



**NTH Consultants, Ltd.**

Infrastructure Engineering  
and Environmental Services

608 S. Washington Avenue  
Lansing, MI 48933  
517.484.6900  
517.485.8323 Fax

Mr. David Riddle  
Senior Environmental Engineer  
Michigan Dept. of Environmental Quality  
AQD - Thermal Process Unit  
P.O. Box 30260  
Lansing, MI 48909

April 24, 2008  
NTH Project No. 16-060504

**RE: Clean Air Act – Section 112(g) Applicability Review  
Northern Michigan University**

Dear Mr. Riddle:


Northern Michigan University (NMU) has taken an inventory of existing equipment in order to determine whether the campus would be a major source of hazardous air pollutants (HAP) as a result of constructing and installing the new CFB boiler at the Ripley Heating Plant. A total of 34 miscellaneous natural gas-fired boilers were found in their inventory. These boilers range in size from less than 1 MMBtu/hr to 70 MMBtu/hr. Further, nine natural gas and 5 diesel-fired emergency generators were found.

NTH has calculated the potential HAP emissions for all known equipment owned and operated by NMU and on-site at the Marquette, MI campus. We have determined that NMU is not currently an existing major source for HAPs and will not become a major source for HAPs with the installation of the new CFB boiler. Therefore, NMU is not subject to Section 112(g) of the Clean Air Act (CAA) for a case-by-case determination for maximum achievable control technology (MACT).

I am including an updated spreadsheet that shows the maximum HAP emissions for the new CFB boiler as well as a listing of the additional equipment found at the campus and a spreadsheet showing the emissions of HAPs from this additional equipment. Should you have any questions regarding the information presented, please do not hesitate to contact me.

Sincerely,

NTH Consultants, Ltd.



Jeffrey P. Jaros  
Project Manager

cc: Mr. Mike Hellman, Northern Michigan University  
Mr. Steve Yambor, C&B|HDR, Inc.  
Mr. Randy Russell, C&B|HDR, Inc.

Enclosures

JPJ/mjb

<b>Natural Gas-fired Emergency Generators</b>	<b>Fuel</b>	<b>Size (kW)</b>	<b>Heat Input (MMBtu/hr)</b>
PEIF	Natural Gas	75	0.26
University Center	Natural Gas	20	0.07
Berry Events Center	Natural Gas	114	0.39
Van Antwerp	Natural Gas	130	0.44
LRC	Natural Gas	130	0.44
Meyland Hall	Natural Gas	50	0.17
Hedgcock - Student Services	Natural Gas	180	0.61
West Science	Natural Gas	450	1.54
Woodland Apartments	Natural Gas	80	0.27
<b>Total Natural Gas Heat Input (MMBtu/hr)</b>			<b>4.20</b>
<b>Diesel-fired Emergency Generators</b>	<b>Fuel</b>	<b>Size (kW)</b>	<b>Size (hp)</b>
Superior Dome	Diesel	300	402
Jacobetti Center	Diesel	140	188
Art & Design	Diesel	300	402
<b>Total hp of Diesel-fired up to 600 hp</b>			<b>992</b>
Ripley Heating Plant	Diesel	600	685
NSF	Diesel	450	603
<b>Total hp of Diesel-fired &gt;600 hp</b>			<b>1288</b>



Boiler	Size	Units
Ripley Heating Plant (as natural gas-fired)	166	MMBtu/hr
34 Miscellaneous Boilers	173	MMBtu/hr
Nat. Gas. Emergency Gens (total)	4.20	MMBtu/hr
Total hp of Diesel-fired up to 600 hp	992	hp
Total hp of Diesel-fired >600 hp	1288	hp

Compound	Natural Gas-fired Boilers						
	Emission Factors			Ripley Heating Plant		34 Misc. Boilers	
	Value	Units	Basis	Emission Rates		Emission Rates	
				(lb/hr)	(tpy)	(lb/hr)	(tpy)
Dibenzo(a,h)anthracene	1.18E-09	lb/MMBtu	AP-42	1.95E-07	8.55E-07	2.04E-07	8.91E-07
Fluoranthene	2.94E-09	lb/MMBtu	AP-42	4.88E-07	2.14E-06	5.09E-07	2.23E-06
Fluorene	2.75E-09	lb/MMBtu	AP-42	4.56E-07	2.00E-06	4.75E-07	2.08E-06
Indeno(1,2,3,c,d)pyrene	1.76E-09	lb/MMBtu	AP-42	2.93E-07	1.28E-06	3.05E-07	1.34E-06
Naphthalene <sup>1</sup>	5.98E-07	lb/MMBtu	AP-42	9.93E-05	4.35E-04	1.03E-04	4.53E-04
PAH							
Phenanthrene	1.67E-08	lb/MMBtu	AP-42	2.77E-06	1.21E-05	2.88E-06	1.26E-05
Pyrene	4.90E-09	lb/MMBtu	AP-42	8.14E-07	3.56E-06	8.48E-07	3.71E-06
<b>Total POMs</b>				<b>1.14E-04</b>	<b>4.98E-04</b>	<b>1.18E-04</b>	<b>5.19E-04</b>
<b>Maximum Single HAP</b>				<b>0.29</b>	<b>1.28</b>	<b>0.31</b>	<b>1.34</b>
<b>Aggregate HAPs</b>				<b>0.31</b>	<b>1.35</b>	<b>0.32</b>	<b>1.40</b>

Compound	Diesel-fired Emergency Generators >600 hp				
	Emission Factors			Emission Rates	
	Value	Units	Basis	Emission Rates	
				(lb/hr) <sup>2</sup>	(tpy)
Dibenzo(a,h)anthracene	3.46E-07	lb/MMBtu	AP-42	3.12E-06	1.37E-05
Fluoranthene	4.03E-06	lb/MMBtu	AP-42	3.63E-05	1.59E-04
Fluorene	1.28E-05	lb/MMBtu	AP-42	1.15E-04	5.06E-04
Indeno(1,2,3,c,d)pyrene	4.14E-07	lb/MMBtu	AP-42	3.73E-06	1.64E-05
Naphthalene <sup>1</sup>	1.30E-04	lb/MMBtu	AP-42	1.17E-03	5.14E-03
PAH	2.12E-04	lb/MMBtu		1.91E-03	8.37E-03
Phenanthrene	4.08E-05	lb/MMBtu	AP-42	3.68E-04	1.61E-03
Pyrene	3.71E-06	lb/MMBtu	AP-42	3.35E-05	1.47E-04
<b>Total POMs</b>				<b>3.82E-03</b>	<b>1.67E-02</b>
<b>Maximum Single HAP</b>				<b>0.01</b>	<b>0.03</b>
<b>Aggregate HAPs</b>				<b>0.02</b>	<b>0.07</b>

Compound	Diesel-fired Emergency Generators up to 600 hp				
	Emission Factors			Emission Rates	
	Value	Units	Basis	Emission Rates	
				(lb/hr) <sup>2</sup>	(tpy)
Dibenzo(a,h)anthracene	5.83E-07	lb/MMBtu	AP-42	4.05E-06	1.77E-05
Fluoranthene	7.61E-06	lb/MMBtu	AP-42	5.29E-05	2.32E-04
Fluorene	2.92E-05	lb/MMBtu	AP-42	2.03E-04	8.88E-04
Indeno(1,2,3,c,d)pyrene	3.75E-07	lb/MMBtu	AP-42	2.60E-06	1.14E-05
Naphthalene <sup>1</sup>	8.48E-05	lb/MMBtu	AP-42	5.89E-04	2.58E-03
PAH					
Phenanthrene	2.94E-05	lb/MMBtu	AP-42	2.04E-04	8.95E-04
Pyrene	4.78E-06	lb/MMBtu	AP-42	3.32E-05	1.45E-04
<b>Total POMs</b>				<b>1.17E-03</b>	<b>5.11E-03</b>
<b>Maximum Single HAP</b>				<b>0.01</b>	<b>0.04</b>
<b>Aggregate HAPs</b>				<b>0.03</b>	<b>0.12</b>

Compound	Natural Gas-fired Emergency Generators (2-stroke Lean Burn)				
	Emission Factors			Emission Rates	
	Value	Units	Basis	Emission Rates	
				(lb/hr)	(tpy)
Dibenzo(a,h)anthracene	3.61E-07	lb/MMBtu	AP-42	1.51E-06	6.63E-06
Fluoranthene	1.69E-06	lb/MMBtu	AP-42	7.09E-06	3.11E-05
Fluorene	9.93E-09	lb/MMBtu	AP-42	4.17E-08	1.82E-07
Indeno(1,2,3,c,d)pyrene	9.63E-05	lb/MMBtu	AP-42	4.04E-04	1.77E-03
Naphthalene <sup>1</sup>	1.34E-04	lb/MMBtu	AP-42	5.62E-04	2.46E-03
PAH	3.53E-06	lb/MMBtu	AP-42	1.48E-05	6.49E-05
Phenanthrene	5.84E-07	lb/MMBtu	AP-42	2.45E-06	1.07E-05
<b>Total POMs</b>				<b>1.12E-03</b>	<b>4.93E-03</b>
<b>Maximum Single HAP</b>				<b>0.23</b>	<b>1.01</b>
<b>Aggregate HAPs</b>				<b>0.33</b>	<b>1.46</b>

<sup>1</sup> These pollutants belong to the POM family as well as having their own unique HAP listing

<sup>2</sup> From AP-42 for diesel engines, 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr

Total campus-wide HAP emissions from existing equipment **4.40 tons per year**  
 Total HAP emissions from proposed CFB boiler **14.55 tons per year**  
**18.95 tons per year**

Boiler Parameters	Specification
Boiler Type	Circulating Fluidized Bed
Maximum Rated Heat Input. (MM btu/hr)	185
Gross Output (MW/hr)	10 (Approximate; normally 7)

Material	Sulfur Content	Material Usage (%)	Heat Input (MM BTU/hr)	Heating Value (BTU/lb)	Material Throughput (lb/hr)	Material Throughput (tph)	Material Throughput (tpy)	Natural Gas Maximum Usage Rate MMscf/hr
Coal, Bituminous	3.50%	100.0%	185	11,800	15,678	7.84	68,669	0.1814
Coal, PRB	0.60%	100.0%	185	8,500	21,765	10.88	95,329	
Natural Gas	0.00%	100.0%	185	23,200	7,974	3.99	34,927	
Virgin Wood	0.00%	100.0%	205	4,500	45,556	22.78	199,533	

TABLE B-1. EMISSION RATES OF CRITERIA POLLUTANTS, HAPS, AND TACS FROM THE NEW BOILER ON A PER-FUEL BASIS

Compound	CAS Reference Number	Coal, Bituminous				Coal, PRB				Natural Gas				Waste Wood			
		Emission Factors		Emission Rates		Emission Factors		Emission Rates		Emission Factors		Emission Rates		Emission Factors		Emission Rates	
		Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)
PM <sub>10</sub> (filterable and condensable)		0.03	lb/MMBtu	5.6	24.3	0.03	lb/MMBtu	5.6	24.3					0.03	lb/MMBtu	6.2	26.9
SO <sub>2</sub>	7446095	0.475	lb/MMBtu	87.8	384.5	0.200	lb/MMBtu	37.0	162.1					0.025	lb/MMBtu	5.1	22.4
NO <sub>x</sub>	10102440	0.10	lb/MMBtu	18.5	81.0	0.10	lb/MMBtu	18.5	81.0	0.10	lb/MMBtu	18.5	81.0	0.10	lb/MMBtu	20.5	89.8
CO	630080	0.15	lb/MMBtu	27.8	121.5	0.15	lb/MMBtu	27.8	121.5	0.15	lb/MMBtu	27.8	121.5	0.17	lb/MMBtu	34.9	152.6
Lead **	7439921	1.34E-05	lb/MMBtu	0.002	0.011	4.52E-06	lb/MMBtu	0.001	0.004					5.52E-07	lb/MMBtu	1.13E-04	4.96E-04
VOC		0.002	lb/MMBtu	0.45	1.97	0.003	lb/MMBtu	0.63	2.74	6.33	lb/MMscf	1.15	5.0	0.02	lb/MMBtu	4.0	17.6
Mercury	7439976	3.00E-06	lb/MMBtu	5.55E-04	2.43E-03	3.00E-06	lb/MMBtu	5.55E-04	2.43E-03	2.99E-04	lb/MMscf	5.42E-05	2.38E-04	3.00E-06	lb/MMBtu	6.15E-04	2.69E-03
HCl ***	7647010	0.11	lb/ton	0.9	3.8	0.11	lb/ton	1.20	5.26								
HF ***	73602616	0.01	lb/ton	0.1	0.5	0.0138	lb/ton	0.15	0.66								
H <sub>2</sub> SO <sub>4</sub> (As Sulfuric Acid Mist) <sup>2</sup>	7664939	6.10E-03	lb/MMBtu	1.1	4.9	6.10E-03	lb/MMBtu	1.1	4.9								
Total Dioxin/Furan <sup>2</sup>	1746016	2.34E-12	lb/MMBtu	4.33E-10	1.90E-09	2.34E-12	lb/MMBtu	4.33E-10	1.90E-09								
<b>Metals</b>																	
Antimony *	7440360	9.09E-06	lb/MMBtu	1.68E-03	7.36E-03	9.09E-06	lb/MMBtu	1.68E-03	7.36E-03					9.09E-08	lb/MMBtu	1.86E-05	8.16E-05
Arsenic *	7440382	7.67E-07	lb/MMBtu	1.42E-04	6.22E-04	7.67E-07	lb/MMBtu	1.42E-04	6.22E-04	2.30E-04	lb/MMscf	4.17E-05	1.83E-04	2.53E-07	lb/MMBtu	5.19E-05	2.27E-04
Barium	7440393									5.06E-03	lb/MMscf	9.18E-04	4.02E-03	1.96E-06	lb/MMBtu	4.01E-04	1.76E-03
Beryllium *	7440417	2.00E-08	lb/MMBtu	3.70E-06	1.62E-05	2.00E-08	lb/MMBtu	3.70E-06	1.62E-05	1.38E-05	lb/MMscf	2.50E-06	1.10E-05	1.27E-08	lb/MMBtu	2.59E-06	1.14E-05
Cadmium *	7440439	9.59E-08	lb/MMBtu	1.77E-05	7.77E-05	9.59E-08	lb/MMBtu	1.77E-05	7.77E-05	1.27E-03	lb/MMscf	2.29E-04	1.00E-03	4.72E-08	lb/MMBtu	9.67E-06	4.23E-05
Chromium, total <sup>4</sup>	7440473	1.20E-06	lb/MMBtu	2.21E-04	9.69E-04	1.20E-06	lb/MMBtu	2.21E-04	9.69E-04	1.61E-03	lb/MMscf	2.92E-04	1.28E-03	2.42E-05	lb/MMBtu	4.95E-03	2.17E-02
Chromium, hexavalent *	18540299	3.59E-07	lb/MMBtu	6.64E-05	2.91E-04	3.59E-07	lb/MMBtu	6.64E-05	2.91E-04					4.03E-06	lb/MMBtu	8.25E-04	3.61E-03
Chromium, trivalent *	16065831	8.37E-07	lb/MMBtu	1.55E-04	6.78E-04	8.37E-07	lb/MMBtu	1.55E-04	6.78E-04								
Cobalt	7440484	1.15E-04	lb/ton	9.01E-04	3.95E-03	1.15E-04	lb/ton	1.25E-03	5.48E-03					7.48E-08	lb/MMBtu	1.53E-05	6.71E-05
Copper	7440508													5.64E-07	lb/MMBtu	1.16E-04	5.06E-04
Iron	7439896													1.14E-05	lb/MMBtu	2.33E-03	1.02E-02
Magnesium	7439954	1.27E-02	lb/ton	9.92E-02	4.34E-01	1.27E-02	lb/ton	1.38E-01	6.03E-01								
Manganese *	7439965	9.30E-06	lb/MMBtu	1.72E-03	7.54E-03	9.30E-06	lb/MMBtu	1.72E-03	7.54E-03	4.37E-04	lb/MMscf	7.93E-05	3.47E-04	1.84E-05	lb/MMBtu	3.77E-03	1.65E-02
Molybdenum	7439987									1.27E-03	lb/MMscf	2.29E-04	1.00E-03	2.42E-08	lb/MMBtu	4.95E-06	2.17E-05
Nickel *	7440020	1.67E-06	lb/MMBtu	3.09E-04	1.35E-03	1.67E-06	lb/MMBtu	3.09E-04	1.35E-03					3.80E-07	lb/MMBtu	7.78E-05	3.41E-04
Phosphorus	7723140													3.11E-07	lb/MMBtu	6.37E-05	2.79E-04
Potassium	7440097													4.49E-04	lb/MMBtu	9.19E-02	4.03E-01
Selenium	7782492	1.50E-03	lb/ton	1.18E-02	5.15E-02	1.50E-03	lb/ton	1.63E-02	7.15E-02					3.22E-08	lb/MMBtu	6.60E-06	2.89E-05
Silver	7440224													1.96E-05	lb/MMBtu	4.01E-03	1.76E-02
Sodium	7440235													4.14E-06	lb/MMBtu	8.49E-04	3.72E-03
Strontium	7440246													1.15E-07	lb/MMBtu	2.36E-05	1.03E-04
Tin	7440315													2.65E-07	lb/MMBtu	5.42E-05	2.37E-04
Titanium	7440326													2.30E-07	lb/MMBtu	4.72E-05	2.07E-04
Vanadium	7440622									2.65E-03	lb/MMscf	4.80E-04	2.10E-03	1.13E-08	lb/MMBtu	2.31E-06	1.01E-05
Yttrium	7440655													3.45E-09	lb/MMBtu	7.07E-07	3.10E-06
Zinc (as zinc oxide) *	1314132	2.83E-04	lb/MMBtu	5.23E-02	2.29E-01	2.83E-04	lb/MMBtu	5.23E-02	2.29E-01	3.34E-02	lb/MMscf	6.05E-03	2.65E-02	4.83E-06	lb/MMBtu	9.90E-04	4.34E-03
<b>Organic Compounds</b>																	
Acetaldehyde	75070	6.56E-04	lb/ton	5.14E-03	2.25E-02	6.56E-04	lb/ton	7.13E-03	3.12E-02					9.55E-04	lb/MMBtu	1.96E-01	8.57E-01
Acetophenone	98862	1.73E-05	lb/ton	1.35E-04	5.92E-04	1.73E-05	lb/ton	1.88E-04	8.22E-04					3.68E-09	lb/MMBtu	7.54E-07	3.30E-06
Acrolein	107028	3.34E-04	lb/ton	2.61E-03	1.15E-02	3.34E-04	lb/ton	3.63E-03	1.59E-02					1.16E-04	lb/MMBtu	2.39E-02	1.05E-01
Benzene	71432	1.50E-03	lb/ton	1.17E-02	5.13E-02	1.50E-03	lb/ton	1.63E-02	7.13E-02	2.42E-03	lb/MMscf	4.38E-04	1.92E-03	4.83E-03	lb/MMBtu	9.90E-01	4.34E+00
Benzyl chloride	100447	8.05E-04	lb/ton	6.31E-03	2.76E-02	8.05E-04	lb/ton	8.76E-03	3.84E-02								
Benzoic acid	65850													5.41E-08	lb/MMBtu	1.11E-05	4.85E-05
Bis(2-Ethylhexyl)phthalate	117817	8.40E-05	lb/ton	6.58E-04	2.88E-03	8.40E-05	lb/ton	9.14E-04	4.00E-03					5.41E-08	lb/MMBtu	1.11E-05	4.85E-05
Bromoform	75252	4.49E-05	lb/ton	3.52E-04	1.54E-03	4.49E-05	lb/ton	4.88E-04	2.14E-03								
Carbon disulfide	75150	1.50E-04	lb/ton	1.17E-03	5.13E-03	1.50E-04	lb/ton	1.63E-03	7.13E-03								
Carbazole	86748													2.07E-06	lb/MMBtu	4.24E-04	1.86E-03
Carbon tetrachloride	56235													5.18E-05	lb/MMBtu	1.06E-02	4.65E-02
Chlorine	7782505													9.09E-04	lb/MMBtu	1.86E-01	8.16E-01
2-Chloroacetophenone	532274	8.05E-06	lb/ton	6.31E-05	2.76E-04	8.05E-06	lb/ton	8.76E-05	3.84E-04					2.76E-09	lb/MMBtu	5.66E-07	2.48E-06
Chlorobenzene	108907	2.53E-05	lb/ton	1.98E-04	8.69E-04	2.53E-05	lb/ton	2.75E-04	1.21E-03					3.80E-05	lb/MMBtu	7.78E-03	3.41E-02
Chloroform	67663	6.79E-05	lb/ton	5.32E-04	2.33E-03	6.79E-05	lb/ton	7.38E-04	3.23E-03					3.22E-05	lb/MMBtu	6.60E-03	2.89E-02
2-Chloronaphthalene	91587													2.76E-09	lb/MMBtu	5.66E-07	2.48E-06
2-Chlorophenol	95578													2.76E-08	lb/MMBtu	5.66E-06	2.48E-05
Cumene	98828	6.10E-06	lb/ton	4.78E-05	2.09E-04	6.10E-06	lb/ton	6.63E-05	2.91E-04								
Cyanide	74908	2.88E-03	lb/ton	2.25E-02	9.87E-02	2.88E-03	lb/ton	3.13E-02	1.37E-01								
1,4-Dichlorobenzene	106467									1.38E-03	lb/MMscf	2.50E-04	1.10E-03				

TABLE B-2. MAXIMUM EMISSION RATES

Compound	Maximum Emission Rates		Fuel	Emission Factor lb/MMBtu
	(lb/hr)	(tpy)		
PM <sub>10</sub> (filterable and condensable)	6.15	26.9	Wood	3.00E-02
SO <sub>2</sub>	87.80	384.5	Coal	4.75E-01
NO <sub>x</sub>	20.50	89.8	Wood	1.00E-01
CO	34.85	152.6	Wood	1.70E-01
Lead	0.002	0.011	Coal	1.34E-05
VOC	4.01	17.6	Wood	1.96E-02
Mercury	6.15E-04	2.69E-03	Wood	3.00E-06
HCl	1.2	5.26	PRB Coal	6.49E-03
HF	0.2			

Boiler Parameters	Specification
Boiler Type	Circulating Fluidized Bed
Maximum Rated Heat Input, (MM btu/hr)	185
Gross Output (MW/hr)	10 (Approximate; normally 7)

Material	Sulfur Content	Material Usage (%)	Heat Input (MM BTU/hr)	Heating Value (BTU/lb)	Material Throughput (lb/hr)	Material Throughput (tph)	Material Throughput (tpy)	Natural Gas Maximum Usage Rate MMscf/hr
Coal, Bituminous	3.50%	100.0%	185	11,800	15,678	7.84	68,669	0.1814
Coal, PRB	0.60%	100.0%	185	8,500	21,765	10.88	95,329	
Natural Gas	0.00%	100.0%	185	23,200	7,974	3.99	34,927	
Virgin Wood	0.00%	100.0%	205	4,500	45,556	22.78	199,533	

TABLE B-1. EMISSION RATES OF CRITERIA POLLUTANTS, HAPS, AND TACS FROM THE NEW BOILER ON A PER-FUEL BASIS

Compound	CAS Reference Number	Coal, Bituminous				Coal, PRB				Natural Gas				Waste Wood			
		Emission Factors		Emission Rates		Emission Factors		Emission Rates		Emission Factors		Emission Rates		Emission Factors		Emission Rates	
		Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)
2,4-Dinitrotoluene	121142	3.22E-07	lb/ton	2.52E-06	1.11E-05	3.22E-07	lb/ton	3.50E-06	1.53E-05								
Dimethyl sulfate	77781	5.52E-05	lb/ton	4.33E-04	1.90E-03	5.52E-05	lb/ton	6.01E-04	2.63E-03								
2,4-Dinitrophenol	51285													2.07E-07	lb/MMBtu	4.24E-05	1.86E-04
Ethylbenzene	108678	1.08E-04	lb/ton	8.47E-04	3.71E-03	1.08E-04	lb/ton	1.18E-03	5.15E-03					3.57E-05	lb/MMBtu	7.31E-03	3.20E-02
Ethylchloride	75003	4.83E-05	lb/ton	3.79E-04	1.66E-03	4.83E-05	lb/ton	5.26E-04	2.30E-03								
Ethylene dichloride	107062	4.69E-05	lb/ton	3.61E-04	1.58E-03	4.69E-05	lb/ton	5.01E-04	2.19E-03								
Ethylene dibromide	106934	1.38E-06	lb/ton	1.08E-05	4.74E-05	1.38E-06	lb/ton	1.50E-05	6.58E-05								
Formaldehyde	50000	2.76E-04	lb/ton	2.16E-03	9.48E-03	2.76E-04	lb/ton	3.00E-03	1.32E-02	8.63E-02	lb/MMscf	1.56E-02	6.85E-02	5.06E-03	lb/MMBtu	1.04E+00	4.54E+00
Heptachlorobiphenyl	28655712													7.59E-11	lb/MMBtu	1.56E-08	6.82E-08
Hexachlorobiphenyl	26601649													6.33E-10	lb/MMBtu	1.30E-07	5.68E-07
Hexanal	66251													8.05E-06	lb/MMBtu	1.65E-03	7.23E-03
Hexane	110543	7.71E-05	lb/ton	6.04E-04	2.65E-03	7.71E-05	lb/ton	8.38E-04	3.67E-03	2.07E+00	lb/MMscf	3.75E-01	1.64E+00				
Isobutyraldehyde	78842													1.38E-05	lb/MMBtu	2.83E-03	1.24E-02
Isophorone	78591	6.67E-04	lb/ton	5.23E-03	2.29E-02	6.67E-04	lb/ton	7.26E-03	3.18E-02								
2-Methylnaphthalene	91576									2.76E-05	lb/MMscf	5.01E-06	2.19E-05	1.84E-07	lb/MMBtu	3.77E-05	1.65E-04
3-Methylchloranthrene										2.07E-06	lb/MMscf	3.75E-07	1.64E-06				
Monochlorobiphenyl														2.53E-10	lb/MMBtu	5.19E-08	2.27E-07
Methyl bromide (bromomethane)	74839	1.84E-04	lb/ton	1.44E-03	6.32E-03	1.84E-04	lb/ton	2.00E-03	8.77E-03					1.73E-05	lb/MMBtu	3.54E-03	1.55E-02
Methyl chloride	74873	6.10E-04	lb/ton	4.78E-03	2.09E-02	6.10E-04	lb/ton	6.63E-03	2.91E-02					2.65E-05	lb/MMBtu	5.42E-03	2.37E-02
Methyl ethyl ketone	78933	4.49E-04	lb/ton	3.52E-03	1.54E-02	4.49E-04	lb/ton	4.88E-03	2.14E-02					6.21E-06	lb/MMBtu	1.27E-03	5.58E-03
Methyl hydrazine	60344	1.96E-04	lb/ton	1.53E-03	6.71E-03	1.96E-04	lb/ton	2.13E-03	9.32E-03								
Methyl methacrylate	80626	2.30E-05	lb/ton	1.80E-04	7.90E-04	2.30E-05	lb/ton	2.50E-04	1.10E-03								
Methyl tert butyl ether	1634044	4.03E-05	lb/ton	3.16E-04	1.38E-03	4.03E-05	lb/ton	4.38E-04	1.92E-03								
Methylene chloride (Dichloromethane)	75092	3.34E-04	lb/ton	2.61E-03	1.15E-02	3.34E-04	lb/ton	3.63E-03	1.59E-02					3.34E-04	lb/MMBtu	6.84E-02	2.99E-01
2-Nitrophenol	88755													2.76E-07	lb/MMBtu	5.66E-05	2.48E-04
4-Nitrophenol	100027													1.27E-07	lb/MMBtu	2.59E-05	1.14E-04
Pentachlorobiphenyl	25429292													1.38E-09	lb/MMBtu	2.83E-07	1.24E-06
Pentachlorophenol	87865													5.87E-08	lb/MMBtu	1.20E-05	5.27E-05
Perylene	198550													5.98E-10	lb/MMBtu	1.23E-07	5.37E-07
Phenol	108952	1.84E-05	lb/ton	1.44E-04	6.32E-04	1.84E-05	lb/ton	2.00E-04	8.77E-04					5.87E-05	lb/MMBtu	1.20E-02	5.27E-02
Propionaldehyde	123386	4.37E-04	lb/ton	3.43E-03	1.50E-02	4.37E-04	lb/ton	4.76E-03	2.08E-02					7.02E-05	lb/MMBtu	1.44E-02	6.30E-02
Propanal	123386													3.68E-06	lb/MMBtu	7.54E-04	3.30E-03
Styrene	100425	2.88E-05	lb/ton	2.25E-04	9.87E-04	2.88E-05	lb/ton	3.13E-04	1.37E-03					2.19E-03	lb/MMBtu	4.48E-01	1.96E+00
Tetrachlorobiphenyl	26914330													2.88E-09	lb/MMBtu	5.89E-07	2.58E-06
Tetrachloroethylene	127184	4.95E-05	lb/ton	3.88E-04	1.70E-03	4.95E-05	lb/ton	5.38E-04	2.36E-03					4.37E-05	lb/MMBtu	8.96E-03	3.92E-02
Toluene	108883	2.76E-04	lb/ton	2.16E-03	9.48E-03	2.76E-04	lb/ton	3.00E-03	1.32E-02	3.91E-03	lb/MMscf	7.09E-04	3.11E-03	1.06E-03	lb/MMBtu	2.17E-01	9.50E-01
o-Tolualdehyde	529204													8.28E-06	lb/MMBtu	1.70E-03	7.43E-03
p-Tolualdehyde	104870													1.27E-05	lb/MMBtu	2.59E-03	1.14E-02
Trichlorobiphenyl														2.99E-09	lb/MMBtu	6.13E-07	2.68E-06
Trichlorofluoromethane	75694													4.72E-05	lb/MMBtu	9.67E-03	4.23E-02
Trichlorethene	79016													3.45E-05	lb/MMBtu	7.07E-03	3.10E-02
1,1,1-Trichloroethane	71556	2.30E-05	lb/ton	1.80E-04	7.90E-04	2.30E-05	lb/ton	2.50E-04	1.10E-03					3.57E-05	lb/MMBtu	7.31E-03	3.20E-02
2,4,6-Trichlorophenol	88062													2.53E-08	lb/MMBtu	5.19E-06	2.27E-05
Vinyl acetate	108054	8.74E-05	lb/ton	6.85E-04	3.00E-03	8.74E-05	lb/ton	9.51E-04	4.17E-03								
Vinyl Chloride	75014													2.07E-05	lb/MMBtu	4.24E-03	1.86E-02
Xylenes	1330207	4.26E-05	lb/ton	3.34E-04	1.46E-03	4.26E-05	lb/ton	4.63E-04	2.03E-03								
o-Xylene	95476													2.88E-05	lb/MMBtu	5.89E-03	2.58E-02
<b>Polynuclear Aromatic Hydrocarbons (PAH)</b>																	
Acenaphthene	83329	5.87E-07	lb/ton	4.60E-06	2.01E-05	5.87E-07	lb/ton	6.38E-06	2.80E-05	2.07E-06	lb/MMscf	3.75E-07	1.64E-06	1.05E-06	lb/MMBtu	2.15E-04	9.40E-04
Acenaphthylene	208968	2.88E-07	lb/ton	2.25E-06	9.87E-06	2.88E-07	lb/ton	3.13E-06	1.37E-05	2.07E-06	lb/MMscf	3.75E-07	1.64E-06	5.75E-06	lb/MMBtu	1.18E-03	5.16E-03
Acetone	67641													2.19E-04	lb/MMBtu	4.48E-02	1.96E-01
Anthracene	120127	2.42E-07	lb/ton	1.89E-06	8.29E-06	2.42E-07	lb/ton	2.63E-06	1.15E-05	2.76E-06	lb/MMscf	5.01E-07	2.19E-06	3.45E-06	lb/MMBtu	7.07E-04	3.10E-03
Benzaldehyde	100527													9.78E-07	lb/MMBtu	2.00E-04	8.78E-04
Benzo(a)anthracene	56553	9.20E-08	lb/ton	7.21E-07	3.16E-06	9.20E-08	lb/ton	1.00E-06	4.39E-06	2.07E-06	lb/MMscf	3.75E-07	1.64E-06	7.48E-08	lb/MMBtu	1.53E-05	6.71E-05
Benzo(a)pyrene	50328	4.37E-08	lb/ton	3.43E-07	1.50E-06	4.37E-08	lb/ton	4.76E-07	2.08E-06	1.38E-06	lb/MMscf	2.50E-07	1.10E-06	2.99E-06	lb/MMBtu	6.13E-04	2.68E-03
Benzo(e)pyrene	192972									1.38E-06	lb/MMscf	2.50E-07	1.10E-06	2.99E-06	lb/MMBtu	6.13E-04	2.68E-03
Benzo(b)fluoranthene	205992									2.07E-06	lb/MMscf	3.75E-07	1.64E-06	1.15E-07	lb/MMBtu	2.36E-05	1.03E-04
Benzo(j,k)fluoranthene	206440													1.84E-07	lb/MMBtu	3.77E-05	1.65E-04
Benzo(k)fluoranthene	205823									2.07E-06	lb/MMscf	3.75E-07	1.64E-06	4.14E-08	lb/MMBtu	8.49E-06	3.72E-05

TABLE B-2. MAXIMUM EMISSION RATES

Compound	Maximum Emission Rates		Fuel	Emission Factor
	(lb/hr)	(tpy)		
2,4-Dinitrotoluene	3.50E-06	1.53E-05	PRB Coal	1.89E-08
Dimethyl sulfate	6.01E-04	2.63E-03	PRB Coal	3.25E-06
2,4-Dinitrophenol	4.24E-05	1.86E-04	Wood	2.07E-07
Ethylbenzene	7.31E-03	3.20E-02	Wood	3.57E-05
Ethylchloride	5.26E-04	2.30E-03	PRB Coal	2.84E-06
Ethylene dichloride	5.01E-04	2.19E-03	PRB Coal	2.71E-06
Ethylene dibromide	1.50E-05	6.58E-05	PRB Coal	8.12E-08
Formaldehyde	1.04E+00	4.54E+00	Wood	5.06E-03
Heptachlorobiphenyl	1.56E-08	6.82E-08	Wood	7.59E-11
Hexachlorobiphenyl	1.30E-07	5.68E-07	Wood	6.33E-10
Hexanal	1.65E-03	7.23E-03	Wood	8.05E-06
Hexane	3.75E-01	1.64E+00	Nat Gas	2.03E-03
Isobutyraldehyde	2.83E-03	1.24E-02	Wood	1.38E-05
Isophorone	7.26E-03	3.18E-02	PRB Coal	3.92E-05
2-Methylnaphthalene	3.77E-05	1.65E-04	Wood	1.84E-07
3-Methylchloranthrene	3.75E-07	1.64E-06	Nat Gas	2.03E-09
Monochlorobiphenyl	5.19E-08	2.27E-07	Wood	2.53E-10
Methyl bromide	3.54E-03	1.55E-02	Wood	1.73E-05
Methyl chloride	6.63E-03	2.91E-02	PRB Coal	3.59E-05
Methyl ethyl ketone	4.88E-03	2.14E-02	PRB Coal	2.64E-05
Methyl hydrazine	2.13E-03	9.32E-03	PRB Coal	1.15E-05
Methyl methacrylate	2.50E-04	1.10E-03	PRB Coal	1.35E-06
Methyl tert butyl ether	4.38E-04	1.92E-03	PRB Coal	2.37E-06
Methylene chloride	6.84E-02	2.99E-01	Wood	3.34E-04
2-Nitrophenol	5.66E-05	2.48E-04	Wood	2.76E-07
4-Nitrophenol	2.59E-05	1.14E-04	Wood	1.27E-07
Pentachlorobiphenyl	2.83E-07	1.24E-06	Wood	1.38E-09
Pentachlorophenol	1.20E-05	5.27E-05	Wood	5.87E-08
Perylene	1.23E-07	5.37E-07	Wood	5.98E-10
Phenol	1.20E-02	5.27E-02	Wood	5.87E-05
Propionaldehyde	1.44E-02	6.30E-02	Wood	7.02E-05
Propanal	7.54E-04	3.30E-03	Wood	3.68E-06
Styrene	4.48E-01	1.96E+00	Wood	2.19E-03
Tetrachlorobiphenyl	5.89E-07	2.58E-0		

Boiler Parameters	Specification
Boiler Type	Circulating Fluidized Bed
Maximum Rated Heat Input (MM btu/hr)	185
Gross Output (MW/hr)	10 (Approximate; normally 7)

Material	Sulfur Content	Material Usage (%)	Heat Input (MM BTU/hr)	Heating Value (BTU/lb)	Material Throughput (lb/hr)	Material Throughput (tph)	Material Throughput (tpy)	Natural Gas Maximum Usage Rate MMscf/hr
Coal, Bituminous	3.50%	100.0%	185	11,800	15,678	7.84	68,669	0.1814
Coal, PRB	0.60%	100.0%	185	8,500	21,765	10.88	95,329	
Natural Gas	0.00%	100.0%	185	23,200	7,974	3.59	34,927	
Virgin Wood	0.00%	100.0%	205	4,500	45,556	22.78	199,533	

TABLE B-1. EMISSION RATES OF CRITERIA POLLUTANTS, HAPS, AND TACS FROM THE NEW BOILER ON A PER-FUEL BASIS

Compound	CAS Reference Number	Coal, Bituminous				Coal, PRB				Natural Gas				Waste Wood			
		Emission Factors		Emission Rates		Emission Factors		Emission Rates		Emission Factors		Emission Rates		Emission Factors		Emission Rates	
		Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)	Value	Units	(lb/hr)	(tpy)
Benzo(b,j,k)fluoranthene		1.27E-07	lb/ton	9.92E-07	4.34E-06	1.27E-07	lb/ton	1.38E-06	6.03E-06					1.15E-07	lb/MMBtu	2.36E-05	1.03E-04
Benzo(g,h,i)perylene	191242	3.11E-08	lb/ton	2.43E-07	1.07E-06	3.11E-08	lb/ton	3.38E-07	1.48E-06	1.38E-06	lb/MMscf	2.50E-07	1.10E-06	1.07E-07	lb/MMBtu	2.19E-05	9.60E-05
Biphenyl	92524	1.96E-06	lb/ton	1.53E-05	6.71E-05	1.96E-06	lb/ton	2.13E-05	9.32E-05								
Chrysene	218019	1.15E-07	lb/ton	9.01E-07	3.95E-06	1.15E-07	lb/ton	1.25E-06	5.48E-06	2.07E-06	lb/MMscf	3.75E-07	1.64E-06	4.37E-08	lb/MMBtu	8.96E-06	3.92E-05
Crotonaldehyde	4170303													1.14E-05	lb/MMBtu	2.33E-03	1.02E-02
Decachlorobiphenyl	2051243													3.11E-10	lb/MMBtu	6.37E-08	2.79E-07
Dibenzo(a,h)anthracene	53703									1.38E-06	lb/MMscf	2.50E-07	1.10E-06	1.05E-08	lb/MMBtu	2.15E-06	9.40E-06
1,2-Dibromoethene	540498													6.33E-05	lb/MMBtu	1.30E-02	5.68E-02
Dichlorobiphenyl	2050682													8.51E-10	lb/MMBtu	1.74E-07	7.64E-07
1,2-Dichloroethane	107062													3.34E-05	lb/MMBtu	6.84E-03	2.99E-02
1,2-Dichloropropane	78875													3.80E-05	lb/MMBtu	7.78E-03	3.41E-02
7,12-Dimethylbenz(a)anthracene	57976									1.84E-05	lb/MMscf	3.34E-06	1.46E-05				
Fluoranthene	206440	8.17E-07	lb/ton	6.40E-06	2.80E-05	8.17E-07	lb/ton	8.89E-06	3.89E-05	3.45E-06	lb/MMscf	6.26E-07	2.74E-06	1.84E-06	lb/MMBtu	3.77E-04	1.65E-03
Fluorene	86737	1.05E-06	lb/ton	8.20E-06	3.59E-05	1.05E-06	lb/ton	1.14E-05	4.99E-05	3.22E-06	lb/MMscf	5.84E-07	2.56E-06	3.91E-06	lb/MMBtu	8.02E-04	3.51E-03
Indeno(1,2,3-c,d)pyrene	193395	7.02E-08	lb/ton	5.50E-07	2.41E-06	7.02E-08	lb/ton	7.63E-07	3.34E-06	2.07E-06	lb/MMscf	3.75E-07	1.64E-06	1.00E-07	lb/MMBtu	2.05E-05	8.98E-05
Naphthalene	91203	1.50E-05	lb/ton	1.17E-04	5.13E-04	1.50E-05	lb/ton	1.63E-04	7.13E-04	7.02E-04	lb/MMscf	1.27E-04	5.57E-04	1.12E-04	lb/MMBtu	2.29E-02	1.00E-01
Phenanthrene	85018	3.11E-06	lb/ton	2.43E-05	1.07E-04	3.11E-06	lb/ton	3.38E-05	1.48E-04	1.96E-05	lb/MMscf	3.55E-06	1.55E-05	8.05E-06	lb/MMBtu	1.65E-03	7.23E-03
Pyrene	129000	3.80E-07	lb/ton	2.97E-06	1.30E-05	3.80E-07	lb/ton	4.13E-06	1.81E-05	5.75E-06	lb/MMscf	1.04E-06	4.57E-06	4.26E-06	lb/MMBtu	8.72E-04	3.82E-03
5-Methyl chrysene	3697243	2.53E-08	lb/ton	1.98E-07	8.69E-07	2.53E-08	lb/ton	2.75E-07	1.21E-06					9.89E-12	lb/MMBtu	2.03E-09	8.88E-09
total tons HAPs					4.925				6.729				1.750	0.018			14.55
lb HAP/MMBtu					0.0061				0.0083				0.0022				0.0162

These shaded areas depict air contaminants subject to PSD review.

These shaded areas indicate no data available.

These shaded areas depict HAPs.

Unless otherwise noted below, emission factors are from the EPA AP-42 database, and are increased by a 15% safety factor.

\* Coal firing emission factor based on Wyandotte Energy stack test results. Wyandotte Energy is located in Wyandotte, Michigan.

\*\* The lead estimated emission rates for PRB & Bituminous fuels are based on a statistical analysis of respective typical coals, with a 99% control efficiency of the baghouse collector.

\*\*\* Both HCl and HF emission factors include a 15% safety factor and 92% control using limestone in the CFB.

<sup>1</sup> Emissions are based on the proposed BACT.

<sup>2</sup> Sulfuric acid mist emission based on RBLC search, Plum Point Energy entry. This facility is located in Arkansas.

<sup>3</sup> Total dioxin/furan for the coal firing is from the Wyandotte Energy stack test results, and dioxin/furan for the wood combustion is from the EPA AP-42, Chapter 1.6, Table 1.6-3.

<sup>4</sup> Total chromium is supplied here for information purposes only. Total chromium is a sum of hexavalent and trivalent chromium.

CFB Boiler Maximum Single HAP Emission Rate (HCI) = 5.3 tpy

CFB Boiler Maximum Combined Total HAP Emission Rate = 14.5 tpy

TABLE B-2. MAXIMUM EMISSION RATES

Compound	Maximum Emission Rates		Fuel	Emission Factor
	(lb/hr)	(tpy)		
Benzo(b,j,k)fluoranthene	2.36E-05	1.03E-04	Wood	1.15E-07
Benzo(g,h,i)perylene	2.19E-05	9.60E-05	Wood	1.07E-07
Biphenyl	2.13E-05	9.32E-05	PRB Coal	1.15E-07
Chrysene	8.96E-06	3.92E-05	Wood	4.37E-08
Crotonaldehyde	2.33E-03	1.02E-02	Wood	1.14E-05
Decachlorobiphenyl	6.37E-08	2.79E-07	Wood	3.11E-10
Dibenzo(a,h)anthracene	2.15E-06	9.40E-06	Wood	1.05E-08
1,2-Dibromoethene	1.30E-02	5.68E-02	Wood	6.33E-05
Dichlorobiphenyl	1.74E-07	7.64E-07	Wood	8.51E-10
1,2-Dichloroethane	6.84E-03	2.99E-02	Wood	3.34E-05
1,2-Dichloropropane	7.78E-03	3.41E-02	Wood	3.80E-05
7,12-Dimethylbenz(a)anthracene	3.34E-06	1.46E-05	Nat Gas	1.84E-05
Fluoranthene	3.77E-04	1.65E-03	Wood	1.84E-06
Fluorene	8.02E-04	3.51E-03	Wood	3.91E-06
Indeno(1,2,3-c,d)pyrene	2.05E-05	8.98E-05	Wood	1.00E-07
Naphthalene	2.29E-02	1.00E-01	Wood	1.12E-04
Phenanthrene	1.65E-03	7.23E-03	Wood	8.05E-06
Pyrene	8.72E-04	3.82E-03	Wood	4.26E-06
5-Methyl chrysene	2.75E-07	1.21E-06	PRB Coal	9.89E-12