

Note: This is a reference cited in AP 42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference maybe from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section:	1.1
Reference:	42
Title:	Draft Final Report. A Study of Toxic Emissions from a Coal-Fired Power Plant-Niles Station No. 2. Volumes One, Two, and Three. Battelle, Columbus, Ohio. December 29, 1993.

DRAFT FINAL REPORT

VOLUME 1 of 3 - SAMPLING

**A Study of Toxic Emissions
from a Coal-Fired Power
Plant - Niles Station Boiler
No. 2**

Contract DE-AC22-93PC93251

To

U.S. Department of Energy

Pittsburgh Energy Technology Center

December 29, 1993

2.0 SITE DESCRIPTION

The host site for this study was Ohio Edison's Niles Station Boiler No. 2. The site is described in this section of the report as follows. The configuration of the boiler is described followed by a description of the process stream locations at which samples were collected. Finally, the expected and actual operating conditions of the boiler during the study are summarized.

2.1 Plant Configuration

2.1.1 Description of the Plant

Niles Station of Ohio Edison is located in Niles, Ohio, on the bank of the Mahoning River. The Niles Boiler No. 2 is a Babcock & Wilcox cyclone boiler burning bituminous coal with a net generating capacity of 108 megawatts. The furnace gas temperature at full load upstream of the superheater is about 1900 F. The boiler has four cyclone burners, each fed by a separate feeder. The Niles Plant uses coal with a low ash fusion temperature to allow the majority of the ash to drop out in the furnace cyclone combustors and to avoid carry-over into the boiler. The coal is mined in eastern Ohio and western Pennsylvania and is received in the respective proportions of about 70/30. Coal mined in Ohio comes principally from coal seams Nos. 6 and 7. The Pennsylvania mined coal comes also from seams Nos. 6 and 7, and from the Kittanning/Freeport seam. All the coal burned at the plant is from spot market purchases which are provided by up to a dozen different suppliers. The nominal contents of sulfur, ash, and heat are 2.7 percent, 10-12 percent, and 12,000 Btu/lb, respectively. The coal is blended in the coal yard at the plant to meet 24-hour and 30-day rolling averages for SO₂ content of flue gas. The feed rate of crushed coal to the four cyclone burners is determined by Ohio Edison from the quantity of coal on the four conveyor belts delivering the coal to the burners, along with the speed of travel of the belts. Each belt holds approximately 45 kg/m (30 lb/ft) of coal. The lag time for coal on each of the four conveyor belts to reach the cyclone burners and be fired is a few minutes.

The flue gas leaves the boiler, passes through an air heater, and enters an electrostatic precipitator (ESP) with five fields, each with two hoppers. The first row of hoppers is

TABLE 2-9. RESULTS OF ANALYSIS OF BUNKER COAL SAMPLES

Day of Coal Sample ^(a)	Coal Analysis - As Received			
	Moisture (percent)	Ash (percent)	Sulfur (percent)	Heat Value (Btu/lb)
July 25, 1993	6.91	11.52	2.58	11,964
July 26, 1993	4.47	10.67	2.68	12,504
July 27, 1993	4.57	11.15	2.74	12,397
July 28, 1993	5.36	11.77	2.57	12,139
July 29, 1993	6.39	11.32	2.51	12,031
July 30, 1993	6.92	11.21	2.40	12,068

- (a) Coal in bunker is burned about 1 day after sample is collected. Thus data shown represent coal burned on study days of July 26-31, 1993.

Avg = 12,184

TABLE 6-6. EMISSION FACTORS FOR ELEMENTS (lb/10¹² BTU)

Analyte	N-5a-MUM-727		N-5a-MUM-729		N-5a-MUM-731		AVERAGE	TU
Aluminum		3280		8.59		53.4	1114	4656
Antimony	ND	0.186	ND	0.177	ND	0.181	0.18 #	0.03
Arsenic		49.7		35.2		41.4	42	19
Barium		9.69		2.73		3.79	5.4	9.3
Beryllium		0.194		0.165		0.196	0.19	0.05
Boron		NA		NA		NA	NA	NA
Cadmium	ND	0.032	ND	0.028		0.141	0.07 #	0.16
Chromium		3.08		3.48		2.58	3.0	1.2
Cobalt	ND	0.061	ND	0.055	ND	0.059	0.06 #	0.01
Copper		4.87		3.17		4.02	4.0	2.2
Lead		1.65		1.12		2.04	1.6	1.2
Manganese		4.80		2.42		2.99	3.4	3.1
Mercury		17.1		12.5		13.7	14	6.4
Molybdenum		2.56		2.52		1.69	2.3	1.3
Nickel		0.824		0.551		0.275	0.55	0.69
Potassium		2040	ND	0.429		73.4	705 #	2871
Selenium		85.6		33.1		66.4	62	67
Sodium		4762	ND	15.1		525	1767 #	6469
Titanium		32.1		16.9		21.4	23	20
Vanadium		2.34		2.37		2.88	2.5	0.85

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

NA = Not analyzed.

Average emission factor was calculated from one or more non-detects.

TABLE 6-8. EMISSION FACTORS FOR AMMONIA/CYANIDE (lb/10¹² BTU)

Analyte	N-5a-NH4-727		N-5a-NH4-729		N-5a-NH4-731		AVERAGE	TU
	N-5a-CN-727		N-5a-CN-729		N-5a-CN-731			
Ammonia	ND	0.359		208	ND	0.356	70 #	298
Cyanide		72.1		165		302	180	288

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-9. EMISSION FACTORS FOR AMMONIA/CYANIDE (μg/MJ)

Analyte	N-5a-NH4-727		N-5a-NH4-729		N-5a-NH4-731		AVERAGE	TU
	N-5a-CN-727		N-5a-CN-729		N-5a-CN-731			
Ammonia	ND	0.154		89.5	ND	0.153	30 #	128
Cyanide		31.0		71.0		130	77	124

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-10. EMISSION FACTORS FOR ANIONS (lb/10⁶ 12 BTU)

Analyte	N-5a-FCL-727	N-5a-FCL-729	N-5a-FCL-731	AVERAGE	TU
Hydrogen Chloride	138594	128797	128756	132049 =	25262
Hydrogen Fluoride	7995	9290	9479	8921 =	2455
Chloride (Particulate) *	8.85	23.2	23.6	19	21
Fluoride (Particulate) *	5.18	9.41	18.9	11	18
Phosphate (Particulate) *	ND 12.2	147	173	111 #	215
Sulfate (Particulate) *	13355	10512	12978	12282	4298

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor calculated from one or more non-detects.

* Sampling for anions was conducted at a single point in the duct; traverses were not made.

TABLE 6-11. EMISSION FACTORS FOR ANIONS (μg/MJ)

Analyte	N-5a-FCL-727	N-5a-FCL-729	N-5a-FCL-731	AVERAGE	TU
Hydrogen Chloride	59596	55383	55365	56781	10863
Hydrogen Fluoride	3438	3995	4076	3836	1056
Chloride (Particulate) *	3.81	10.0	10.2	8.0	9.1
Fluoride (Particulate) *	2.23	4.05	8.13	4.8	7.5
Phosphate (Particulate) *	ND 5.25	63.2	74.3	48 #	92
Sulfate (Particulate) *	5743	4520	5580	5281	1848

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

* Sampling for anions was conducted at a single point in the duct; traverses were not made.

TABLE 6-12. EMISSION FACTORS FOR VOC (lb/10⁶ BTU)

Analyte	N-5a-VOS-726		N-5a-VOS-728		N-5a-VOS-730		AVERAGE	TU
X Chloromethane		9.60	ND	2.59	ND	2.44	4.9 #	10
X Bromomethane	ND	2.58	ND	4.72	ND	2.44	3.2 #	3.2
X Vinyl Chloride	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Chloroethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Methylene Chloride		NC		NC		NC	NC	NC
Acetone		NC		NC		NC	NC	NC
X Carbon Disulfide	ND	2.62		6.14		9.05	5.9 #	8.0
1,1-Dichloroethene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X 1,1-Dichloroethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
Trans-1,2-Dichloroethene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Chloroform	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X 1,2-Dichloroethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X 2-Butanone	ND	2.58		10.21	ND	2.44	5.1 #	11
X 1,1,1-Trichloroethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Carbon Tetrachloride	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Vinyl Acetate	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
Bromodichloromethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X 1,2-Dichloropropane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
cis-1,3-Dichloropropylene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Trichloroethene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
Dibromochloromethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X 1,1,2-Trichloroethane	ND	2.58	ND	2.31	ND	2.44	2.4 #	0.53
X Benzene		5.97		10.4		7.28	7.9	5.7
X trans-1,3-Dichloropropylene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
2-Chloroethylvinylether	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Bromoform	ND	2.58	ND	2.31	ND	2.44	2.4 #	0.53
4-Methyl-2-Pentanone	ND	2.58		9.96	ND	2.44	5.0 #	11
2-Hexanone	ND	2.58		18.3	ND	2.44	7.8 #	23
X Tetrachloroethene		4.29	ND	2.59	ND	2.44	3.1 #	2.6
X 1,1,2,2-Tetrachloroethane	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Toluene		6.80	ND	2.31	ND	1.30	3.5 #	7.3
X Chlorobenzene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Ethylbenzene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Styrene	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47
X Xylenes (Total)	ND	2.58	ND	2.59	ND	2.44	2.5 #	0.47

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

NC = Not calculated.

Average emission factor was calculated from one or more non-detects.

TABLE 6-14. EMISSION FACTORS FOR PAH/SVOC (lb/10¹² BTU)

Analyte	N-5a-MM- F+X-726		N-5a-MM- F+X-728		N-5a-MM- F+X-730		AVERAGE	TU
✓ Benzylchloride	ND	0.0085	ND	0.0084	ND	0.0008	0.0059 #	0.0111
✓ Acetophenone		0.8829		0.7183		0.3070	0.6360	0.7425
✓ Hexachloroethane	ND	0.0085	ND	0.0084	ND	0.0008	0.0059 #	0.0111
✓ Naphthalene		0.3056		0.2323		0.1080	0.2153	0.2500
✓ Hexachlorobutadiene	ND	0.0085	ND	0.0084	ND	0.0008	0.0059 #	0.0111
✓ 2-Chloroacetophenone		0.4607		0.3452		0.0577	0.2879	0.5166
1-Methylnaphthalene		0.0791		0.0219		0.0115	0.0375	0.0905
2-Methylnaphthalene		0.0327		0.0102		0.0042	0.0157	0.0372
✓ Hexachlorocyclopentadiene	ND	0.0085	ND	0.0084	ND	0.0008	0.0059 #	0.0111
✓ Biphenyl		0.0590		0.2904		0.0278	0.1257	0.3563
✓ Acenaphthylene		0.0176	ND	0.0017		0.0010	0.0068 #	0.0233
2,6-Dinitrotoluene		0.6602		0.4998		0.5031	0.5544	0.2437
Acenaphthene		0.0646		0.0135		0.0014	0.0265	0.0833
Dibenzofuran		0.1234		0.0442		0.0286	0.0654	0.1264
2,4-Dinitrotoluene		0.0296	ND	0.0084		0.0209	0.0197 #	0.0266
Fluorene		0.0729		0.0125		0.0086	0.0313	0.0895
Hexachlorobenzene	ND	0.0085	ND	0.0084	ND	0.0008	0.0059 #	0.0111
Pentachlorophenol	ND	0.0085	ND	0.0084	ND	0.0008	0.0059 #	0.0111
Phenanthrene		0.1554		0.0547		0.0227	0.0776	0.1722
Anthracene		0.0529		0.0070		0.0020	0.0207	0.0696
Fluoranthene		0.0461		0.0247		0.0103	0.0270	0.0449
Pyrene		0.0249		0.0139		0.0030	0.0139	0.0272
Benz(a)anthracene		0.0081	ND	0.0017		0.0012	0.0037 #	0.0095
Chrysene		0.0185		0.0047		0.0036	0.0089	0.0206
Benzo(b & k)fluoranthene		0.0183	ND	0.0017		0.0011	0.0070 #	0.0243
Benzo(e)pyrene		0.0046	ND	0.0017	ND	0.0002	0.0021 #	0.0056
Benzo(a)pyrene	ND	0.0017	ND	0.0017	ND	0.0002	0.0012 #	0.0022
Indeno(1,2,3-c,d)pyrene	ND	0.0017	ND	0.0017	ND	0.0002	0.0012 #	0.0022
Dibenzo(a,h)anthracene	ND	0.0017	ND	0.0017	ND	0.0002	0.0012 #	0.0022
Benzo(g,h,i)perylene	ND	0.0017	ND	0.0017	ND	0.0002	0.0012 #	0.0022

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-16. EMISSION FACTORS FOR DIOXINS/FURANS (lb/10¹² BTU)

Analyte	N-5a-MM5-726	N-5a-MM5-728	N-5a-MM5-730	AVERAGE	TU
2,3,7,8-Tetrachlorodibenzo-p-dioxin	ND 1.39E-06	ND 8.50E-07	ND 9.20E-07	1.05E-06 #	7.50E-07
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ND 2.00E-06	ND 1.14E-06	ND 1.13E-06	1.42E-06 #	1.25E-06
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	ND 2.85E-06	ND 1.20E-06	ND 1.05E-06	1.70E-06 #	2.49E-06
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	6.69E-06	ND 1.12E-06	ND 1.06E-06	2.96E-06 #	8.04E-06
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	6.86E-06	ND 6.90E-07	ND 1.00E-06	2.85E-06 #	8.64E-06
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	3.70E-05	5.72E-06	8.43E-06	1.71E-05	4.31E-05
Octachlorodibenzo-p-dioxin	5.36E-05	1.14E-06	2.01E-06	1.89E-05	7.46E-05
2,3,7,8-Tetrachlorodibenzofuran	1.03E-05	2.14E-06	ND 1.82E-06	4.76E-06 #	1.20E-05
1,2,3,7,8-Pentachlorodibenzofuran	ND 2.86E-06	ND 8.10E-07	ND 1.43E-06	1.70E-06 #	2.63E-06
2,3,4,7,8-Pentachlorodibenzofuran	ND 5.42E-06	ND 8.90E-07	3.34E-06	3.22E-06 #	5.64E-06
1,2,3,4,7,8-Hexachlorodibenzofuran	2.43E-05	ND 1.54E-06	ND 2.93E-06	9.61E-06 #	3.17E-05
1,2,3,6,7,8-Hexachlorodibenzofuran	8.42E-06	ND 1.11E-06	ND 1.99E-06	3.84E-06 #	9.91E-06
1,2,3,7,8,9-Hexachlorodibenzofuran	1.26E-05	ND 2.09E-06	4.90E-06	6.53E-06 #	1.35E-05
2,3,4,6,7,8-Hexachlorodibenzofuran	ND 1.76E-06	ND 7.80E-07	ND 1.21E-06	1.25E-06 #	1.24E-06
1,2,3,4,6,7,8-Heptachlorodibenzofuran	4.03E-05	6.71E-06	ND 4.45E-06	1.72E-05 #	4.98E-05
1,2,3,4,7,8,9-Heptachlorodibenzofuran	7.63E-06	ND 1.36E-06	ND 1.86E-06	3.62E-06 #	8.66E-06
Octachlorodibenzofuran	3.05E-05	1.20E-05	1.61E-05	1.95E-05	2.43E-05

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-17. EMISSION FACTORS FOR DIOXINS/FURANS (µg/MJ)

Analyte	N-5a-MM5-726	N-5a-MM5-728	N-5a-MM5-730	AVERAGE	TU
2,3,7,8-Tetrachlorodibenzo-p-dioxin	ND 5.98E-07	ND 3.66E-07	ND 3.96E-07	4.51E-07 #	3.23E-07
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ND 8.60E-07	ND 4.90E-07	ND 4.86E-07	6.11E-07 #	5.38E-07
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	ND 1.23E-06	ND 5.16E-07	ND 4.51E-07	7.31E-07 #	1.07E-06
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	2.88E-06	ND 4.82E-07	ND 4.56E-07	1.27E-06 #	3.46E-06
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	2.95E-06	ND 2.97E-07	ND 4.30E-07	1.23E-06 #	3.72E-06
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1.59E-05	2.46E-06	3.62E-06	7.34E-06	1.85E-05
Octachlorodibenzo-p-dioxin	2.30E-05	4.90E-07	8.64E-07	8.14E-06	3.21E-05
2,3,7,8-Tetrachlorodibenzofuran	4.45E-06	9.20E-07	ND 7.83E-07	2.05E-06 #	5.16E-06
1,2,3,7,8-Pentachlorodibenzofuran	ND 1.23E-06	ND 3.48E-07	ND 6.15E-07	7.31E-07 #	1.13E-06
2,3,4,7,8-Pentachlorodibenzofuran	ND 2.33E-06	ND 3.83E-07	1.44E-06	1.38E-06 #	2.43E-06
1,2,3,4,7,8-Hexachlorodibenzofuran	1.05E-05	ND 6.62E-07	ND 1.26E-06	4.13E-06 #	1.36E-05
1,2,3,6,7,8-Hexachlorodibenzofuran	3.62E-06	ND 4.77E-07	ND 8.56E-07	1.65E-06 #	4.26E-06
1,2,3,7,8,9-Hexachlorodibenzofuran	5.41E-06	ND 8.99E-07	2.11E-06	2.81E-06 #	5.81E-06
2,3,4,6,7,8-Hexachlorodibenzofuran	ND 7.57E-07	ND 3.35E-07	ND 5.20E-07	5.38E-07 #	5.33E-07
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.73E-05	2.89E-06	ND 1.91E-06	7.37E-06 #	2.14E-05
1,2,3,4,7,8,9-Heptachlorodibenzofuran	3.28E-06	ND 5.85E-07	ND 8.00E-07	1.56E-06 #	3.72E-06
Octachlorodibenzofuran	1.31E-05	5.17E-06	6.90E-06	8.40E-06	1.05E-05

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-18. EMISSION FACTORS FOR ALDEHYDES (lb/10³ BTU)

Analyte	N-5a-ALD-726	N-5a-ALD-726	N-5a-ALD-726	AVERAGE	TU
Formaldehyde	7.73	3.26	ND 0.803	3.9 #	8.7
Acetaldehyde	69.9	171	27.3	89	184
Acrolein	3.99	111	7.18	41	151
Propionaldehyde	31.3	41.6	1.08	25	52

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-19. EMISSION FACTORS FOR ALDEHYDES (μg/MJ)

Analyte	N-5a-ALD-726	N-5a-ALD-726	N-5a-ALD-726	AVERAGE	TU
Formaldehyde	3.32	1.40	ND 0.345	1.7 #	3.8
Acetaldehyde	30.0	73.7	11.7	38	79
Acrolein	1.72	47.8	3.09	18	65
Propionaldehyde	13.5	17.9	0.462	11	23

TU = Total uncertainty.

ND = Emission factor calculated using one half of the detection limit.

Average emission factor was calculated from one or more non-detects.

TABLE 6-22. EMISSION FACTORS FOR PARTICULATE MATTER (lb/10¹² BTU)

Analyte	N-5a-MUM-727	N-5a-MUM-729	N-5a-MUM-731	AVERAGE	TU
Particulate Matter	27213	11502	20192	19636	19779

TU = Total uncertainty.

TABLE 6-23. EMISSION FACTORS FOR PARTICULATE MATTER (μg/MJ)

Analyte	N-5a-MUM-727	N-5a-MUM-729	N-5a-MUM-731	AVERAGE	TU
Particulate Matter	11702	4946	8683	8443	8505

TU = Total uncertainty.

TEST REPORT TITLE:

A Study of Toxic Emissions From a Coal-Fired Power Plant-
Battelle, Columbus, Ohio. December 29, 1993.

COAL EF DATABASE REFERENCE NO.

25

FILENAME

DOE2.WK1

FACILITY:

Niles, Ohio

PROCESS DATA

Coal type a Bituminous
Boiler configuration a Cyclone
Coal source a Ohio/W. Pa.
SCC 10100203
Control device 1 a ESP
Control device 2 None
Control device 3 None
Data Quality B
Process Parameters a 108 MW
Test methods Assumed EPA, or EPA-approved, test methods
Number of test runs b 3

Coal HHV, as received (Btu/lb) c 12,184
Coal HHV, as received (Btu/ton) 24,368,000
Coal HHV, as received (MMBtu/ton) 24.4

a Page 2-1

b Pages 6-24, 6-26, 6-27, 6-28, 6-30, 6-32, 6-33, 6-35

c Page 2-18. Average of 11964, 12504, 12397, 12139, 12031, and 12068 Btu/lb.

METALS EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
Aluminum	1114	1.11E-03	2.71E-02
Antimony b	0.18	1.80E-07	4.39E-06
Arsenic	42	4.20E-05	1.02E-03
Barium	5.4	5.40E-06	1.32E-04
Beryllium	0.19	1.90E-07	4.63E-06
Cadmium c	0.07	7.00E-08	1.71E-06
Chromium	3.0	3.00E-06	7.31E-05
Cobalt b	0.06	6.00E-08	1.46E-06
Copper	4.0	4.00E-06	9.75E-05
Lead	1.6	1.60E-06	3.90E-05
Manganese	3.4	3.40E-06	8.29E-05

Mercury	14	1.40E-05	3.41E-04
Molybdenum	2.3	2.30E-06	5.60E-05
Nickel	0.55	5.50E-07	1.34E-05
Potassium d	705	7.05E-04	1.72E-02
Selenium	62.0	6.20E-05	1.51E-03
Sodium	1767	1.77E-03	4.31E-02
Titanium	23	2.30E-05	5.60E-04
Vanadium	2.5	2.50E-06	6.09E-05

a Page 6-24, "Average" values.

b Pollutant was not detected in any of the sampling runs.

c Detection limit values (1/2) for two runs used in developing EF.

d Detection limit value (1/2) for one run used in developing EF.

AMMONIA/CYANIDE EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
Ammonia b	70	7.00E-05	1.71E-03
Cyanide	180	1.80E-04	4.39E-03

a Page 6-26, Table 6-8, "Average" values.

b Detection limit values (1/2) for two runs used in developing EF.

HCl, HFl EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
Hydrogen Chloride	132,049	1.32E-01	3.22E+00
Hydrogen Fluoride	8,921	8.92E-03	2.17E-01

Page 6-27, Table 6-10, "Average" values.

VOC EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
Chloromethane (Methyl Chloride) c	4.9	4.90E-06	1.19E-04
Bromomethane (Methyl Bromide) d	3.2	3.20E-06	7.80E-05
Vinyl Chloride d	2.5	2.50E-06	6.09E-05
Chloroethane (Ethyl Chloride) d	2.5	2.50E-06	6.09E-05
Carbon Disulfide b	5.9	5.90E-06	1.44E-04
1,1-Dichloroethane (Ethylidene Dichloride) d	2.5	2.50E-06	6.09E-05
Chloroform d	2.5	2.50E-06	6.09E-05

1,2-Dichloroethane (Ethylene Dichloride) d	2.5	2.50E-06	6.09E-05
2-Butanone (Methyl Ethyl Ketone) c	5.1	5.10E-06	1.24E-04
1,1,1-Trichloroethane d	2.5	2.50E-06	6.09E-05
Carbon Tetrachloride d	2.5	2.50E-06	6.09E-05
Vinyl Acetate d	2.5	2.50E-06	6.09E-05
1,2-Dichloropropane (Propylene Dichloride) d	2.5	2.50E-06	6.09E-05
Trichloroethene d	2.5	2.50E-06	6.09E-05
1,1,2-Trichloroethane d	2.4	2.40E-06	5.85E-05
Benzene	7.9	7.90E-06	1.93E-04
1,3-Dichloropropylene d	2.5	2.50E-06	6.09E-05
Bromoform d	2.4	2.40E-06	5.85E-05
Tetrachloroethene c	3.1	3.10E-06	7.55E-05
1,1,2,2-Tetrachloroethane d	2.5	2.50E-06	6.09E-05
Toluene c	3.5	3.50E-06	8.53E-05
Chlorobenzene d	2.5	2.50E-06	6.09E-05
Ethylbenzene d	2.5	2.50E-06	6.09E-05
Styrene d	2.5	2.50E-06	6.09E-05
Xylenes d	2.5	2.50E-06	6.09E-05

a Page 6-28 (only 189 HAPs).

b Detection limit values (1/2) for one run used in developing EF.

c Detection limit values (1/2) for two runs used in developing EF.

d Pollutant not detected in any sampling runs.

PAH/SVOC EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
Benzyl chloride d	0.0059	5.90E-09	1.44E-07
Acetophenone	0.6360	6.36E-07	1.55E-05
Hexachloroethane d	0.0059	5.90E-09	1.44E-07
Naphthalene	0.2153	2.15E-07	5.25E-06
Hexachlorobutadiene d	0.0059	5.90E-09	1.44E-07
2-Chloroacetophenone	0.2879	2.88E-07	7.02E-06
Biphenyl	0.1257	1.26E-07	3.06E-06
Acenaphthylene b	0.0068	6.80E-09	1.66E-07
Acenaphthene	0.0265	2.65E-08	6.46E-07
Dibenzofurans	0.0654	6.54E-08	1.59E-06
2,4-Dinitrotoluene b	0.0197	1.97E-08	4.80E-07
Fluorene	0.0313	3.13E-08	7.63E-07
Hexachlorobenzene d	0.0059	5.90E-09	1.44E-07
Phenanthrene	0.0776	7.76E-08	1.89E-06
Anthracene	0.0207	2.07E-08	5.04E-07
Fluoranthene	0.0270	2.70E-08	6.58E-07
Pyrene	0.0139	1.39E-08	3.39E-07
Benzo(a)anthracene b	0.0037	3.70E-09	9.02E-08
Chrysene	0.0089	8.90E-09	2.17E-07
Benzo(b,k)fluoranthene	0.0070	7.00E-09	1.71E-07

Benzo(a)pyrene d	0.0012	1.20E-09	2.92E-08
Indeno(1,2,3-c,d)pyrene d	0.0012	1.20E-09	2.92E-08
Benzo(g,h,i)perylene d	0.0012	1.20E-09	2.92E-08

- a Page 6-30 (most common PAHs, 189 HAPs).
- b Detection limit values (1/2) for one run used in developing EF.
- c Detection limit values (1/2) for two runs used in developing EF.
- d Pollutant not detected in any sampling runs.

DIOXINS/FURANS EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
2,3,7,8-TCDD d	9.90E-07	9.90E-13	2.41E-11
OCDD	1.51E-05	1.51E-11	3.68E-10
2,3,7,8-TCDF	9.89E-06	9.89E-12	2.41E-10
OCDF b	6.29E-06	6.29E-12	1.53E-10

- a Page 6-86
- b Detection limit values (1/2) for one run used in developing EF.
- d Pollutant not detected in any sampling runs.

ALDEHYDES EMISSION FACTORS

Pollutant	Emission Factor (lb/10 ¹² Btu) a	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
Formaldehyde c	1.8	1.80E-06	4.39E-05
Acetaldehyde	67	6.70E-05	1.63E-03
Acrolein d	1.1	1.10E-06	2.68E-05
Propionaldehyde	12	1.20E-05	2.92E-04

- a Page 6-88
- b Detection limit values (1/2) for one run used in developing EF.
- c Detection limit values (1/2) for two runs used in developing EF.
- d Pollutant not detected in any sampling runs.

PM, FILTERABLE, EMISSION FACTOR a

Emission Factor (lb/10 ¹² Btu) b	Emission Factor (lb/MMBtu)	Emission Factor (lb/ton)
10,367	1.04E-02	2.53E-01

- a Charlie Parrish, Radian, says PM reported from a Multi-metals Method 29 train is "filterable".
- b Page 6-92

=====