Older traveling grate stokers are often uncontrolled. Indeed, particulate control has often been considered unnecessary because of anthracite's low smoking tendencies and the fact that a significant fraction of large size flyash from stokers is readily collected in flyash hoppers as well as in the breeching and base of the stack. Cyclone collectors have been employed on traveling grate stokers, and limited information suggests these devices may be up to 75 percent efficient on particulate. Flyash reinjection, frequently used in traveling grate stokers to enhance fuel use efficiency, tends to increase PM emissions per unit of fuel combusted. High-energy venturi scrubbers can generally achieve PM collection efficiencies of 90 percent or greater.

Emission factors and ratings for pollutants from anthracite coal combustion and anthracite culm combustion are given in Tables 1.2-1, 1.2-2, 1.2-3, 1.2-4, 1.2-5, 1.2-6, and 1.2-7. Cumulative size distribution data and size-specific emission factors and ratings for particulate emissions are summarized in Table 1.2-8. Uncontrolled and controlled size-specific emission factors are presented in Figure 1.2-1. Particle size distribution data for bituminous coal combustion may be used for uncontrolled emissions from pulverized anthracite-fired furnaces, and data for anthracite-fired traveling grate stokers may be used for hand-fired units (Figure 1.2-2).[10-13]

Table 1.2-1 (Metric And English Units). EMISSION FACTORS FOR SPECIATED METALS FROM ANTHRACITE COAL COMBUSTION IN STOKER FIRED BOILERS[a]

EMISSION FACTOR RATING: E

	Emission Factor Range		Average Emission Factor	
Pollutant	kg/Mg	lb/ton	kg/Mg	lb/ton
Mercury	4.4 E-05 - 6.5 E-05	8.7 E-05 - 1.3 E-04	6.5 E-05	1.3 E-04
Arsenic	BDL - 1.2 E-04	BDL - 2.4 E-04	9.3 E-05	1.9 E-04
Antimony	BDL	BDL	BDL	BDL
Beryllium	1.5 E-05 - 2.7 E-04	3.0 E-05 - 5.4 E-04	1.5 E-04	3.1 E-04
Cadmium	2.3 E-05 - 5.5 E-03	4.5 E-05 - 1.1 E-04	3.6 E-05	7.1 E-05
Chromium	3.0 E-03 - 2.5 E-02	5.9 E-03 - 4.9 E-02	1.4 E-02	2.8 E-02
Manganese	4.9 E-04 - 2.7 E-03	9.8 E-04 - 5.3 E-03	1.8 E-03	3.6 E-03
Nickel	3.9 E-03 - 1.8 E-02	7.8 E-03 - 3.5 E-02	1.3 E-02	2.6 E-02
Selenium	2.4 E-04 - 1.1 E-03	4.7 E-04 - 2.1 E-03	6.3 E-04	1.3 E-03

[a] Reference 9. Units are kg of pollutant/Mg of coal burned and lb of pollutant/ton of coal burned. Source Classification Codes are 1-01-001-02, 1-02-001-04, and 1-03-001-02. BDL = below detection limit.

Table 1.2-2 (Metric And English Units). EMISSION FACTORS FOR TOTAL ORGANIC COMPOUNDS (TOC) AND METHANE (CH_4) FROM ANTHRACITE COAL COMBUSTORS[a]

Source Category	TOC Emission Factor			CH_4 Emission Factor		
	kg/Mg	lb/ton	RATING	kg/Mg	lb/ton	RATING
Stoker fired boilers[b] (SCC 1-01-001-02, 1-02-001-04, 1-03-001-02)	0.10	0.20	E	ND	ND	NA
Residential space heaters[c] (SCC A2104001000)	ND	ND	NA	4	8	E

[a] Units are kg of pollutant/Mg of coal burned and lb of pollutant/ton of coal burned. SCC = Source Classification Code. ND = no data. NA = not applicable.
[b] Reference 9.
[c] Reference 14.

Table 1.2-3 (Metric Units). EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM ANTHRACITE COAL COMBUSTORS[a]

EMISSION FACTOR RATING: E

Pollutant	Stoker Fired Boilers[b] (SCC 1-01-001-02, 1-02-001-04, 1-03-001-02)	Residential Space Heaters[c] (No SCC)	
	Emission Factor	Emission Factor Range	Emission Factor
Biphenyl	1.25 E-02	ND	ND
Phenanthrene	3.4 E-03	4.6 E-02 - 2.1 E-02	1.6 E-01
Naphthalene	0.65 E-01	4.5 E-03 - 2.4 E-02	1.5 E-01
Acenaphthene	ND	7.0 E-03 - 3.4 E-01	3.5 E-01
Acenaphthalene	ND	7.0 E-03 - 2.0 E-02	2.5 E-01
Fluorene	ND	4.5 E-03 - 2.9 E-02	1.7 E-02
Anthracene	ND	4.5 E-03 - 2.3 E-02	1.6 E-02
Fluoranthrene	ND	4.8 E-02 - 1.7 E-01	1.1 E-01
Pyrene	ND	2.7 E-02 - 1.2 E-01	7.9 E-02
Benzo(a)anthracene	ND	7.0 E-03 - 1.0 E-01	2.8 E-01
Chrysene	ND	1.2 E-02 - 1.1 E-01	5.3 E-02
Benzo(k)fluoranthrene	ND	7.0 E-03 - 3.1 E-02	2.5 E-01
Benzo(e)pyrene	ND	2.3 E-03 - 7.3 E-03	4.2 E-03
Benzo(a)pyrene	ND	1.9 E-03 - 4.5 E-03	3.5 E-03
Perylene	ND	3.8 E-04 - 1.2 E-03	8.5 E-04
Indeno(123-cd) perylene	ND	2.3 E-03 - 7.0 E-03	2.4 E-01
Benzo(g,h,i,) perylene	ND	2.2 E-03 - 6.0 E-03	2.1 E-01
Anthanthrene	ND	9.5 E-05 - 5.5 E-04	3.5 E-03
Coronene		5.5 E-04 - 4.0 E-03	1.2 E-02

[a] Units are kg of pollutant/Mg of anthracite coal burned. SCC = Source Classification Code. ND = no data.
[b] Reference 9.
[c] Reference 14.

Table 1.2-4 (English Units). EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM ANTHRACITE COAL COMBUSTORS[a]

EMISSION FACTOR RATING: E

Pollutant	Stoker Fired Boilers[b] (SCC 1-01-001-02, 1-02-001-04, 1-03-001-02)	Residential Space Heaters[c] (SCC A2104001000)	
	Emission Factor	Emission Factor Range	Emission Factor
Biphenyl	2.5 E-02	ND	ND
Phenanthrene	6.8 E-03	9.1 E-02 - 4.3 E-02	3.2 E-01
Naphthalene	1.3 E-01	9.0 E-03 - 4.8 E-02	3.0 E-01
Acenaphthene	ND	1.4 E-02 - 6.7 E-01	7.0 E-01
Acenaphthalene	ND	1.4 E-02 - 3.0 E-01	4.9 E-01
Fluorene	ND	9.0 E-03 - 5.8 E-02	3.4 E-02
Anthracene	ND	9.0 E-03 - 4.5 E-02	3.3 E-02
Fluoranthrene	ND	9.6 E-02 - 3.3 E-01	2.2 E-01
Pyrene	ND	5.4 E-02 - 2.4 E-01	1.6 E-01
Benzo(a)anthracene	ND	1.4 E-02 - 2.0 E-01	5.5 E-01
Chrysene	ND	2.3 E-02 - 2.2 E-01	1.1 E-01
Benzo(k)fluoranthrene	ND	1.4 E-02 - 6.3 E-02	5.0 E-01
Benzo(e)pyrene	ND	4.5 E-03 - 1.5 E-02	8.4 E-03
Benzo(a)pyrene	ND	3.8 E-03 - 9.0 E-03	7.0 E-03
Perylene	ND	7.6 E-04 - 2.3 E-03	1.7 E-03
Indeno(123-cd) perylene	ND	4.5 E-03 - 1.4 E-02	4.7 E-01
Benzo(g,h,i,) perylene	ND	4.3 E-03 - 1.2 E-02	4.2 E-01
Anthanthrene	ND	1.9 E-04 - 1.1 E-03	7.0 E-03
Coronene	ND	1.1 E-03 - 8.0 E-03	2.4 E-02

[a] Units are lbs. of pollutant/ton of anthracite coal burned. SCC = Source Classification Code. ND = no data.
[b] Reference 9.
[c] Reference 14.

Table 1.2-5 (Metric And English Units). EMISSION FACTORS FOR PARTICULATE MATTER (PM) AND LEAD (Pb) FROM ANTHRACITE COAL COMBUSTORS[a]

Source Category	Filterable PM Emission Factor			Condensable PM Emission Factor			Pb Emission Factor		
	kg/Mg	lb/ton	RATING	kg/Mg	lb/ton	RATING	kg/Mg	lb/ton	RATING
Stoker fired boilers[b] (SCC 1-01-001-02, 1-02-001-04, 1-03-001-02)	0.4A[c]	0.8A	C	0.04A	0.08A	C	4.5 E-03	8.9 E-03	E
Hand fired units[d] (SCC 1-02-002-07, 1-03-001-03)	5	10	B	ND	ND	NA	ND	ND	NA

[a] Units are kg of pollutant/Mg of coal burned and lb of pollutant/ton of coal burned. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] References 9-12.

[c] A = ash content of fuel, weight percent.

[d] Reference 16.

Table 1.2-6 (Metric And English Units). EMISSION FACTORS FOR NITROGEN OXIDE COMPOUNDS (NO_x) AND SULFUR DIOXIDE (SO_2) FROM ANTHRACITE COAL COMBUSTORS[a]

Source Category	NO_x Emission Factor[b]			SO_2 Emission Factor[c]		
	kg/Mg	lb/ton	RATING	kg/Mg	lb/ton	RATING
Stoker fired boilers[d] (SCC 1-01-001-02, 1-02-001-04, 1-03-001-02)	4.6	9.0	C	19.5S	39S	B
FBC boilers[f] (no SCC)	0.9	1.8	E	1.5	2.9	E
Pulverized coal boilers (SCC 1-01-001-01, 1-02-001-01, 1-03-001-01)	9	18	B	19.5S		B
Residential space heaters (no SCC)	1.5	3	B	19.5S		B

[a] Units are kg of pollutant/Mg of coal burned and lb of pollutant/ton of coal burned. SCC = Source Classification Code. FBC = fluidized bed combustion.
[b] References 17-18.
[c] Reference 19.
[d] References 10-11.
[e] S = weight percent sulfur.
[f] Reference 15. FBC boilers burning culm fuel; all other sources burning anthracite coal.

Table 1.2-7 (Metric And English Units). EMISSION FACTORS FOR CARBON MONOXIDE (CO) AND CARBON DIOXIDE (CO_2) FROM ANTHRACITE COAL COMBUSTORS[a]

Source Category	CO Emission Factor			CO_2 Emission Factor		
	kg/Mg	lb/ton	RATING	kg/Mg	lb/ton	RATING
Stoker fired boilers[b] (SCC 1-01-001-02, 1-02-001-04, 1-03-001-02)	0.3	0.6	B	2840	5680	C
FBC boilers[c] (no SCC)	0.15	0.3	E	ND	ND	NA

[a] Units are kg of pollutant/Mg of coal burned and lb of pollutant/ton of coal burned. SCC = Source Classification Code. FBC = fluidized bed combustion. ND = no data. NA = not applicable.
[b] References 10,13.
[c] Reference 15. FBC boilers burning culm fuel; all other sources burning anthracite coal.

Table 1.2-8 (Metric And English Units). CUMULATIVE PARTICLE SIZE-DISTRIBUTION AND SIZE-SPECIFIC EMISSION FACTORS FOR DRY BOTTOM BOILERS BURNING PULVERIZED ANTHRACITE COAL[a]

EMISSION FACTOR RATING: D

Particle Size[b] (μm)	Cumulative Mass % ≤ Stated Size			Cumulative Emission Factor[d] kg/Mg (lb/ton) Coal, As Fired		
	Uncontrolled	Controlled[c] Multiple Cyclone	Controlled[c] Baghouse	Uncontrolled	Controlled[c] Multiple Cyclone	Controlled[c] Baghouse
15	32	63	79	1.6A (3.2A)[e]	0.63A (1.26A)	0.0079A (0.016A)
10	23	55	67	1.2A (2.3A)	0.55A (1.10A)	0.0067A (0.013A)
6	17	46	51	0.9A (1.7A)	0.46A (0.92A)	0.0051A (0.010A)
2.5	6	24	32	0.3A (0.6A)	0.24A (0.48A)	0.0032A (0.006A)
1.25	2	13	21	0.1A (0.2A)	0.13A (0.26A)	0.0021A (0.004A)
1.00	2	10	18	0.1A (0.2A)	0.10A (0.20A)	0.0018A (0.004A)
0.625	1	7	ND	0.05A (0.1A)	0.07A (0.14A)	—[f]
TOTAL	100	100	100	5A (10A)	1A (2A)	0.01A (0.02A)

Table 1.2-8 (cont.).

[a] Reference 8. Source Classification Codes are 1-01-001-01, 1-02-001-01, and 1-03-001-01.
[b] Expressed as aerodynamic equivalent diameter.
[c] Estimated control efficiency for multiple cyclone is 80%; for baghouse, 99.8%.
[d] Units are kg of pollutant/Mg of coal burned and lb of pollutant/ton of coal burned.
[e] A = coal ash weight %, as fired.
[f] Insufficient data.

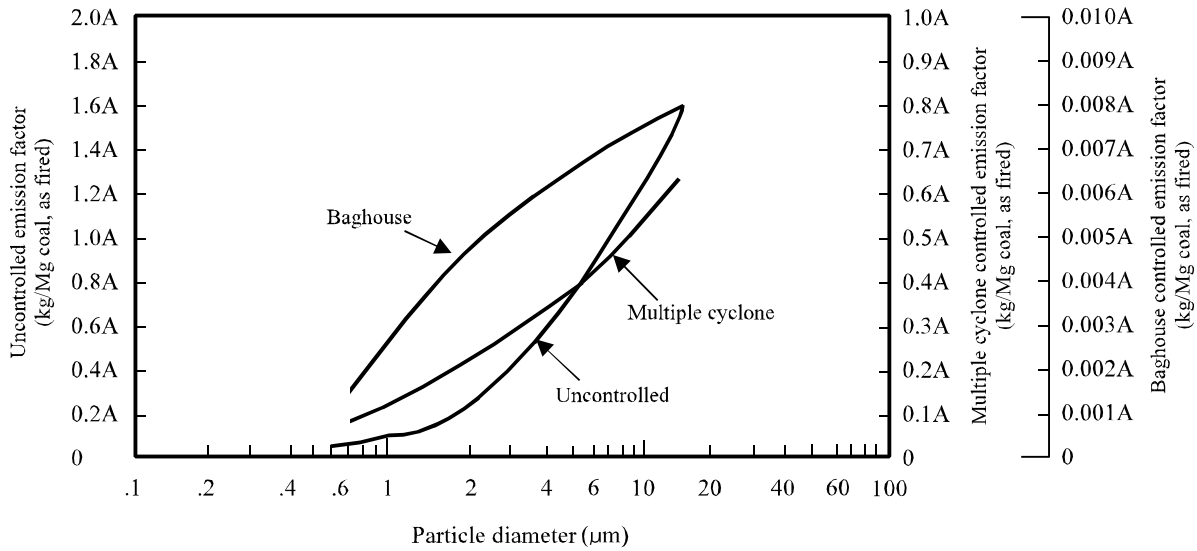

Figure 1.2-1. Cumulative size-specific emission factors for dry bottom boilers burning pulverized anthracite coal.

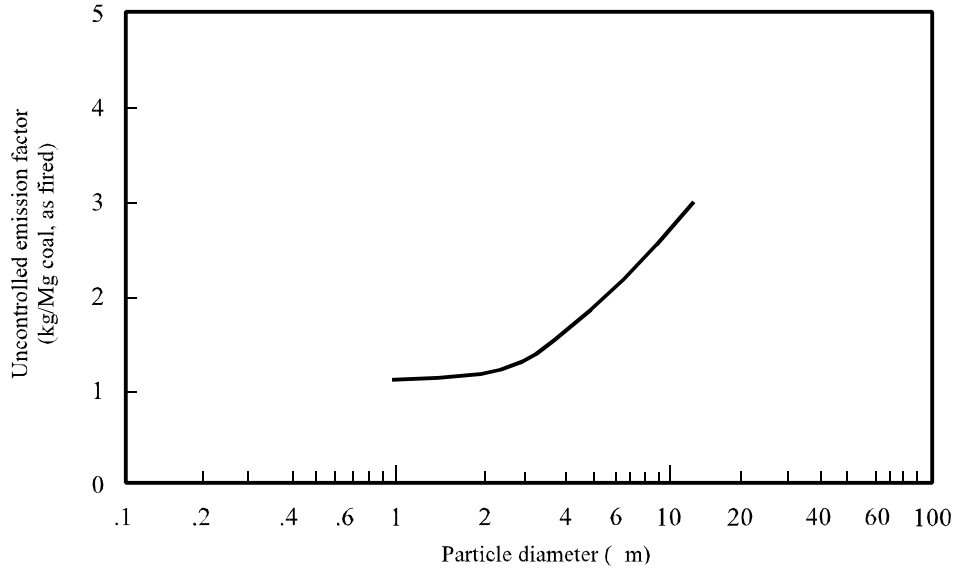

Figure 1.2-2. Cumulative size-specific emission factors for traveling grate stokers burning anthracite coal.

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