCorpBayport/Boiler 11 EU620	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.070	32.0	3.46
MNAndersonCorpBayport/Boiler 12 EU621	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.076	34.4	3.54
MNAndersonCorpBayport/Boiler 11 EU620	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.091	41.4	3.72
MNAndersonCorpBayport/Boiler 12 EU621	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.091	41.3	3.72
WIFlambeauRiverPaper/B24	Wood	Wood	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.257	116.5	4.76
MNDESPHansONyman/EU007	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	2	0.160	72.8	4.29
ORStimsonLumberForestGrove/Boiler 1	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Dutch Oven/Pile Burner	None	None	None	DRAFT BMACT data (version 8).accdb	12	0.297	134.7	4.90
ALGPEngineeredWoodProductsThornsby/EU 001 Wood Fired Boiler	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	9	0.797	361.4	5.89
MSIPVicksburg/Power Boiler-AA-006	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	0.220	99.9	4.60
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	3 (>2010)	A (>250)	Fluidized Bed	DSI	None	None	Source Test Report	4	0.024	11.0	2.40
GA_Graphic Packaging International/B005	Wood	Wood	3 (>2010)	A (>250)	Stoker	None	None	None	Webfire Report	25	0.018	8.2	2.10
AZ_Frito-Lay, Inc./Biomass Boiler	Wood	Wood	3 (>2010)	C (10 to 100)	Unknown	None	None	None	Source Test Report	3	0.087	39.5	3.68
WI_Gundersen Health Systems/B31	Wood	Wood	3 (>2010)	C (10 to 100)	Unknown	None	None	None	Source Test Report	3	0.019	8.7	2.17
VA_MeadWestvaco Corporation Packaging Resources Group/PWR014	Wood	Wood	3 (>2010)	Unknown	Fluidized Bed	None	None	None	Webfire Report	3	0.014	6.1	1.81
WI_Rothschild Biomass Cogeneration Plant/B01	Wood	Wood	3 (>2010)	Unknown	Fluidized Bed	None	None	None	Webfire Report	19	0.001	0.3	-1.13
NC_Avoca Inc./NC	Wood	Wood	3 (>2010)	Unknown	Stoker	None	None	None	Webfire Report	3	0.013	5.9	1.77
VA_Altavista Power Station/Unit 001	Wood	Wood	3 (>2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	Source Test Report	3	0.158	71.8	4.27
VA_Altavista Power Station/Unit 002	Wood	Wood	3 (>2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	Source Test Report	3	0.268	121.7	4.80
ME_Colby College/B101 and B102	Wood	Wood	3 (>2010)	C (10 to 100)	Chiptec biomass gasification boiler	None	None	None	Source Test Report	3	0.108	49.0	3.89

Notes:
¹The boiler size category units are MMBtu/hr.
²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.
³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.
⁴Source test reports were obtained from the permitting agency through a public records request.
⁵Unit averages are based on higher heating value.

Conversion Factor:
453.592 g/lb

Abbreviations:
BF - bio filter
DSI - dry sorben injection
g - grams
HAP - hazardous air pollutant
HHV - higher heating value
lb - pound
LN - natural logarithm
MMBtu - million british thermal units

Source File:
\\wcirvfps1\Projects\VA\Argonne National Laboratory\0438528A-EmissionFactors\Technical\3-Emission Factors\Deliverables-Rev3\[EmissionFactorAnalysis_CO_R3.xlsx]Biomass_PDF_Table

COAL-FIRED BOILERS - VOC

Row Labels	Fuel Type	GREET Boiler Size Category	Count of VOC	Max of VOC	Min of VOC	Average of VOC (g propane/MMBTU)	StdDev of VOC	Average of VOC LN(g propane/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bituminous	B (100 to 250)	3	0.42	0.22	0.32	0.10	-1.18	0.31	N/A	0.32
1 (<=2005)	Sub-bituminous	A (>250)	1	0.36	0.36	0.36	#DIV/0!	-1.04	0.36	N/A	0.36
2 (2006 to 2010)	Bituminous	A (>250)	6	3.64	0.09	1.21	1.34	-0.54	0.58	Normal	1.21
2 (2006 to 2010)	Bituminous	B (100 to 250)	13	2.80	0.05	0.79	0.92	-0.95	0.39	Lognormal	0.39
2 (2006 to 2010)	Bituminous	C (10 to 100)	2	1.05	0.26	0.65	0.56	-0.65	0.52	N/A	0.65
2 (2006 to 2010)	Sub-bituminous	A (>250)	2	1.44	0.11	0.78	0.94	-0.91	0.40	N/A	0.78
2 (2006 to 2010)	Sub-bituminous	B (100 to 250)	2	3.46	0.31	1.88	2.23	0.03	1.03	N/A	1.88
Grand Total			29	3.64	0.05	0.88	1.02	-0.802195468			

COAL-FIRED BOILERS - VOC

GREET Boiler Size Ca (All)

Row Labels	Fuel Type	Count of VOC	Max of VOC	Min of VOC	Average of VOC (g propane/MMBTU)	StdDev of VOC	Average of VOC LN(g propane/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bituminous	3	0.42	0.22	0.32	0.10	-1.18	0.31	N/A	0.32
1 (<=2005)	Sub-bituminous	1	0.36	0.36	0.36	#DIV/0!	-1.04	0.36	N/A	0.36
2 (2006 to 2010)	Bituminous	21	3.64	0.05	0.90	1.01	-0.81	0.45	Lognormal	0.45
2 (2006 to 2010)	Sub-bituminous	4	3.46	0.11	1.33	1.54	-0.44	0.64	N/A	1.33
3 (>2010)	Bituminous	1	0.05	0.05	0.05	#DIV/0!	-2.93	0.05	N/A	0.05
Grand Total		30	3.64	0.05	0.85	1.02	-0.87			

COAL-FIRED BOILERS - VOC

Fuel Type (Multiple Items) Bituminous, subbituminous
GREET Boiler Size Ca (All)

Row Labels	Count of VOC	Max of VOC	Min of VOC	Average of VOC (g propane/MMBTU)	StdDev of VOC	Average of VOC LN(g propane/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	4	0.42	0.22	0.33	0.08	-1.15	0.32	N/A	0.33
2 (2006 to 2010)	25	3.64	0.05	0.97	1.08	-0.75	0.47	Lognormal	0.47
3 (>2010)	1	0.05	0.05	0.05	#DIV/0!	-2.93	0.05	N/A	0.05
Grand Total		30	3.64	0.05	0.85	1.02	-0.87		

COAL-FIRED BOILERS - VOC

Fuel Type (Multiple Items) Bituminous, subbituminous

Row Labels	GREET Boiler Size Ca	Count of VOC	Max of VOC	Min of VOC	Average of VOC (g propane/MMBTU)	StdDev of VOC	Average of VOC LN(g propane/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	A (>250)	1	0.36	0.36	0.36	#DIV/0!	-1.04	0.36	N/A	0.36
1 (<=2005)	B (100 to 250)	3	0.42	0.22	0.32	0.10	-1.18	0.31	N/A	0.32
2 (2006 to 2010)	A (>250)	8	3.64	0.09	1.10	1.21	-0.63	0.53	Normal	1.10
2 (2006 to 2010)	B (100 to 250)	15	3.46	0.05	0.94	1.11	-0.82	0.44	Lognormal	0.44
2 (2006 to 2010)	C (10 to 100)	2	1.05	0.26	0.65	0.56	-0.65	0.52	N/A	0.65
Grand Total		29	3.64	0.05	0.88	1.02	-0.80			

Table 6A. Volatile Organic Compound Emission Factors (Unit Averages) for Coal Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	HAP Controls 1	HAP Controls 2	HAP Controls 3	Reference File Name ^{2,3}	Number of Runs		
									Methane	THC	TNMOC
IARoquetteAmerica/Circulating Fluidized Bed Boiler (121)	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
ILBungeDanville/CFB Boiler	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
INPurdueUniverisity/Boiler 5	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
NCUNCCogen/ES-001	Bituminous	2 (2006 to 2010)	A (>250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
TNEastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	2	0
VASmurfitStoneWestpt/PB08/2	Bituminous	2 (2006 to 2010)	A (>250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
ILPolyOne/B1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
VAPhilipMorrisPark500/B2	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	0	2	0
VAPhilipMorrisPark500/B3	Bituminous	1 (<=2005)	B (100 to 250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	0	1	0
IAUofNorthernIowa/Boiler #3	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
NCMillerCoors/ES-2 Coal/No. 2 & 6 Fuel Oil Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
VAINVISTAWaynesboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
VAPhilipMorrisPark500/B3	Bituminous	2 (2006 to 2010)	B (100 to 250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
OHAppletonIdeas/Boiler 4 (B003)	Bituminous	1 (<=2005)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
INNotreDame/B-4	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
TNCargillMemphis/Stoker Boiler 8001	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
VACogentrixHopewell/1A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
VACogentrixPortsmouth/2A	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
VACogentrixHopewell/2A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	1	0
VACogentrixHopewell/2A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
VACogentrixPortsmouth/1A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
VACogentrixPortsmouth/1A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
ILAbbottAbbottPark/Unit 5AP	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
VAUniversityofVirginia/7103-1-01R	Bituminous	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	2	0
IAADMCornProcessingCR/EU-501B/2	Bituminous/Sub-bituminous	Unknown	A (>250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	0	2	0
AR_AEP John W. Turk Jr. Power Plant/ARR000017764	Bituminous	3 (>2010)	Unknown	Stoker/SlopedGrate/Other	ACI	None	None	Webfire Report	0	0	3
OKGPMuskogeeMill/B-4	Sub-bituminous	1 (<=2005)	A (>250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
AZCatalystPaperSnowflake/Power Boiler #2 Coal	Sub-bituminous	2 (2006 to 2010)	A (>250)	Pulverized coal	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
WINewPageBiron/B24	Sub-bituminous	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0
IAArchersDanielsMidlandDesMoines/Asea Boiler #1	Sub-bituminous	2 (2006 to 2010)	B (100 to 250)	Fluidized bed	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0
KYISPCchemicals/OAA (Riley)	Sub-bituminous	2 (2006 to 2010)	B (100 to 250)	Stoker/SlopedGrate/Other	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0

Table 6A. Volatile Organic Compound Emission Factors (Unit Averages) for Coal Fired Boilers
Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Type	Test Year Category	GREET Boiler Size Category ¹	Unit Averages from Reference ⁴			Calculated Unit Averages ⁴				VOC/THC Ratio ⁶	VOC ^{4,7} (lb propane/ MMBtu HHV)	VOC ^{4,7} (g propane/ MMBtu HHV)	VOC ^{4,7} LN(g propane/ MMBtu HHV)
				Methane (lb/MMBtu HHV)	THC	TNMOC	Methane	THC	VOC ⁵	VOC ⁵ (lb propane/ MMBtu HHV)				
					(lb propane/MMBtu HHV)	(lb-mole C/MMBtu HHV)								
IARoquetteAmerica/Circulating Fluidized Bed Boiler (121)	Bituminous	2 (2006 to 2010)	A (>250)	2.85E-04	8.28E-03	0.00E+00	1.78E-05	5.64E-04	5.46E-04	8.02E-03	0.968	8.02E-03	3.64E+00	1.29
ILBungeDanville/CFB Boiler	Bituminous	2 (2006 to 2010)	A (>250)	3.06E-04	4.20E-03	0.00E+00	1.91E-05	2.86E-04	2.67E-04	3.92E-03	0.933	3.92E-03	1.78E+00	0.58
INPurdueUniversity/Boiler 5	Bituminous	2 (2006 to 2010)	A (>250)	1.02E-04	3.02E-04	0.00E+00	6.36E-06	2.06E-05	1.42E-05	2.09E-04	0.691	2.09E-04	9.48E-02	-2.36
NCUNCCogen/ES-001	Bituminous	2 (2006 to 2010)	A (>250)	3.78E-04	2.27E-03	0.00E+00	2.36E-05	1.55E-04	1.31E-04	1.93E-03	0.848	1.93E-03	8.74E-01	-0.13
TNEastman_NO_CBIDATA/Boiler 30/2	Bituminous	2 (2006 to 2010)	A (>250)	2.81E-04	4.62E-04	0.00E+00	1.75E-05	3.15E-05	1.39E-05	2.05E-04	0.442	2.05E-04	9.28E-02	-2.38
VASmurfitStoneWestpt/PB08/2	Bituminous	2 (2006 to 2010)	A (>250)	7.95E-04	2.47E-03	0.00E+00	4.96E-05	1.68E-04	1.18E-04	1.74E-03	0.705	1.74E-03	7.88E-01	-0.24
ILPolyOne/B1	Bituminous	2 (2006 to 2010)	B (100 to 250)	2.14E-04	8.61E-04	0.00E+00	1.33E-05	5.86E-05	4.52E-05	6.64E-04	0.772	6.64E-04	3.01E-01	-1.20
VAPhilipMorrisPark500/B2	Bituminous	1 (<=2005)	B (100 to 250)	0.00E+00	1.30E-03	0.00E+00	Unknown	8.82E-05	Unknown	Unknown	Unknown	9.34E-04	4.23E-01	-0.86
VAPhilipMorrisPark500/B3	Bituminous	1 (<=2005)	B (100 to 250)	0.00E+00	9.33E-04	0.00E+00	Unknown	6.35E-05	Unknown	Unknown	Unknown	6.71E-04	3.05E-01	-1.19
IAUofNorthernIowa/Boiler #3	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	3.64E-04	0.00E+00	Unknown	2.48E-05	Unknown	Unknown	Unknown	2.62E-04	1.19E-01	-2.13
NCMillerCoors/ES-2 Coal/No. 2 & 6 Fuel Oil Boiler	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	2.82E-03	0.00E+00	Unknown	1.92E-04	Unknown	Unknown	Unknown	2.03E-03	9.21E-01	-0.08
VAINVISTAWaynesboro/2-205 (B#2) Boiler #2	Bituminous	2 (2006 to 2010)	B (100 to 250)	1.71E-03	5.95E-03	0.00E+00	1.07E-04	4.05E-04	2.98E-04	4.38E-03	0.736	4.38E-03	1.99E+00	0.69
VAPhilipMorrisPark500/B3	Bituminous	2 (2006 to 2010)	B (100 to 250)	3.06E-05	6.21E-03	0.00E+00	1.91E-06	4.23E-04	4.21E-04	6.18E-03	0.995	6.18E-03	2.80E+00	1.03
OHAppletonIdeas/Boiler 4 (B003)	Bituminous	1 (<=2005)	B (100 to 250)	0.00E+00	6.88E-04	0.00E+00	Unknown	4.68E-05	Unknown	Unknown	Unknown	4.92E-04	2.23E-01	-1.50
INNotreDame/B-4	Bituminous	2 (2006 to 2010)	B (100 to 250)	1.82E-03	1.89E-03	0.00E+00	1.14E-04	1.28E-04	1.45E-05	2.14E-04	0.113	2.14E-04	9.69E-02	-2.33
TNCargillMemphis/Stoker Boiler 8001	Bituminous	2 (2006 to 2010)	B (100 to 250)	6.81E-04	3.01E-03	0.00E+00	4.24E-05	2.05E-04	1.63E-04	2.39E-03	0.793	2.39E-03	1.08E+00	0.08
VACogentrixHopewell/1A	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	1.00E-03	0.00E+00	Unknown	6.81E-05	Unknown	Unknown	Unknown	7.16E-04	3.25E-01	-1.12
VACogentrixPortsmouth/2A	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	5.29E-04	0.00E+00	Unknown	3.60E-05	Unknown	Unknown	Unknown	3.78E-04	1.71E-01	-1.76
VACogentrixHopewell/2A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	1.52E-04	0.00E+00	Unknown	1.04E-05	Unknown	Unknown	Unknown	1.09E-04	4.94E-02	-3.01
VACogentrixHopewell/2A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	9.50E-04	0.00E+00	Unknown	6.46E-05	Unknown	Unknown	Unknown	6.79E-04	3.08E-01	-1.18
VACogentrixPortsmouth/1A/1	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	6.22E-03	0.00E+00	Unknown	4.23E-04	Unknown	Unknown	Unknown	4.45E-03	2.02E+00	0.70
VACogentrixPortsmouth/1A/2	Bituminous	2 (2006 to 2010)	B (100 to 250)	0.00E+00	3.99E-04	0.00E+00	Unknown	2.71E-05	Unknown	Unknown	Unknown	2.85E-04	1.29E-01	-2.05
ILAbbottAbbottPark/Unit 5AP	Bituminous	2 (2006 to 2010)	C (10 to 100)	1.23E-04	6.83E-04	0.00E+00	7.67E-06	4.65E-05	3.88E-05	5.70E-04	0.835	5.70E-04	2.59E-01	-1.35
VAUniversityofVirginia/7103-1-01R	Bituminous	2 (2006 to 2010)	C (10 to 100)	2.39E-04	2.53E-03	0.00E+00	1.49E-05	1.72E-04	1.57E-04	2.31E-03	0.913	2.31E-03	1.05E+00	0.05
IAADMCornProcessingCR/EU-501B/2	Bituminous/Sub-bituminous	Unknown	A (>250)	0.00E+00	2.44E-03	0.00E+00	Unknown	1.66E-04	Unknown	Unknown	Unknown	2.00E-03	9.07E-01	-0.10
AR_AEP John W. Turk Jr. Power Plant/ARR000017764	Bituminous	3 (>2010)	Unknown	0.00E+00	0.00E+00	1.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000	1.18E-04	5.34E-02	-2.93
OKGPMuskogeeMill/B-4	Sub-bituminous	1 (<=2005)	A (>250)	0.00E+00	1.09E-03	0.00E+00	Unknown	7.40E-05	Unknown	Unknown	Unknown	7.83E-04	3.55E-01	-1.04
AZCatalystPaperSnowflake/Power Boiler #2 Coal	Sub-bituminous	2 (2006 to 2010)	A (>250)	0.00E+00	4.42E-03	0.00E+00	Unknown	3.01E-04	Unknown	Unknown	Unknown	3.18E-03	1.44E+00	0.37
WINewPageBiron/B24	Sub-bituminous	2 (2006 to 2010)	A (>250)	0.00E+00	3.43E-04	0.00E+00	Unknown	2.33E-05	Unknown	Unknown	Unknown	2.45E-04	1.11E-01	-2.20
IAArchersDanielsMidlandDesMoines/Asea Boiler #1	Sub-bituminous	2 (2006 to 2010)	B (100 to 250)	3.07E-04	9.57E-04	0.00E+00	1.91E-05	6.51E-05	4.59E-05	6.75E-04	0.706	6.75E-04	3.06E-01	-1.18
KYISPCchemicals/OAA (Riley)	Sub-bituminous	2 (2006 to 2010)	B (100 to 250)	7.34E-04	8.30E-03	0.00E+00	4.58E-05	5.64E-04	5.19E-04	7.62E-03	0.919	7.62E-03	3.46E+00	1.24

Notes:

¹The boiler size category units are MMBtu/hr.

²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.

³Webfire Reports were obtained from <http://cfpub.epa.gov/webfire/index.cfm?action=fire.searchERTSubmission>. The report can be located using the facility name and state seen under Unit ID.

⁴Unit averages are based on higher heating value.

⁵VOC is assumed to be non-methane hydrocarbons. For units which do not have VOC or TNMOC measurements, VOC is estimated at the difference between THC and methane.

⁶This data is used to estimate an average VOC/THC ratio of each boiler furance type: Fluidized Bed, Pulverized Coal, and Stoker/SlopedGrate/Other.

⁷VOC is assumed to be non-methane hydrocarbons. For units which do not have VOC or TNMOC measurements, VOC is estimated at the difference between THC and methane. If methane measurements were not made, then the VOC is estimated using the VOC/THC ratio of the unit's boiler furnace type.

Conversion Factor:

453.592 g/lb

Constants:

Molecular Weight of Methane

Molecular Weight of Propane

16.04 lb/lb-mol

44.1 lb/lb-mol

VOC/THC Ratios:

Fluidized Bed 0.82

Pulverized Coal 0.72

Stoker/SlopedGrate/Other 0.71

Abbreviations:

ACI - activated carbon injection

C - carbon

g - grams

HAP - hazardous air pollutant

HHV - higher heating value

lb - pound

LN - natural logarithm

MMBtu - million british thermal units

THC - total hydrocarbon

TNMOC - total non-methane organic carbon

VOC - volatile organic carbon

Source File:

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BIOMASS-FIRED BOILERS - VOC

Row Labels	Standardized Fuel	GREET Boiler Size Category	Count of VOC	Max of VOC	Min of VOC	Average of VOC	StdDev of VOC	Average of VOC LN(g propane/ MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bagasse	A (>250)	14	159.93	5.14	80.16	50.73	4.07	58.41	Normal	80.16
1 (<=2005)	Bagasse	B (100 to 250]	2	299.46	121.82	210.64	125.61	5.25	191.00	N/A	210.64
1 (<=2005)	Wood	C (10 to 100)	1	0.20	0.20	0.20	#DIV/0!	-1.62	0.20	N/A	0.20
2 (2006 to 2010)	Bagasse	A (>250)	12	237.52	0.32	85.20	74.14	3.59	36.26	Normal	85.20
2 (2006 to 2010)	Bagasse	B (100 to 250]	1	215.20	215.20	215.20	#DIV/0!	5.37	215.20	N/A	215.20
2 (2006 to 2010)	Wood	A (>250)	5	7.88	0.06	2.41	3.17	-0.09	0.92	Normal	2.41
2 (2006 to 2010)	Wood	B (100 to 250]	4	0.96	0.19	0.52	0.36	-0.86	0.42	N/A	0.52
2 (2006 to 2010)	Wood	C (10 to 100)	6	99.76	0.27	26.17	40.23	1.73	5.66	Lognormal	5.66
3 (>2010)	Cellulosic Eth	A (>250)	1	4.07	4.07	4.07	#DIV/0!	1.40	4.07	N/A	4.07
3 (>2010)	Wood	A (>250)	3	1.29	0.10	0.56	0.64	-1.10	0.33	N/A	0.56
3 (>2010)	Wood	C (10 to 100)	1	0.56	0.56	0.56	#DIV/0!	-0.59	0.56	N/A	0.56
Grand Total			50	299.46	0.06	59.17	72.71	2.37			

BIOMASS-FIRED BOILERS - VOC

Row Labels	GREET Boiler Si	Count of VOC	Max of VOC	Min of VOC	Average of VOC	StdDev of VOC	Average of VOC LN(g propane/ MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	A (>250)	14	159.93	5.14	80.16	50.73	4.07	58.41	Normal	80.2
1 (<=2005)	B (100 to 250)	2	299.46	121.82	210.64	125.61	5.25	191.00	N/A	210.6
1 (<=2005)	C (10 to 100)	1	0.20	0.20	0.20	#DIV/0!	-1.62	0.20	N/A	0.2
2 (2006 to 2010)	A (>250)	17	237.52	0.06	60.85	72.76	2.51	12.30	Lognormal	12.3
2 (2006 to 2010)	B (100 to 250)	5	215.20	0.19	43.46	96.01	0.39	1.47	Lognormal	1.5
2 (2006 to 2010)	C (10 to 100)	6	99.76	0.27	26.17	40.23	1.73	5.66	Lognormal	5.7
3 (>2010)	A (>250)	4	4.07	0.10	1.43	1.83	-0.47	0.62	N/A	1.4
3 (>2010)	C (10 to 100)	1	0.56	0.56	0.56	#DIV/0!	-0.59	0.56	N/A	0.6
Grand Total		50	299.46	0.06	59.17	72.71	2.37			

BIOMASS-FIRED BOILERS - VOC

Row Labels	Standardized Fi	Count of VOC	Max of VOC	Min of VOC	Average of VOC	StdDev of VOC	Average of VOC LN(g propane/ MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	Bagasse	16	299.46	5.14	96.47	72.59	4.22	67.73	Normal	96.47
1 (<=2005)	Wood	1	0.20	0.20	0.20	#DIV/0!	-1.62	0.20	N/A	0.20
2 (2006 to 2010)	Bagasse	13	237.52	0.32	95.20	79.61	3.73	41.59	Normal	95.20
2 (2006 to 2010)	Wood	15	99.76	0.06	11.41	27.15	0.44	1.55	Lognormal	1.55
3 (>2010)	Wood	4	1.29	0.10	0.56	0.52	-0.97	0.38	N/A	0.56
Grand Total		49	299.46	0.06	60.30	73.02	2.39			

BIOMASS-FIRED BOILERS - VOC

Standardized Fuel (All)

Row Labels	Count of VOC	Max of VOC	Min of VOC	Average of VOC	StdDev of VOC	Average of VOC LN(g propane/MMBTU)	Geometric Mean (g/MMBTU)	Type of Distribution	Emission Factor (g/MMBTU)
1 (<=2005)	17	299.46	0.20	90.80	74.06	3.87	48.06	Normal	90.80
2 (2006 to 2010)	28	237.52	0.06	50.31	70.78	1.96	7.13	Lognormal	7.13
3 (>2010)	5	4.07	0.10	1.26	1.63	-0.50	0.61	Normal	1.26
Grand Total	50	299.46	0.06	59.17	72.71	2.37			

Table 6B. Volatile Organic Compound Emission Factors (Unit Averages) for Biomass Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Subtype	Standardized Fuel	Test Year Category	GREET Boiler Size Category ¹	Boiler Furnace Type	Standardized Boiler Furnace Type	HAP Controls 1	HAP Controls 2	HAP Controls 3	Reference File Name ^{2,3}	Number of Runs			
											Methane	THC	TNMOC	VOC
FLOsceolaFarms/Boiler No. 2	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	19	19	0	0
FLOsceolaFarms/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	23	20	0	0
FLOsceolaFarms/Boiler No. 5	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	24	21	0	0
FLOsceolaFarms/Boiler No. 6	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	6	5	0	0
FLSugarCaneGrowersCoop/Boiler No. 1	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	24	22	0	0
FLSugarCaneGrowersCoop/Boiler No. 2	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	29	29	0	0
FLSugarCaneGrowersCoop/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	30	23	0	0
FLSugarCaneGrowersCoop/Boiler No. 5	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	27	17	0	0
FLSugarCaneGrowersCoop/Boiler No. 8	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	10	0	0
FLUSSugarCorp/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	22	19	0	0
FLUSSugarCorp/Boiler No. 7	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	19	20	0	0
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
HIPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	0	8	0	0
FLOsceolaFarms/Boiler No. 2	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	14	0	0
FLOsceolaFarms/Boiler No. 4	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	12	11	0	0
FLOsceolaFarms/Boiler No. 5	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	6	10	0	0
FLOsceolaFarms/Boiler No. 6	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
FLSugarCaneGrowersCoop/Boiler No. 1	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	9	13	0	0
FLSugarCaneGrowersCoop/Boiler No. 2	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	9	10	0	0
FLSugarCaneGrowersCoop/Boiler No. 5	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	12	7	0	0
FLSugarCaneGrowersCoop/Boiler No. 8	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	15	7	0	0
FLUSSugarCorp/Boiler No. 4	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	13	15	0	0
FLUSSugarCorp/Boiler No. 7	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	3	14	0	0
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	12	13	0	0
TXRGVSG/Boiler No. 6	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0	0
FLSugarCaneGrowersCoop/Boiler No. 3	Bagasse	Bagasse	1 (<=2005)	B (100 to 250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	28	26	0	0
HIPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	1 (<=2005)	B (100 to 250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	0	9	0	0
FLSugarCaneGrowersCoop/Boiler No. 3	Bagasse	Bagasse	2 (2006 to 2010)	B (100 to 250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	13	13	0	0
HIPuuneneSugarMill/Boiler 3/2	Bagasse	Bagasse	1 (<=2005)	A (>250)	Suspension/Grate	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	0	7	0	0
ARPotlatchForestWarren/Wellons Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	Dutch Oven/Pile Burner	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	9	9	0	0
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Dutch Oven/Pile Burner	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	Fuel Cell	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Dutch Oven/Pile Burner	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
IDPotlatch/PB-1 CE	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	3 (>2010)	A (>250)	Unknown	Unknown	None	None	None	Source Test Report	0	0	0	3
OHSauderWoodArchbold/B008	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	0	0	3	0
OHSauderWoodArchbold/B009	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Suspension Burner	Hybrid suspension grate	None	None	None	DRAFT BMACT data (version 8).accdb	0	0	3	0
GATempleInlandRome/WF	Wood	Wood	2 (2006 to 2010)	A (>250)	FB	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
ARGBPMorrilton/SN-04	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0	0
MEBoralexStratton/Boiler #1/2	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	2	2	0	0
ARAnthonyForestProducts/SN-12	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Fuel Cell	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	3	3	0	0
ARWestFraserHuttig/SN-24	Wood	Wood	1 (<=2005)	C (10 to 100)	Stoker/SlopedGrate/Other	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	0	0	3	0
ARWestFraserHuttig/SN-24	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	Stoker/SlopedGrate/Other	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0	0
MSIPVicksburg/Power Boiler-AA-006	Wood	Wood	2 (2006 to 2010)	A (>250)	Stoker/SlopedGrate/Other	Other furnace type	None	None	None	DRAFT BMACT data (version 8).accdb	0	3	0	0
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	3 (>2010)	A (>250)	Bubbling Fluidized Bed	Other furnace type	DSI	None	None	Source Test Report	0	4	0	0
VA_Altavista Power Station/Unit 001	Wood	Wood	3 (>2010)	A (>250)	Spreader Stoker	Other furnace type	None	None	None	Source Test Report	0	3	0	0
VA_Altavista Power Station/Unit 002	Wood	Wood	3 (>2010)	A (>250)	Spreader Stoker	Other furnace type	None	None	None	Source Test Report	0	3	0	0
ME_Colby College/B1O1 and B1O2	Wood	Wood	3 (>2010)	C (10 to 100)	Chiptec biomass gasification boiler	Other furnace type	None	None	None	Source Test Report	0	3	0	0

Table 6B. Volatile Organic Compound Emission Factors (Unit Averages) for Biomass Fired Boilers

Argonne National Laboratory
Lemont, Illinois

Unit ID	Fuel Subtype	Standardized Fuel	Test Year Category	GREET Boiler Size Category ¹	Unit Averages from Reference ⁴				Calculated Unit Averages ⁴				VOC/THC Ratio ⁶	VOC ^{4,7} (lb propane/MMBtu HHV)	VOC ^{4,7} (g propane/MMBtu HHV)	VOC ^{4,7} LN(g propane/MMBtu HHV)
					Methane (lb/MMBtu HHV)	THC	TNMOC	VOC	Methane	THC	VOC ⁵	VOC ⁵ (lb propane/MMBtu HHV)				
						(lb propane/MMBtu HHV)				(lb-mole C/MMBtu HHV)						
FLOsceolaFarms/Boiler No. 2	Bagasse	Bagasse	1 (<=2005)	A (>250)	3.64E-02	2.98E-01	0.00E+00	0.00E+00	2.27E-03	2.03E-02	1.80E-02	2.65E-01	0.888	2.65E-01	1.20E+02	4.79
FLOsceolaFarms/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	3.78E-02	3.42E-01	0.00E+00	0.00E+00	2.35E-03	2.33E-02	2.09E-02	3.08E-01	0.899	3.08E-01	1.39E+02	4.94
FLOsceolaFarms/Boiler No. 5	Bagasse	Bagasse	1 (<=2005)	A (>250)	5.74E-02	2.39E-01	0.00E+00	0.00E+00	3.58E-03	1.63E-02	1.27E-02	1.86E-01	0.780	1.86E-01	8.46E+01	4.44
FLOsceolaFarms/Boiler No. 6	Bagasse	Bagasse	1 (<=2005)	A (>250)	3.82E-01	5.97E-01	0.00E+00	0.00E+00	2.38E-02	4.06E-02	1.68E-02	2.47E-01	0.414	2.47E-01	1.12E+02	4.72
FLSugarCaneGrowersCoop/Boiler No. 1	Bagasse	Bagasse	1 (<=2005)	A (>250)	9.46E-02	2.17E-01	0.00E+00	0.00E+00	5.90E-03	1.48E-02	8.88E-03	1.31E-01	0.601	1.31E-01	5.92E+01	4.08
FLSugarCaneGrowersCoop/Boiler No. 2	Bagasse	Bagasse	1 (<=2005)	A (>250)	2.17E-01	5.26E-01	0.00E+00	0.00E+00	1.36E-02	3.58E-02	2.23E-02	3.27E-01	0.621	3.27E-01	1.48E+02	5.00
FLSugarCaneGrowersCoop/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	1.04E-01	2.40E-01	0.00E+00	0.00E+00	6.50E-03	1.63E-02	9.79E-03	1.44E-01	0.601	1.44E-01	6.53E+01	4.18
FLSugarCaneGrowersCoop/Boiler No. 5	Bagasse	Bagasse	1 (<=2005)	A (>250)	7.70E-02	2.80E-01	0.00E+00	0.00E+00	4.80E-03	1.91E-02	1.43E-02	2.10E-01	0.748	2.10E-01	9.51E+01	4.56
FLSugarCaneGrowersCoop/Boiler No. 8	Bagasse	Bagasse	1 (<=2005)	A (>250)	8.62E-02	1.75E-01	0.00E+00	0.00E+00	5.38E-03	1.19E-02	6.52E-03	9.59E-02	0.548	9.59E-02	4.35E+01	3.77
FLUSSugarCorp/Boiler No. 4	Bagasse	Bagasse	1 (<=2005)	A (>250)	1.40E-01	4.80E-01	0.00E+00	0.00E+00	8.70E-03	3.27E-02	2.40E-02	3.53E-01	0.734	3.53E-01	1.60E+02	5.07
FLUSSugarCorp/Boiler No. 7	Bagasse	Bagasse	1 (<=2005)	A (>250)	2.43E-03	3.94E-02	0.00E+00	0.00E+00	1.51E-04	2.68E-03	2.53E-03	3.72E-02	0.944	3.72E-02	1.69E+01	2.83
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	1 (<=2005)	A (>250)	1.88E-05	1.14E-02	0.00E+00	0.00E+00	1.17E-06	7.72E-04	7.71E-04	1.13E-02	0.998	1.13E-02	5.14E+00	1.64
HIPuuneneSugarMill/Boiler 3/1	Bagasse	Bagasse	1 (<=2005)	A (>250)	0.00E+00	5.51E-02	0.00E+00	0.00E+00	Unknown	3.75E-03	Unknown	Unknown	Unknown	4.27E-02	1.94E+01	2.96
FLOsceolaFarms/Boiler No. 2	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	6.81E-02	3.19E-01	0.00E+00	0.00E+00	4.25E-03	2.17E-02	1.75E-02	2.57E-01	0.804	2.57E-01	1.16E+02	4.76
FLOsceolaFarms/Boiler No. 4	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	1.04E-02	5.33E-01	0.00E+00	0.00E+00	6.50E-04	3.63E-02	3.56E-02	5.24E-01	0.982	5.24E-01	2.38E+02	5.47
FLOsceolaFarms/Boiler No. 5	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	1.32E-03	3.60E-01	0.00E+00	0.00E+00	8.24E-05	2.45E-02	2.44E-02	3.59E-01	0.997	3.59E-01	1.63E+02	5.09
FLOsceolaFarms/Boiler No. 6	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	1.07E-01	2.09E-01	0.00E+00	0.00E+00	6.68E-03	1.42E-02	7.53E-03	1.11E-01	0.530	1.11E-01	5.02E+01	3.92
FLSugarCaneGrowersCoop/Boiler No. 1	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	1.60E-02	1.40E-01	0.00E+00	0.00E+00	9.96E-04	9.55E-03	8.56E-03	1.26E-01	0.896	1.26E-01	5.71E+01	4.04
FLSugarCaneGrowersCoop/Boiler No. 2	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	4.60E-02	2.32E-01	0.00E+00	0.00E+00	2.87E-03	1.58E-02	1.29E-02	1.90E-01	0.818	1.90E-01	8.60E+01	4.45
FLSugarCaneGrowersCoop/Boiler No. 5	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	7.44E-04	3.72E-01	0.00E+00	0.00E+00	4.64E-05	2.53E-02	2.52E-02	3.71E-01	0.998	3.71E-01	1.68E+02	5.13
FLSugarCaneGrowersCoop/Boiler No. 8	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	1.00E-02	2.00E-01	0.00E+00	0.00E+00	6.26E-04	1.36E-02	1.30E-02	1.91E-01	0.954	1.91E-01	8.67E+01	4.46
FLUSSugarCorp/Boiler No. 4	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	6.44E-02	1.57E-01	0.00E+00	0.00E+00	4.01E-03	1.07E-02	6.66E-03	9.79E-02	0.624	9.79E-02	4.44E+01	3.79
FLUSSugarCorp/Boiler No. 7	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	7.61E-06	4.79E-03	0.00E+00	0.00E+00	4.75E-07	3.26E-04	3.26E-04	4.79E-03	0.999	4.79E-03	2.17E+00	0.78
FLUSSugarCorp/Boiler No. 8	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	2.90E-03	2.58E-02	0.00E+00	0.00E+00	1.81E-04	1.76E-03	1.58E-03	2.32E-02	0.897	2.32E-02	1.05E+01	2.35
TXRGVSG/Boiler No. 6	Bagasse	Bagasse	2 (2006 to 2010)	A (>250)	0.00E+00	8.96E-04	0.00E+00	0.00E+00	Unknown	6.09E-05	Unknown	Unknown	Unknown	6.95E-04	3.15E-01	-1.15
FLSugarCaneGrowersCoop/Boiler No. 3	Bagasse	Bagasse	1 (<=2005)	B (100 to 250)	4.45E-01	1.07E+00	0.00E+00	0.00E+00	2.77E-02	7.26E-02	4.49E-02	6.60E-01	0.618	6.60E-01	2.99E+02	5.70
HIPuuneneSugarMill/Boiler 1	Bagasse	Bagasse	1 (<=2005)	B (100 to 250)	0.00E+00	3.46E-01	0.00E+00	0.00E+00	Unknown	2.36E-02	Unknown	Unknown	Unknown	2.69E-01	1.22E+02	4.80
FLSugarCaneGrowersCoop/Boiler No. 3	Bagasse	Bagasse	2 (2006 to 2010)	B (100 to 250)	5.24E-01	9.55E-01	0.00E+00	0.00E+00	3.27E-02	6.50E-02	3.23E-02	4.74E-01	0.497	4.74E-01	2.15E+02	5.37
HIPuuneneSugarMill/Boiler 3/2	Bagasse	Bagasse	1 (<=2005)	A (>250)	0.00E+00	1.51E-01	0.00E+00	0.00E+00	Unknown	1.03E-02	Unknown	Unknown	Unknown	1.17E-01	5.30E+01	3.97
ARPotlatchForestWarren/Wellons Boiler	Hog Fuel	Wood	2 (2006 to 2010)	A (>250)	4.26E-03	2.13E-02	0.00E+00	0.00E+00	2.65E-04	1.45E-03	1.18E-03	1.74E-02	0.817	1.74E-02	7.88E+00	2.06
WAGraysHarborPaper/No. 6 Boiler (EU2)	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	1.64E-03	2.09E-03	0.00E+00	0.00E+00	1.02E-04	1.42E-04	3.95E-05	5.81E-04	0.278	5.81E-04	2.64E-01	-1.33
WAWeyerhaeuser_Raymond/Hog Fuel Boiler EU1	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	1.56E-03	2.92E-03	0.00E+00	0.00E+00	9.71E-05	1.99E-04	1.02E-04	1.49E-03	0.511	1.49E-03	6.78E-01	-0.39
ARWeyerhaeuserDierksMill/SN-45	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	3.38E-03	5.22E-03	0.00E+00	0.00E+00	2.11E-04	3.55E-04	1.44E-04	2.12E-03	0.406	2.12E-03	9.61E-01	-0.04
MSWeyerhaeuserBruce/AA-002 No. 2 Boiler	Hog Fuel	Wood	2 (2006 to 2010)	B (100 to 250)	9.05E-04	1.24E-03	0.00E+00	0.00E+00	5.64E-05	8.46E-05	2.82E-05	4.15E-04	0.333	4.15E-04	1.88E-01	-1.67
ORRosboroSpringfield/DV 01.1	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	1.49E-03	5.84E-03	0.00E+00	0.00E+00	9.28E-05	3.97E-04	3.05E-04	4.48E-03	0.767	4.48E-03	2.03E+00	0.71
IDPotlatch/PB-1 CE	Hog Fuel	Wood	2 (2006 to 2010)	C (10 to 100)	1.04E-02	2.21E-02	0.00E+00	0.00E+00	6.51E-04	1.50E-03	8.53E-04	1.25E-02	0.567	1.25E-02	5.69E+00	1.74
IA_Poet DSM Advanced Biofuels Project Liberty/EU069	N/A	Cellulosic Ethanol	3 (>2010)	A (>250)	0.00E+00	0.00E+00	0.00E+00	8.97E-03	Unknown	Unknown	Unknown	Unknown	Unknown	8.97E-03	4.07E+00	1.40
OHSauderWoodArchbold/B008	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	0.00E+00	0.00E+00	1.04E-01	0.00E+00	Unknown	Unknown	Unknown	Unknown	Unknown	1.04E-01	4.70E+01	3.85
OHSauderWoodArchbold/B009	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	0.00E+00	0.00E+00	2.20E-01	0.00E+00	Unknown	Unknown	Unknown	Unknown	Unknown	2.20E-01	9.98E+01	4.60
GATempleInlandRome/WF	Wood	Wood	2 (2006 to 2010)	A (>250)	1.12E-03	5.39E-03	0.00E+00	0.00E+00	6.98E-05	3.67E-04	2.97E-04	4.36E-03	0.810	4.36E-03	1.98E+00	0.68
ARGBPMorrilton/SN-04	Wood	Wood	2 (2006 to 2010)	A (>250)	0.00E+00	6.60E-03	0.00E+00	0.00E+00	Unknown	4.49E-04	Unknown	Unknown	Unknown	3.81E-03	1.73E+00	0.55
MEBoralexStratton/Boiler #1/2	Wood	Wood	2 (2006 to 2010)	A (>250)	4.80E-04	1.32E-03	0.00E+00	0.00E+00	2.99E-05	8.98E-05	5.99E-05	8.80E-04	0.667	8.80E-04	3.99E-01	-0.92
ARAnthonyForestProducts/SN-12	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	3.42E-03	8.12E-03	0.00E+00	0.00E+00	2.13E-04	5.52E-04	3.39E-04	4.99E-03	0.615	4.99E-03	2.26E+00	0.82
ARWestFraserHuttig/SN-24	Wood	Wood	1 (<=2005)	C (10 to 100)	0.00E+00	0.00E+00	4.38E-04	0.00E+00	Unknown	Unknown	Unknown	Unknown	Unknown	4.38E-04	1.99E-01	-1.62
ARWestFraserHuttig/SN-24	Wood	Wood	2 (2006 to 2010)	C (10 to 100)	0.00E+00	1.02E-03	0.00E+00	0.00E+00	Unknown	6.96E-05	Unknown	Unknown	Unknown	5.90E-04	2.68E-01	-1.32
MSIPVicksburg/Power Boiler-AA-006	Wood	Wood	2 (2006 to 2010)	A (>250)	0.00E+00	2.32E-04	0.00E+00	0.00E+00	Unknown	1.58E-05	Unknown	Unknown	Unknown	1.34E-04	6.08E-02	-2.80
FL_Gainesville Renewable Energy Center (GREC)/EU-002	Wood	Wood	3 (>2010)	A (>250)	0.00E+00	1.04E-03	0.00E+00	0.00E+00	Unknown	7.09E-05	Unknown	Unknown	Unknown	6.01E-04	2.73E-01	-1.30
VA_Altavista Power Station/Unit 001	Wood	Wood	3 (>2010)	A (>250)	0.00E+00	4.00E-04	0.00E+00	0.00E+00	Unknown	2.72E-05	Unknown	Unknown	Unknown	2.31E-04	1.05E-01	-2.26
VA_Altavista Power Station/Unit 002	Wood	Wood	3 (>2010)	A (>250)	0.00E+00	4.93E-04	0.00E+00	0.00E+00	Unknown	3.35E-04	Unknown	Unknown	Unknown	2.84E-03	1.29E+00	0.25
ME_Colby College/B1O1 and B1O2	Wood	Wood	3 (>2010)	C (10 to 100)	0.00E+00	2.12E-03	0.00E+00	0.00E+00	Unknown	1.45E-04	Unknown	Unknown	Unknown	1.23E-03	5.56E-01	-0.59

Notes:

¹The boiler size category units are MMBtu/hr.

²DRAFT BMACT data (version 8).accdb is available at <http://www3.epa.gov/airtoxics/boiler/boilerpg.html>.

³Source test reports were obtained from the permitting agency through a public records request.

⁴Unit averages are based on higher heating value.

⁵VOC is assumed to be non-methane hydrocarbons. For units which do not have VOC or TNMOC measurements, VOC is estimated at the difference between THC and methane.

⁶This data is used to estimate an average VOC/THC ratio of each standardized boiler furance type: hybrid suspension grate and other.

⁷VOC is assumed to be non-methane hydrocarbons. For units which do not have VOC or TNMOC measurements, VOC is estimated at the difference between THC and methane. If methane measurements were not made, then the VOC is estimated using the VOC/THC ratio of the unit's standardized boiler furnace type.

Conversion Factor:

453.592 g/lb

Constants:

Molecular Weight of Methane

16.04 lb/lb-mol

Molecular Weight of Propane

44.1 lb/lb-mol

VOC/THC Ratios:

Hybrid Suspension Grate

0.78

Other Furnace Type

0.58

Abbreviations:

C - carbon

HAP - hazardous air pollutant

LN - natural logarithm

TNMOC - total non-methane organic carbon

DSI - dry sorbent injection

HHV - higher heating value

MMBtu - million british thermal units

VOC - volatile organic carbon

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APPENDIX B
SUMMARY OF U.S. FEDERAL BOILER
EMISSION LIMITS

40 CFR 60 Subpart Da New Source Performance Standards (NSPS) - Standards of Performance for Electric Utility Steam Generating Units

Affected Units	Fuel	Dates of Applicability	NSPS Pollutant Limit		
			PM	SO ₂	NO _x (expressed as NO ₂)
>25 Mwe net & >1/3 net output for sale	Any fossil fuel	Commenced construction, reconstruction, or modification before 3/1/ 2005	0.03 lb/MMBtu		
		Commenced construction, reconstruction, or modification after 2/28/2005 and before 5/4/2011	0.14 lb/MWh gross energy output or 0.015 lb/MMBtu heat input combustion		
		Commenced construction, reconstruction, or modification after 5/3/2011	0.090 lb/MWh gross energy output or 0.097 lb/MMBtu net energy input		
	Solid fuel/Solid-derived fuel	Commenced construction, reconstruction, or modification on or before 3/1/2005		1) 1.20 lb/MMBtu heat input and 10% of the potential combustion concentration; 2) 30% of the potential combustion concentration when emissions are less than 0.60 lb/MMBtu heat input; 3) 1.4 lb/MWh gross energy output; or 4) 0.15 lb/MMBtu heat input.	
		Commenced construction, reconstruction, or modification after 2/28/2005 and before 5/4/2011		1) For an affected facility which commenced construction, either 1.4 lb/MWh gross energy output or 5% of the potential combustion concentration; 2) For an affected facility which commenced reconstruction, either 1.4 lb/MWh gross energy output, or 5% of the potential combustion concentration; 3) For an affected facility which commenced modification, either 1.4 lb/MWh gross energy output; 0.15 lb/MMBtu heat input; or 10 percent of the potential combustion concentration.	
		Commenced construction, reconstruction, or modification after 5/3/2011		1.0 lb/MWh gross energy output; or 1.2 lb/MWh) net energy output; or 3% of the potential combustion concentration.	
		Commenced construction, reconstruction, or modification before 7/10/1997			0.50 lb/MMBtu
	Subbituminous coal				
	Bituminous coal				0.60 lb/MMBtu
	Anthracite coal				0.60 lb/MMBtu
	Any fossil fuel	Commenced construction, reconstruction, or modification after 7/9/1997 and before 3/1/2005			1) For an affected facility which commenced construction, 1.6 lb/MWh gross energy output 2) For an affected facility which commenced reconstruction, 0.15 lb/MMBtu heat input.
		Commenced construction, reconstruction, or modification after 2/28/ 2005 and before 5/4/2011			1) For an affected facility which commenced construction, either 1.0 lb/MWh gross energy output; 2) For an affected facility which commenced reconstruction, either 1.0 lb/MWh gross energy output, or 0.11 lb/MMBtu heat input; 3) For an affected facility which commenced modification, either 1.4 lb/MWh gross energy output; 0.15 lb/MMBtu heat input.

40 CFR 60 Subpart Da New Source Performance Standards (NSPS) - Standards of Performance for Electric Utility Steam Generating Units

Affected Units	Fuel	Dates of Applicability	NSPS Pollutant Limit		
>25 Mwe net & >1/3 net output for sale			PM	SO2	NOx (expressed as NO2)
		Commenced construction, reconstruction, or modification after 5/3/2011			1) For an affected facility which commenced construction or reconstruction, 0.70 lb/MWh gross energy output; or 0.76 lb/MWh net energy output. 2) For an affected facility which commenced construction or reconstruction and that burns 75 percent or more coal refuse (by heat input) on a 12-month rolling average basis, 0.85 lb/MWh gross energy output; or 0.92 lb/MWh net energy output. 3) For an affected facility which commenced modification, 1.1 lb/MWh gross energy output.

40 CFR 60 Subpart Db New Source Performance Standards (NSPS) - Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units

Affected Units	Fuel	Dates of Applicability	NSPS Limits		
			PM	SO ₂	NO _x (expressed as NO ₂)
Industrial-Commercial-Institutional Steam Generating Units that commenced construction, modification, or reconstruction after June 19, 1984, and that have a heat input capacity greater than 100 MMBtu/hr	Coal or liquid fuel	Commenced construction, reconstruction, or modification on or before 2/28/2005		0.20 lb/MMBtu or 10% of the potential SO ₂ emission rate	
	Coal	Commenced construction, reconstruction, or modification on or before 2/28/2005	0.051 lb/MMBtu		
	Wood	Commenced construction, reconstruction, or modification on or before 2/28/2005	0.10 lb/MMBtu (annual capacity factor > than 30%)		
	Wood	Commenced construction, reconstruction, or modification on or before 2/28/2005	0.20 lb/MMBtu (annual capacity factor ≤ than 30%)		
	Coal, wood, other fuels	Commenced construction, reconstruction, or modification after 2/28/2005	0.030 lb/MMBtu (annual capacity factor ≤ than 30%)		
	Over 30% wood (maximum heat input capacity of 250 MMBtu/h)	Commenced construction, reconstruction, or modification after 2/28/2005	0.10 lb/MMBtu		
	Over 30% wood (maximum heat input capacity > 250 MMBtu/h)	Commenced construction, reconstruction, or modification after 2/28/2005	0.085 lb/MMBtu		
	Coal (Mass-feed stoker)	Commenced construction, reconstruction, or modification after 6/19/1984			0.50 lb/MMBtu
	Coal (Spreader stoker and fluidized bed combustion)	Commenced construction, reconstruction, or modification after 6/19/1984			0.60 lb/MMBtu
	Coal (Pulverized coal)	Commenced construction, reconstruction, or modification after 6/19/1984			0.70 lb/MMBtu
	Coal (Lignite)	Commenced construction, reconstruction, or modification after 6/19/1984			0.60 lb/MMBtu
	Coal (Lignite mined in North Dakota, South Dakota, or Montana and combusted in a slag tap furnace)	Commenced construction, reconstruction, or modification after 6/19/1984			0.80 lb/MMBtu
Industrial-Commercial-Institutional Steam Generating Units >10<100 MMBtu/hr that commenced construction, reconstruction, or modification after 6/9/1989	Coal	Commenced construction, reconstruction, or modification after 6/19/1989		0.20 lb/MMBtu heat input or 10% of the potential SO ₂ emission	
	Coal or mixture - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification on or before 2/28/2005		0.051 lb/MMBtu heat input if the affected facility combusts only coal	
	Wood or mixture - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification on or before 2/28/2005		0.10 lb/MMBtu heat input if the affected facility has an annual capacity factor for wood greater than 30%	
	Over 30% wood - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification after 2/28/2005		0.10 lb/MMBtu heat input	

40 CFR 60 Subpart Dc New Source Performance Standards (NSPS) - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

Affected Units	Fuel	Dates of Applicability	NSPS Limits	
			PM	SO ₂
Industrial-Commercial-Institutional Steam Generating Units >10<100 MMBtu/hr that commenced construction, reconstruction, or modification after 6/9/1989	Coal	Commenced construction, reconstruction, or modification after 6/19/1989		0.20 lb/MMBtu heat input or 10% of the potential SO ₂ emission rate
	Coal or mixture - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification on or before 2/28/2005	1) 0.051 lb/MMBtu heat input if the affected facility combusts only coal, or combusts coal with other fuels and has an annual capacity factor for the other fuels of 10% or less. 2) 0.10 lb/MMBtu heat input if the affected facility combusts coal with other fuels, has an annual capacity factor for the other fuels greater than 10%, and is subject to a federally enforceable requirement limiting operation of the affected facility to an annual capacity factor greater than 10% for fuels other than coal.	0.051 lb/MMBtu heat input if the affected facility combusts only coal
	Wood or mixture - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification on or before 2/28/2005	1) 0.10 lb/MMBtu heat input if the affected facility has an annual capacity factor for wood greater than 30%; or 2) 0.30 lb/MMBtu heat input if the affected facility has an annual capacity factor for wood of 30% or less and is subject to a federally enforceable requirement limiting operation of the affected facility to an annual capacity factor for wood of 30% or less	0.10 lb/MMBtu heat input if the affected facility has an annual capacity factor for wood greater than 30%
	Over 30% wood - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification after 2/28/2005		0.10 lb/MMBtu) heat input
	Coal, oil, wood, a mixture of these fuels, or a mixture of these fuels with any other fuels - 30 MMBtu/hr or greater	Commenced construction, reconstruction, or modification after 2/28/2005	0.030 lb/MMBtu heat input	

40 CFR 63, Subpart DDDDD (Major Sources) National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters

Affected Units	Fuel	New/Existing	Metal HAPs			Organic HAPs	Acid Gases
			Filterable PM	Total Selected Metals (TSM)	Mercury	CO	HCl
Boilers and Process Heaters with heat input or Capacity ≥ 10 MMBtu/hr	Pulverized Coal/Solid Fossil Fuel	Existing	0.04 lb/MMBtu heat input or 0.042 lb/MMBtu steam output 0.49 lb/MWh output	5.3E-05 lb/MMBtu heat input or 5.6E-05 lb/MMBtu steam output 6.5E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	130 ppmvd – stack test or 320 ppmvd – 30 day rolling average 0.11 lb/MMBtu steam output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
			0.04 lb/MMBtu heat input or 0.042 lb/MMBtu steam output 0.49 lb/MWh output	5.3E-05 lb/MMBtu heat input or 5.6E-05 lb/MMBtu steam output 6.5E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	160 ppmvd – stack test or 340 ppmvd – 30 day rolling average 0.14 lb/MMBtu steam output 1.7 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
			0.04 lb/MMBtu heat input or 0.042 lb/MMBtu steam output 0.49 lb/MWh output	5.3E-05 lb/MMBtu heat input or 5.6E-05 lb/MMBtu steam output 6.5E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	130 ppmvd – stack test or 230 ppmvd – 30 day rolling average 0.12 lb/MMBtu steam output 1.4 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
	Fluidized Bed Designed to Burn Coal/Solid Fossil Fuel with Integrated Heat	Existing	0.04 lb/MMBtu heat input or 0.042 lb/MMBtu steam output 0.49 lb/MWh output	5.3E-05 lb/MMBtu heat input or 5.6E-05 lb/MMBtu steam output 6.5E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	140 ppmvd – stack test or 150 ppmvd – 30 day rolling average 0.13 lb/MMBtu steam output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
	Pulverized Coal/Solid Fossil Fuel	New and Reconstructed	0.0011 lb/MMBtu heat input or 0.0011 lb/MMBtu steam output 0.014 lb/MWh output	2.4E-04 lb/MMBtu heat input or 2.8E-04 lb/MMBU steam output 3.4E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	130 ppmvd – stack test or 320 ppmvd – 30 day rolling average 0.11 lb/MMBtu steam output 1.4 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
			0.0011 lb/MMBtu heat input or 0.0011 lb/MMBtu steam output 0.014 lb/MWh output	2.4E-04 lb/MMBtu heat input or 2.8E-04 lb/MMBU steam output 3.4E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	130 ppmvd – stack test or 340 ppmvd – 30 day rolling average 0.12 lb/MMBtu steam output 1.4 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
			0.0011 lb/MMBtu heat input or 0.0011 lb/MMBtu steam output 0.014 lb/MWh output	2.4E-04 lb/MMBtu heat input or 2.8E-04 lb/MMBU steam output 3.4E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	130 ppmvd – stack test or 230 ppmvd – 30 day rolling average 0.11 lb/MMBtu steam output 1.4 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
	Fluidized Bed Designed to Burn Coal/Solid Fossil Fuel with Integrated Heat Exchanger	New and Reconstructed	0.0011 lb/MMBtu heat input or 0.0011 lb/MMBtu steam output 0.014 lb/MWh output	2.4E-04 lb/MMBtu heat input or 2.8E-04 lb/MMBU steam output 3.4E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	140 ppmvd – stack test or 150 ppmvd – 30 day rolling average 0.12 lb/MMBtu steam output 1.5 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
			0.037 lb/MMBtu heat input or 0.043 lb/MMBtu steam output 0.52 lb/MWh output	5.3E-05 lb/MMBtu heat input or 5.6E-05 lb/MMBtu steam output 6.5E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	1500 ppmvd – stack test or 720 ppmvd – 30 day rolling average 1.4 lb/MMBtu steam output 17 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
			0.037 lb/MMBtu heat input or 0.043 lb/MMBtu steam output 0.52 lb/MWh output	5.3E-05 lb/MMBtu heat input or 5.6E-05 lb/MMBtu steam output 6.5E-04 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	1500 ppmvd – stack test or 720 ppmvd – 30 day rolling average 1.4 lb/MMBtu steam output 17 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
	Stoker/Sloped Grate/Other Designed to Burn Wet Biomass	Existing	0.32 lb/MMBtu heat input or 0.37 lb/MMBtu steam output 4.5 lb/MWh output	0.0040 lb/MMBtu heat input or 0.0046 lb/MMBU steam output 0.056 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	460 ppmvd – stack test or 0.42 lb/MMBtu steam output 5.1 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
			0.11 lb/MMBtu heat input or 0.14 lb/MMBtu steam output 1.6 lb/MWh output	1.2E-03 lb/MMBtu heat input or 1.5E-03 lb/MMBU steam output 0.017 lb/MWh output	5.7E-06 lb/MMBtu heat input or 6.4E-06 lb/MMBtu steam output 7.3E-05 lb/MWh output	470 ppmvd – stack test or 310 ppmvd – 30 day rolling average 0.46 lb/MMBtu steam output 5.2 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.27 lb/MWh output
			0.030 lb/MMBtu heat input or 0.035 lb/MMBtu steam output 0.42 lb/MWh output	2.6E-05 lb/MMBtu heat input or 2.7E-05 lb/MMBU steam output 3.7E-04 lb/MWh output	8.0E-07 lb/MMBtu heat input or 8.7E-07 lb/MMBtu steam output 1.1E-05 lb/MWh output	620 ppmvd – stack test or 390 ppmvd – 30 day rolling average 0.58 lb/MMBtu steam output 6.8 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
	Stoker/Sloped Grate/Other Designed to Burn Kiln-Dried Biomass	New and Reconstructed	0.030 lb/MMBtu heat input or 0.035 lb/MMBtu steam output 0.42 lb/MWh output	0.0040 lb/MMBtu heat input or 0.0042 lb/MMBU steam output 0.056 lb/MWh output	8.0E-07 lb/MMBtu heat input or 8.7E-07 lb/MMBtu steam output 1.1E-05 lb/MWh output	460 ppmvd – stack test or 0.42 lb/MMBtu steam output 5.1 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
			0.0098 lb/MMBtu heat input or 0.012 lb/MMBtu steam output 0.14 lb/MWh output	8.3E-05 lb/MMBtu heat input or 1.1E-04 lb/MMBU steam output 0.0012 lb/MWh output	8.0E-07 lb/MMBtu heat input or 8.7E-07 lb/MMBtu steam output 1.1E-05 lb/MWh output	230 ppmvd – stack test or 310 ppmvd – 30 day rolling average 0.22 lb/MMBtu steam output 2.6 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output
			0.0098 lb/MMBtu heat input or 0.012 lb/MMBtu steam output 0.14 lb/MWh output	8.3E-05 lb/MMBtu heat input or 1.1E-04 lb/MMBU steam output 0.0012 lb/MWh output	8.0E-07 lb/MMBtu heat input or 8.7E-07 lb/MMBtu steam output 1.1E-05 lb/MWh output	230 ppmvd – stack test or 310 ppmvd – 30 day rolling average 0.22 lb/MMBtu steam output 2.6 lb/MWh output	0.022 lb/MMBtu heat input or 0.025 lb/MMBtu steam output 0.28 lb/MWh output

40 CFR 63, Subpart JJJJJ (Area Sources) National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources

Affected Units	Fuel	New/Existing	Metal HAPs		Organic HAPs
			Filterable PM	Mercury	CO
Boilers with Heat Input Capacity \geq 10 MMBtu/hr	Coal	Existing		0.000022 lb/MMBtu	420 ppm
	Coal	New		0.000022 lb/MMBtu	420 ppm
Boilers with Heat Input Capacity 10-30 MMBtu/hr	Coal	New	0.42 lb/MMBtu		
Boilers with Heat Input Capacity \geq 30 MMBtu/hr	Coal	New	0.03 lb/MMBtu		
Boilers with Heat Input Capacity 10-30 MMBtu/hr	Biomass	New	0.07 lb/MMBtu		
Boilers with Heat Input Capacity \geq 30 MMBtu/hr	Biomass	New	0.03 lb/MMBtu		

40 CFR 63, Subpart UUUUU National Emission Standards for Hazardous Air Pollutants: Coal and Oil-Fired Electric Utility Steam Generating Units

Coal- and oil-fired electric utility steam generating units (EGUs)

EGU Subcategory: Coal-fired unit not low rank virgin coal	
Emission Limits	
Filterable particulate matter (PM)	9.0E-2 lb/MWh
OR	
Total non-Hg HAP metals	6.0E-2 lb/GWh
OR	
Individual HAP metals	
Antimony (Sb)	8.0E-3 lb/GWh
Arsenic (As)	3.0E-3 lb/GWh
Beryllium (Be)	6.0E-4 lb/GWh
Cadmium (Cd)	4.0E-4 lb/GWh
Chromium (Cr)	7.0E-3 lb/GWh
Cobalt (Co)	2.0E-3 lb/GWh
Lead (Pb)	2.0E-2 lb/GWh
Manganese (Mn)	4.0E-3 lb/GWh
Nickel (Ni)	4.0E-2 lb/GWh
Selenium (Se)	5.0E-2 lb/GWh
Hydrogen chloride (HCl)	1.0E-2 lb/MWh
OR	
Sulfur dioxide (SO ₂)	1.0 lb/MWh
Mercury (Hg)	3.0E-3 lb/GWh

EGU Subcategory: Coal-fired units low rank virgin coal	
Emission Limits	
Filterable particulate matter (PM)	9.0E-2 lb/MWh
OR	
Total non-Hg HAP metals	6.0E-2 lb/GWh
OR	
Individual HAP metals	
Antimony (Sb)	8.0E-3 lb/GWh
Arsenic (As)	3.0E-3 lb/GWh
Beryllium (Be)	6.0E-4 lb/GWh
Cadmium (Cd)	4.0E-4 lb/GWh
Chromium (Cr)	7.0E-3 lb/GWh
Cobalt (Co)	2.0E-3 lb/GWh
Lead (Pb)	2.0E-2 lb/GWh
Manganese (Mn)	4.0E-3 lb/GWh
Nickel (Ni)	4.0E-2 lb/GWh
Selenium (Se)	5.0E-2 lb/GWh
Hydrogen chloride (HCl)	1.0E-2 lb/MWh
OR	
Sulfur dioxide (SO ₂)	1.0 lb/MWh
Mercury (Hg)	3.0E-3 lb/GWh

EGU Subcategory: IGCC unit	
Emission Limits	
Filterable particulate matter (PM)	7.0E-2 lb/MWh 9.0E-2 lb/MWh
OR	
Total non-Hg HAP metals	4.0E-1 lb/GWh
OR	
Individual HAP metals	
Antimony (Sb)	2.0E-2 lb/GWh
Arsenic (As)	2.0E-2 lb/GWh
Beryllium (Be)	1.0E-3 lb/GWh
Cadmium (Cd)	2.0E-3 lb/GWh
Chromium (Cr)	4.0E-2 lb/GWh
Cobalt (Co)	4.0E-3 lb/GWh
Lead (Pb)	9.0E-3 lb/GWh
Manganese (Mn)	2.0E-2 lb/GWh
Nickel (Ni)	7.0E-2 lb/GWh
Selenium (Se)	3.0E-1 lb/GWh
Hydrogen chloride (HCl)	2.0E-3 lb/MWh
OR	
Sulfur dioxide (SO ₂)	4.0E-1 lb/MWh
Mercury (Hg)	3.0E-3 lb/GWh