ALLEGHENY COUNTY HEALTH DEPARTMENT
AIR QUALITY PROGRAM

August 26, 2014

SUBJECT: **Veterans Affairs Medical Center**
Oakland Facility
University Drive C
Pittsburgh, PA 15240
Allegheny County

Synthetic Minor Source Operating Permit No. 0276

TO: Sandra L. Etzel
Chief Engineer

FROM: Michael Dorman
Air Quality Engineer

STATEMENT OF AUTHORITY

FACILITY DESCRIPTION:

The Veterans Affairs Pittsburgh Healthcare System consists of three Divisions operating under one management. The University Drive Division is located in the Oakland District of Pittsburgh adjacent to the University of Pittsburgh. University Drive serves as the acute care facility and has approximately 146 operating beds distributed among Medicine, Surgery, Neurology, and Critical Care. A large Primary Care outpatient clinic is also located here. The source consists of three (3) boilers, eight (8) emergency generators, one (1) fire pump, two (2) ethylene oxide sterilizers, three (3) cooling towers, five (5) diesel fuel storage tanks and three (3) No.2 fuel oil storage tanks. The boilers are used to provide comfort heating and hot water for the building. These boilers are natural gas fired, with No. 2 fuel oil used as an emergency back-up fuel, vent through one combined stack. The emergency generators are designed to power hospital equipment in the event that utility power is interrupted.

The facility is a synthetic minor for nitrogen oxides (NO_X) and a minor source of particulate matter (PM), particulate matter < 10 microns in diameter (PM-10), particulate matter < 2.5 microns in diameter (PM-2.5), sulfur dioxide (SO2), carbon monoxide (CO), volatile organic compounds (VOCs) and hazardous air pollutants (HAPs).

PERMIT APPLICATION COMPONENTS:

1. Synthetic Minor Operating Permit application No. 0276, received July 23, 2013.
2. Synthetic Minor Installation Permit application No. 0276-I003, issued September 30, 2013.
3. Synthetic Minor Installation Permit application No. 0276-I002, issued October 28, 2013.
4. E-mail received February 27, 2014.

EMISSION SOURCES:

TABLE II-1: Emission Unit Identification

I.D.	SOURCE DESCRIPTION	CONTROL DEVICE(S)	MAXIMUM CAPACITY	FUEL/RAW MATERIAL	STACK I.D.
B-001	Tampella Power Corp Boiler No. 1, Model No.: DS 30	None	31.93 MMBtu/Hr	Natural Gas	S002
B-002	Tampella Power Corp Boiler No. 2, Model No.: DS 30		31.93 MMBtu/Hr		
B-003	Tampella Power Corp Boiler No. 3, Model No.: DS 30		19.0 9MMBtu/Hr		
EG-007	Cummins, Model No. DCQA-5779489		600 KW (804 hp)	No. 2 Fuel Oil Ultra-low Sulfur	S010
EG-008	Caterpillar, Model C175-16 Emergency Generator	Catalytic Oxidizer	2850 kW (3263 hp)		S011
EG-009	Caterpillar, Model 3512C Emergency Generator		1500 kW (2206 hp)		S012
EG-010	Caterpillar, Model 3512C Emergency Generator		1500 kW (2206 hp)		S013
EG-011	Caterpillar, Model 3512C Emergency Generator		1500 kW (2206 hp)		S014
EG-012	Caterpillar, Model 3512C Emergency Generator		1500 kW (2206 hp)		S015
EG-013	Cummins, Model QSX15-G9 Emergency Generator	None	563 kW (680 hp)		S016
EG-014	Cummins, Model QSK60-G6 NR2 Emergency Generator		2000 kW (2922 hp)		S017
CO-001	Ethylene Oxide Sterilizer: 3M/EO Model: 50	Catalytic Oxidizer	170 g EtO/cycle	Ethylene Oxide	S001
CO-002	Ethylene Oxide Sterilizer: 3M/EO Model: 50		170 g EtO/cycle		
FP-001	Clark Fire Protection Products Fire Pump - Model: JU4H-UFDW8	None	144 hp	Diesel Fuel Ultra-low Sulfur	S011
CT-001	3 - Cooling Water Towers		1,000 gal/min	NA	
D001	Fuel Tank		10,000	No. 2 Fuel Oil	NA
D002	Fuel Tank		10,000		
D003	Fuel Tank		10,000		
T-006	Fuel Tank		15,000 gal	Diesel Fuel Ultra-low Sulfur	
T-007	Fuel Tank		15,000 gal		
T-008	Fuel Tank		10,000 gal		
T-009	Fuel Tank		4,000 gal		
T-010	Fuel Tank		280 gal		

METHOD OF DEMONSTRATING COMPLIANCE:

Methods of demonstrating compliance with the emission standards of this permit include the following:

1. Recording boiler fuel consumption each day, maintaining fuel certifications from fuel suppliers, and providing written notice of fuel consumption and sulfur content to the Department semiannually;
2. Recording emergency generator fuel consumption, cold starts, operating hours, inspection and maintenance activities, maintaining fuel certifications from fuel suppliers, and providing written notice to the Department semiannually;
3. Recording the number of sterilizations and the amount of ethylene oxide used in each sterilization cycle; and,
4. Operating and maintaining the fuel storage tanks in accordance with the manufacturers' specification and good engineering practices.

Compliance with the short-term (lb/hr) limits must be maintained at all times, including startup and shutdown unless explicitly stated otherwise in the permit. Any emissions due to startup and/or shutdown are included in the facility's total annual emissions. See Operating Permit No. 0276 for the specific conditions for determining compliance with the applicable requirements.

EMISSION CALCULATIONS

See Appendix A

REGULATORY APPLICABILITY:

1. **Article XXI Requirements for Issuance:**

   See Permit Application No. 0276, Section 5. The requirements of Article XXI, Parts B and C for the issuance of operating permits have been met for this facility. Article XXI, Part D, Part E & Part H will have the necessary sections addressed individually.

2. **Testing Requirements:**

   Testing is required for emergency generators EG-008, EG-009, EG-010, EG-011 and EG-012 in accordance with permit requirements at least once every five (5) years. The Department reserves the right to require additional testing, if necessary, to assure compliance with the terms and conditions of this Synthetic Minor Source Operating Permit.

3. **Applicable New Source Performance Standards (NSPS):**

   The installation is subject to 40 CFR Part 60 Subpart Dc (Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units) because the boilers were installed after June 9, 1989 and have maximum design heat input capacities greater than 10,000,000 MMBtu/hr but less than 100,000,000 MMBtu/hr..

   This installation is subject to 40 CFR Part 60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines – CI-RICE) because these emergency generators are diesel fueled RICE..

4. **Non-Applicable New Source Performance Standards (NSPS):**

   The installation is not subject to 40 CFR Part 60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines – SI-RICE) because none of the emergency generators have

spark ignition engines.

5. **Applicable NESHAP and MACT Standards:**

The facility ist subject to 40 CFR Part 63, Subpart WWWWW (National Emissions Standards for Hospital Ethylene Oxide Sterilizers) because this facility is a hospital.

The facility is subject to 40 CFR Part 63, Subpart ZZZZ – *National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines*.

6. **Non-Applicable NESHAP and MACT Standards:**

The facility is not subject to 40 CFR Part 63, Subpart O – *Ethylene Oxide Standards for Sterilization Facilities* because this source is a hospital and is specifically exempted from this Subpart. See 40 CFR §63.360(e).

The facility is not subject to 40 CFR Part 63, Subpart Q – *National Emission Standards for Hazardous Air Pollutants for Industrial Process Cooling Towers* because this source is not an industrial facility.

The facility is not subject to 40 CFR Part 63, Subpart DDDDD – *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters* because it is not a major source.

7. **Risk Management Plan; CAA Section 112(r):**

The facility is not required to have a risk management plan at this time because none of the regulated chemicals exceed the thresholds in the regulation.

8. **Greenhouse Gas Reporting (40 CFR Part 98):**

Greenhouse gases (GHGs) from this facility come from the combustion units. Based on the calculation methodology in 40 CFR Part 98, §98.33(a)(1), potential emissions of CO_2e are 29,734.05 tpy. This is less than the 100,000 tpy major source threshold and the 75,000 ton modification increase threshold. Therefore, the facility is not a major source of GHG emissions. However, the CO_2e emissions are greater than 25,000 tons per year and will be required to submit an annual emissions inventory.

9. **Compliance Assurance Monitoring (40 CFR Part 64):**

The Compliance Assurance Monitoring (CAM) rule found in 40 CFR 64 is not applicable because this facility is not a major source.

EMISSIONS SUMMARY:

Emissions Limitations Summary

Pollutant	Annual Emission Limit (tons/year)*
PM	4.95
PM_{10}	4.95
$PM_{2.5}$	4.95
SO_2	6.843
NO_X	85.437
CO	34.167
ETO	0.0021
CH_2O	0.086
VOCs	3.014
CO_2	29,734.05

* A year is defined as any consecutive 12-month period.

RECOMMENDATION:

All applicable Federal, State, and County regulations have been addressed in the permit application, and the facility is not in violation of the provisions of Article XXI, §2102.04.k. The Synthetic Minor Source Operating Permit for the Veterans Affairs Medical Center – Oakland Facility should be approved with the emission limitations, terms and conditions in Permit No. 0276.

APPENDIX A

EMISSION CALCULATIONS

Boilers No. 1 and No. 2

Boiler No. 1 and No. 2 are fired with natural gas with the ability to use No. 2 fuel oil as a back-up. They are rated at 31.93 MMBtu/hr each. The Department presumes that the No. 2 fuel oil shall be used as an emergency back-up when natural gas is unavailable. Therefore, emissions calculations are based on the combination of using natural gas for 8,250 hours per year and No. 2 fuel oil for 500 hours per year. The emission factors for PM come from Article XXI. For natural gas, it is assumed that PM = PM10 = PM2.5. Emission factors from AP-42 are increased by 15% to compensate for their variability.
31,930,000 Btu/hr ÷ 1050 Btu/cf = 30,409.52 cf/hr
30,409.52 ÷ 1,000,000 = 0.03 MMcf/hr
31,930,000 Btu/hr ÷ 138,500 Btu/gal = 230.54 gal/hr
230.54 gal/hr ÷ 1,000 = 0.231 × 10^3 gal/hr

PM/PM10/PM2.5 (natural gas)
(0.008 lbs/MMbtu) x (31.93 MMbtu/hr) = **0.256 lbs/hr**
0.256 lb/hr × 2 = **0.51 lb/hr both**
(0.51 lbs/hr x 8,260 hr/yr) ÷ (2000 lbs/ton) = **2.11 tons/yr both**
(No. 2 Fuel Oil)
(0.015 lbs/MMbtu) x (31.93 MMbtu/hr) = **0.48 lbs/hr**
0.48 lb/hr × 2 = **0.96 lb/hr both**
(0.96 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.24 tons/yr both**
SO_2 (natural gas)
(0.03 MMcf/hr) × (0.6 lbs/MMcf) = **0.018 lbs/hr**
0.018 lb/hr × 2 = **0.036 lb/hr**
0.036 lb/hr × 1.15 = **0.0414 lb/hr both**
(0.0414 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **0.171 tpy both**
(No. 2 Fuel Oil)
(142 lb/10^3 gal × 0.5 % S) × 0.231 10^3 gal/hr = 16.401 lb/hr
16.401 lb/hr × 2 = **32.802 lb/hr**
32.802 lb/hr × 1.15 = **37.72 lb/hr both**
(0.113 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **9.43 tons/yr both**
NOx (natural gas)
(0.03 MMcf/hr) × (100 lbs/MMcf) = 3.0 lbs/hr
3.0 lb/hr × 2 = **6.0 lb/hr**
6.0 lb/hr × 1.15 = **6.9 lb/hr both**
(6.9 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **28.497 tpy both**
(No. 2 Fuel Oil)
20 lb/10^3 gal × 0.231 10^3 gal/hr = 4.62 lb/hr
4.62 lb/hr × 2 = **9.24 lb/hr**
9.24 lb/hr × 1.15 = **10.63 lb/hr both**
(10.63 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **2.66 tons/yr both**
CO (natural gas)
(0.03 MMcf/hr) × (84 lbs/MMcf) = 2.52 lbs/hr
2.52 lb/hr × 2 = **5.04 lb/hr**
5.04 lb/hr × 1.15 = **5.796 lb/hr both**
(5.796 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **23.94 tpy both**
(No. 2 Fuel Oil)
5 lb/10^3 gal × 0.231 10^3 gal/hr = 1.155 lb/hr
1.155 lb/hr × 2 = **2.31 lb/hr**
2.31 lb/hr × 1.15 = **2.66 lb/hr both**
(2.66 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.67 tons/yr both**

VOCs (natural gas)
(0.03 MMcf/hr) × (5.5 lbs/MMcf) = 0.165 lbs/hr
0.165 lb/hr × 2 = 0.33 lbs/h
0.33 lb/hr × 1.15 = **0.38 lb/hr both**
(0.38 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **1.57 tpy both**
(No. 2 Fuel Oil)
0.34 lb/10^3 gal × 0.231 × 10^3 gal/hr = 0.07854 lb/hr
0.07854 × 2 = 0.15708
0.15708 lb/hr × 1.15 = **0.181 lb/hr both**
(0.181 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.045 tons/yr both**
CO_2 (natural gas)
0.03 MMcf/hr × 120000 lb/MMcf = **3,600.00 lb/hr**
(3,600 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **14,868.00 tpy**
(No. 2 Fuel Oil)
22,300 lb – CO_2/10^3 gal × 0.231 10^3 gal/hr = **5,151.30 lb/hr**
(5,151.30 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **1,287.825 tons/yr**

Boilers B-001 and B-002 Emission Limits

Pollutant	Hourly Emission Limit Natural Gas Combined Boilers (lbs/hr)	Hourly Emission Limit No. 2 Fuel Oil Combined Boilers (lbs/hr)	Annual Emission Limit Combined Fuels & Combined Boilers (tons/year)[1, 2]
PM	0.51	0.96	2.35
PM_{10}	0.51	0.96	2.35
$PM_{2.5}$	0.51	0.96	2.35
SO_2	0.041	37.72	9.601
NO_X	6.90	10.63	31.157
CO	5.796	2.66	24.610
VOCs	0.38	0.181	1.615
CO_2	3600.00	5151.30	16155.83

Boiler No. 3
Boiler No. 3 is fired with natural gas with the ability to use No. 2 fuel oil as a back-up. It is rated at 19.09 MMBtu/hr. The Department presumes that the No. 2 fuel oil shall be used as an emergency back-up when natural gas is unavailable. Therefore, emissions calculations are based on the combination of using natural gas for 8,250 hours per year and No. 2 fuel oil for 500 hours per year. The emission factors for PM come from Article XXI. For natural gas, it is assumed that PM = PM10 = PM2.5. Emission factors from AP-42 are increased by 15% to compensate for their variability.
19,090,000 Btu/hr ÷ 1050 Btu/cf = 18,180.95 cf/hr
18,180.95 ÷ 1,000,000 = 0.018 MMcf/hr
19,090,000 Btu/hr ÷ 138,500 Btu/gal = 137.83 gal/hr
138.83 gal/hr ÷ 1,000 = 0.138 × 10^3 gal/hr

PM/PM10/PM2.5 (natural gas)
(0.008 lbs/MMbtu) x (19.09 MMbtu/hr) = **0.153 lbs/hr**
(0.153 lbs/hr x 8,260 hr/yr) ÷ (2000 lbs/ton) = **0.63 tons/yr**
(No. 2 Fuel Oil)
(0.015 lbs/MMbtu) x (19.09 MMbtu/hr) = **0.29 lbs/hr**
(0.29 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.0725 tons/yr**
SO_2 (natural gas)
(0.018 MMcf/hr) × (0.6 lbs/MMcf) = 0.0108 lbs/hr
0.0108 lb/hr × 1.15 = **0.012 lb/hr**
(0.012 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **0.05 tpy**
(No. 2 Fuel Oil)
(142 lb/10^3 gal × 0.5 % S) × 0.138 10^3 gal/hr = 9.798 lb/hr
9.798 lb/hr × 1.15 = **11.27 lb/hr**
(11.27 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **2.82 tons/yr**
NOx (natural gas)
(0. 018 MMcf/hr) × (100 lbs/MMcf) = 1.8 lbs/hr
1.8 lb/hr × 1.15 = **2.07 lb/hr**
(2.07 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **8.55 tpy**
(No. 2 Fuel Oil)
20 lb/10^3 gal × 0.138 10^3 gal/hr = 2.76 lb/hr
2.76 lb/hr × 1.15 = **3.174 lb/hr**
(3.174 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.79 tons/yr**
CO (natural gas)
(0. 018 MMcf/hr) × (84 lbs/MMcf) = 1.512 lbs/hr
1.512 lb/hr × 1.15 = **1.74 lb/hr**
(1.74 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **7.19 tpy**
(No. 2 Fuel Oil)
5 lb/10^3 gal × 0.138 10^3 gal/hr = 0.64 lb/hr
0.64 lb/hr × 1.15 = **0.74 lb/hr**
(0.74 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.185 tons/yr**
VOCs (natural gas)
(0.018 MMcf/hr) × (5.5 lbs/MMcf) = 0.099 lbs/hr
0.099 lb/hr × 1.15 = **0.114 lb/hr**
(0.114 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **0.47 tpy**
(No. 2 Fuel Oil)
0.34 lb/10^3 gal × 0.138 10^3 gal/hr = 0.04692 lb/hr
0.04692 lb/hr × 1.15 = **0.054 lb/hr**
(0.054 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **0.0135 tons/yr**
CO_2 (natural gas)
0.018 MMcf/hr × 120000 lb/MMcf = **2160.00 lb/hr**
(2160.00 lbs/hr × 8,260 hr/yr) ÷ 2,000 lbs/ton = **8920.80 tpy**
(No. 2 Fuel Oil)
22,300 lb – CO_2/10^3 gal × 0.138 10^3 gal/hr = **3,077.40 lb/hr**
(3,077.40 lbs/hr x 500 hr/yr) ÷ (2000 lbs/ton) = **769.35 tons/yr**

Boiler B-003 Emission Limits

Pollutant	Hourly Emission Limit Natural Gas (lbs/hr)	Hourly Emission Limit No. 2 Fuel Oil (lbs/hr)	Annual Emission Limit Combined Fuels (tons/year)[1, 2]
PM	0.153	0.29	0.703
PM_{10}	0.153	0.29	0.703
$PM_{2.5}$	0.153	0.29	0.703
SO_2	0.012	11.27	2.87
NO_X	2.07	3.174	9.340
CO	1.74	0.74	7.375
VOCs	0.114	0.54	0.484
CO_2	2160	3077.40	9690.15

[1] A year is defined as any consecutive 12-month period.

[2] Annual tons per year are based on the sum of the natural gas emissions at 8,260 hours per year and the No. 2 fuel oil emissions at 500 hours per year.

No. 2 FUEL OIL FIRED EMERGENCY GENERATOR EG-007

Emergency Generator EG-007 has a 600 kW (804 hp) and 5.6 MMBtu/hr diesel fired engine. The emissions limits for this emergency generator were taken from Operating Permit No. 0276 issued October 26, 2009. Values for formaldehyde and CO_2 were not calculated for the previous permit and are shown below. Values are based on AP-42.

CO_2

110 lb/MMBtu × 5.6 MMBtu/hr = **616 lb/hr**
616 lb/hr × 400 hr = 246400 lb/yr
246400 lb/yr ÷ 2000 lb/ton = **123.2 tons/yr**

Formaldehyde

(0.0528 lb/MMBtu × 5.6 MMBtu/hr = 0.30 lb/hr
0.30 lb/hr × (400 hr/yr ÷ 2,000 lb/ton) = 0.06 tons/yr

Diesel-fired Emergency Generator EG-007 Emission Limits

Pollutant	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	0.65	0.16
PM_{10}	0.65	0.16
$PM_{2.5}$	0.65	0.16
SO_2	3.74	0.94
NO_X	14.05	3.51
CO	5.09	1.27
VOCs	0.65	0.16
CH_2O	0.30	0.06
CO_2	616	123.2

[1] A year is defined as any 12 consecutive months.

No. 2 FUEL OIL FIRED EMERGENCY GENERATOR EG-008

The information upon which these emissions are calculated comes from data in the Technical Data Sheet for the Caterpillar Model C175-16 ultra lean burn engine which is used to run this emergency generator. Emissions factors for PM, NOx CO and HC are based on the technical data sheet accompanying this permit application. For engines greater than 3,000 hp the limits in Table 1 of Part 60 Subpart IIII apply. The limits are:
PM – 0.40 g/hp-hr
NOx – 6.9 g/hp-hr
CO – 8.5 g/hp-hr
HC – 1.0 g/hp-hr
These limits are further reduced by 90% for CO and 45% for VOCs due to the addition of a catalytic oxidizer.
From the spec sheet:
Model C175-16 84.67 liters displacement 3,763 hp
210.7 gal/hr @ 100% load
Diesel fuel Btu = 137,080 Btu/gal from North American Combustion Handbook
PM = 0.03 g/hp-hr 0.33 lb/hr
NOx + HC = 5.19 g/hp-hr
NOx = 5.09 g/hp-hr 49.55 lb/hr
CO = 0.65 g/hp-hr 6.21 lb/hr
HC = 0.10 g/hp-hr 0.94 lb/hr
SO_2 = 0.00205 lb/hp-hr
CO_2 = 1.15 lb/hp-hr

PM/PM10/PM2.5:
0.33 lb/hr × 400 hr/yr = 132 lb/yr
132 lb/yr ÷ 2000 lb/ton = 0.066 tons/yr **round to 0.07 tons/yr**
SO_2:
0.00205 lb/hp-hr × 3763 hp = **7.71 lb/hr**
7.71 lb/hr × 400 hr = 3084 lb/yr
3084 lb/yr ÷ 2000 lb/ton = **1.54 tons/yr**
NOx:
49.55 lb/hr × 400 hr/yr = 19,820 lb/yr
19,820 lb/yr ÷ 2000 lb/ton = **9.91 tons/yr**
CO:

6.21 lb/hr × (1.0 – 0.9) = 0.621 lb/hr
0.621 lb/hr × 400 = 248.40 lb/hr
248.40 lb/yr ÷ 2000 lb/ton = 0.1242 tons/yr **round to 0.12 tons/yr**
VOCs:
0.94 lb/hr × (1.0 – 0.45) = 0.517 lb/hr
0.517 lb/hr × 400 hr/yr =206.8 lb/yr
206.8 lb/yr ÷ 2000 lb/ton = 0.1034 tons/yr **round to0.103 tons/yr**
CO_2
1.15 lb/hp-hr × 3763 hp = **4327.45 lb/hr**
4327.45 lb/hr × 400 hr = 1,730,980 lb/yr
1,730,980 lb/yr ÷ 2000 lb/ton = **865.49 tons/yr**
Formaldehyde
(137,080 Btu/gal × 210.7 gal/hr × 0.00118 lb formaldehyde/MMBtu) ÷ 1,000,000 = 0.034 lb/hr
0.034 lb/hr × (400 hr/yr ÷ 2,000 lb/ton) = 0.0068 tons/yr

Diesel-fired Emergency Generator EG-008 Emission Limits

Pollutant	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	0.33	0.07
PM_{10}	0.33	0.07
$PM_{2.5}$	0.33	0.07
SO_2	7.71	1.54
NO_X	49.55	9.91
CO	0.621	0.12
VOCs	0.517	0.103
CH_2O	0.034	0.0068
CO_2	4327.45	865.49

[1] A year is defined as any 12 consecutive months.

No. 2 FUEL OIL FIRED EMERGENCY GENERATORS EG-009, EG-010, EG-011 and EG-012: USING 100% DIESEL FUEL

The information upon which these emissions are calculated comes from data in the Technical Data Sheet for the Caterpillar Model 3512C ultra lean burn engine which is used to run these emergency generators. Emissions factors for PM, NOx CO and HC are based on the technical data sheet accompanying this permit application. There are four (4) such emergency generators at this facility.
These emergency generators are equipped with an Altronic dual fuel system. This system can feed a mixture of fuel oil and natural gas. The maximum permitted percentage of natural gas is 40%. The Btu value of the natural gas is 1066 Btu/ft^3. Emissions are calculated only for fuel oil because such calculations are expected to produce the highest emissions level for NOx while the emissions for CO and VOCs are reduced by the presence of the catalytic oxidizers.
Model 3512C EG009 to EG012 1,500 kW and 2206 bhp
For engines greater than 50 hp and less than 3,000 hp the limits in Table 1 of Part 60 Subpart IIII apply.
Fuel consumption is 104.8 gal/hr @ 100% load
Diesel fuel Btu = 137,080 Btu/gal from North American Combustion Handbook
NOx + HC = 6.4 g/kW-hr (5.65 g/hp-hr)

CO = 3.5 g/kW-hr (2.61 g/hp-hr)
PM = 0.2 g/Kw-hr (0.15 g/hp-hr)
NOx = 4.97 g/hp-hr 28.98 lb/hr
CO = 0.45 g/hp-hr 3.95 lb/hr
HC = 0.11 g/hp-hr 0.71 lb/hr
PM = 0.03 g/hp-hr 0.20 lb/hr
SO2 = .00205 lb/hp-hr
CO2 = 1.15 lb/hp-hr
Each of these engines has a catalytic converter that reduces the CO emissions by 90% and the VOC emissions by 45%. The calculations incorporate these reductions in emissions.
Model QSX15-G9 EG013

PM/PM10/PM2.5:
0.2 lb/hr × 4 = 0.8 lb/hr
0.80 lb/hr × 400 hr/yr = 320 lb/yr
320 lb/yr ÷ 2000 lb/ton = **0.16 tons/yr**
SO_2:
0.00205 lb/hp-hr × 2206 hp = **4.52 lb/hr**
4.52 lb/hr × 4 = 18.08 lb/hr
18.08 lb/hr × 400 hr = 7232 lb/yr
7232 lb/yr ÷ 2000 lb/ton = **3.62 tons/yr**
NOx:
28.98 lb/hr × 4 = 115.92 lb/hr
115.92 lb/hr × 400 hr/yr = 46,368 lb/yr
46,368 lb/yr ÷ 2000 lb/ton = **23.18 tons/yr**
CO:
3.95 lb/hr × (1.0 – 0.9) = 0.395lb/hr
0.395 lb/hr × 4 = 1.58 lb/hr
1.58 lb/hr × 400 hr/yr = 632 lb/yr
632 lb/yr ÷ 2000 lb/ton = **0.32 tons/yr**
VOCs:
0.71 lb/hr × 1.0 – 0.45) = 0.39 lb/hr
0.39 lb/hr × 4 = 1.56 lb/hr
1.56 lb/hr × 400 hr/yr = 624 lb/yr
624 lb/yr ÷ 2000 lb/ton = **0.31 tons/yr**
CO_2
1.15 lb/hp-hr × 2206 hp = **2536.90 lb/hr**
2536.9 lb/hr × 4 = **10147.6 lb/hr combined**
10147.6 lb/hr × 400 hr = 5,073,800 lb/yr
4,059,040 lb/yr ÷ 2000 lb/ton = **2,029.52tons/yr combined**

(137,080 Btu/gal × 104.8 gal/hr × 0.00118 lb formaldehyde/MMBtu) ÷ 1,000,000 = 0.017 lb/hr
0.017 lb/hr × 4 = 0.068
0.068 lb/hr × (400 hr/yr ÷ 2,000 lb/ton) = 0.0136 tons/yr

Diesel-fired Emergency Generators EG-009 to EG-012 Emission Limits

Pollutant	Hourly Emissions (lb/hr)	Hourly Emissions: Combined Generators (lb/hr)	Yearly Emissions: Combined Generators (tons/yr)[1]
PM	0.2	0.8	0.16
PM_{10}	0.2	0.8	0.16
$PM_{2.5}$	0.2	0.8	0.16
SO_2	4.52	18.08	3.62
NO_X	28.98	115.92	23.18
CO	0.395	1.58	0.32
VOCs	0.39	1.56	0.32
CH_2O	0.017	0.068	0.0136
CO_2	2536.90	10147.60	2029.52

[1] **A** year **is defined as any 12 consecutive months.**

No. 2 FUEL OIL FIRED EMERGENCY GENERATORS EG-009, EG-010, EG-011 and EG-012: USING A MIXTURE OF 60% DIESEL FUEL AND 40% NATURAL GAS

The information upon which these emissions are calculated comes from data in the Technical Data Sheet for the Caterpillar Model 3512C ultra lean burn engine which is used to run these emergency generators. Emissions factors for PM, NOx CO and HC are based on the technical data sheet accompanying this permit application. There are four (4) such emergency generators at this facility.
Model 3512C EG009 to EG012 1,500 kW and 2206 bhp
For engines greater than 50 hp and less than 3,000 hp the limits in Table 1 of Part 60 Subpart IIII apply.
Fuel consumption is 104.8 gal/hr @ 100% load
Diesel fuel Btu = 137,080 Btu/gal per the North American Combustion Handbook
NOx + HC = 6.4 g/kW-hr (5.65 g/hp-hr)
CO = 3.5 g/kW-hr (2.61 g/hp-hr)
PM = 0.2 g/Kw-hr (0.15 g/hp-hr)
NOx = 17.84 lb/hr
CO = 0.05 lb/hr
HC = 0.44 lb/hr
PM = 0.06 lb/hr
SO2 = .00205 lb/hp-hr
CO2 = 1.15 lb/hp-hr
Each of these engines has a catalytic converter that reduces the CO emissions by 90% and the VOC emissions by 45%. The calculations incorporate these reductions in emissions.
Model QSX15-G9 EG013

PM/PM10/PM2.5:
0.06 lb/hr × 4 = **0.24 lb/hr**
0.24 lb/hr × 400 hr/yr = 96 lb/yr
96 lb/yr ÷ 2000 lb/ton = **0.05 tons/yr**
SO_2:
0.00205 lb/hp-hr × 2206 hp = **4.52 lb/hr**
4.52 lb/hr × 4 = 18.08 lb/hr

18.08 lb/hr × 400 hr = 7232 lb/yr
7232 lb/yr ÷ 2000 lb/ton = **3.62 tons/yr**
NOx:
1**7.84 lb/hr** × 4 = **71.36 lb/hr**
71.36 lb/hr × 400 hr/yr = 28,544 lb/yr
28,544 lb/yr ÷ 2000 lb/ton = **14.27 tons/yr**
CO:
0.05 lb/hr × 4 = **0.20 lb/hr**
0.2 lb/hr × 400 hr/yr = 80 lb/yr
80 lb/yr ÷ 2000 lb/ton = **0.04 tons/yr**
VOCs:
0.44 lb/hr × 4 = **1.76 lb/hr**
1.76 lb/hr × 400 hr/yr = 704 lb/yr
704 lb/yr ÷ 2000 lb/ton = **0.35 tons/yr**
CO_2
1.15 lb/hp-hr × 2206 hp = **2536.90 lb/hr**
2536.9 lb/hr × 4 = 10147.6 lb/hr
10147.6 lb/hr × 400 hr = 5,073,800 lb/yr
4,059,040 lb/yr ÷ 2000 lb/ton = **2,029.52tons/yr**
Formaldehyde
(137,080 Btu/gal × 104.8 gal/hr × 0.00118 lb formaldehyde/MMBtu) ÷ 1,000,000 = 0.017 lb/hr
0.017 lb/hr × 4 = 0.068
0.068 lb/hr × (400 hr/yr ÷ 2,000 lb/ton) = 0.0136 tons/yr

Diesel-fired Emergency Generators EG-009 to EG-012 Emission Limits

Pollutant	Hourly Emissions: Single Generator (lb/hr)	Hourly Emissions: Combined Generators (lb/hr)	Yearly Emissions: Combined Generators (tons/yr)[1]
PM	0.06	0.24	0.05
PM_{10}	0.06	0.24	0.05
$PM_{2.5}$	0.06	0.24	0.05
SO_2	4.52	18.08	3.62
NO_X	17.84	71.36	14.27
CO	0.05	0.20	0.04
VOCs	0.44	1.76	0.35
CH_2O	0.017	0.068	0.0136
CO_2	2536.90	10147.60	2029.52

[1] **A** year **is defined as any 12 consecutive months.**

No. 2 FUEL OIL FIRED EMERGENCY GENERATOR EG-013

The information upon which these emissions are calculated comes from data in the Technical Data Sheet for the Caterpillar Model QSX-15-G9 ultra lean burn engine which is used to run this emergency generator. Emissions factors for PM, NOx CO and HC are based on the technical data sheet accompanying this permit application.
Diesel fuel Btu = 137,080 Btu/gal from North American Combustion Handbook
NOx = 5.15 g/hp-hr
CO = 0.41 g/hp-hr

HC = 0.08 g/hp-hr
PM = 0.02 g/hp-hr
SO2 = .00205 lb/hp-hr
CO2 = 1.15 lb/hp-hr
30.6 gal/hr @ full prime load
680 hp

PM/PM10/PM2.5:
0.02 g/hp-hr lb/hr × 680 hp × (1 lb/453.59 g) = **0.03 lb/hr**
0.03 lb/hr × 400 hr/yr = 12 lb/yr
12 lb/yr ÷ 2000 lb/ton = **0.0075 tons/yr**
SO_2:
0.00205 lb/hp-hr × 680 hp = **1.39 lb/hr**
1.39 lb/hr × 400 hr = 556 lb/yr
556 lb/yr ÷ 2000 lb/ton = **0.28 tons/yr**
NOx:
5.15 g/hp-hr lb/hr × 680 hp × (1 lb/453.59 g) = **7.72 lb/hr**
7.72 lb/hr × 400 hr/yr = 3,088 lb/yr
3,088 lb/yr ÷ 2000 lb/ton = **1.54 tons/yr**
CO:
0.41 g/hp-hr lb/hr × 680 hp × (1 lb/453.59 g) = **0.61 lb/hr**
0.61 lb/hr × 400 hr/yr = 244 lb/yr
244 lb/yr ÷ 2000 lb/ton = **0.122 tons/yr**
VOCs:
0.08 g/hp-hr lb/hr × 680 hp × (1 lb/453.59 g) = **0.12 lb/hr**
0.12 lb/hr × 400 hr/yr = 48 lb/yr
48 lb/yr ÷ 2000 lb/ton = **0.024 tons/yr**
CO_2
1.15 lb/hp-hr × 680 hp = **782 lb/hr**
782 lb/hr × 400 hr = 312,800 lb/yr
312,800 lb/yr ÷ 2000 lb/ton = **156.4 tons/yr**
Formaldehyde:
(137,080 Btu/gal × 34.7 gal/hr × 0.00118 lb formaldehyde/MMBtu) ÷ 1,000,000 = 0.005813 lb/hr round to 0.0056 lb/hr
0.0056 lb/hr × (400 hr/yr ÷ 2,000 lb/ton) = 0.0011 tons/yr

Diesel-fired Emergency Generator EG-013 Emission Limits

Pollutant	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	0.03	0.006
PM_{10}	0.03	0.006
$PM_{2.5}$	0.03	0.006
SO_2	1.39	0.28
NO_X	7.72	1.54
CO	0.61	0.122
VOCs	0.12	0.024
CH_2O	0.0056	0.0011
CO_2	782.00	156.40

[1] A year is defined as any 12 consecutive months.

No. 2 FUEL OIL FIRED EMERGENCY GENERATOR EG-014
Note: This emergency generator will be removed from service by December 31, 2014.
Emission limits based on the "Exhaust Information Data Sheet" for the emergency generator.
Model DQKAB ER014 bhp = 2922
137.9 gal/hr @ 100% load
Diesel fuel Btu = 137080 Btu/gal from North American Combustion Handbook
NOx = 5.11 g/hp-hr
CO = 0.21 g/hp-hr
HC = 0.23 g/hp-hr
PM = 0.04 g/hp-hr
SO_2 = 0.10 g/hp-hr
CO2 = 1.15 lb/hp-hr

PM/PM10/PM2.5:
0.04 g/hp-hr lb/hr × 2922 hp × (1 lb/453.59 g) = **0.26 lb/hr**
0.26 lb/hr × 400 hr/yr = 104 lb/yr
104 lb/yr ÷ 2000 lb/ton = **0.05 tons/yr**
SO_2:
0.10 g/hp-hr lb/hr × 2922 hp × (1 lb/453.59 g) = **0.64 lb/hr**
0.64 lb/hr × 400 hr/yr = 256 lb/yr
256 lb/yr ÷ 2000 lb/ton = **0.13 tons/yr**
NOx:
5.11 g/hp-hr lb/hr × 2922 hp × (1 lb/453.59 g) = **32.92 lb/hr**
32.92 lb/hr × 400 hr/yr = 13,168 lb/yr
13,168 lb/yr ÷ 2000 lb/ton = **6.58 tons/yr**
CO:
0.21 g/hp-hr lb/hr × 2922 hp × (1 lb/453.59 g) = **1.35 lb/hr**
1.35 lb/hr × 400 hr/yr = 540 lb/yr
540 lb/yr ÷ 2000 lb/ton = **0.27 tons/yr**
VOCs:
0.23 g/hp-hr lb/hr × 2922 hp × (1 lb/453.59 g) = **1.48 lb/hr**
1.48 lb/hr × 400 hr/yr = 592 lb/yr
592 lb/yr ÷ 2000 lb/ton = **0.30 tons/yr**

CO_2
1.15 lb/hp-hr × 2922 hp = **3360.3 lb/hr**
3360.3 lb/hr × 400 hr = 1,344,120 lb/yr
1,344,120 lb/yr ÷ 2000 lb/ton = **672.06 tons/yr**
Formaldehyde:
(137,080 Btu/gal × 137.9 gal/hr × 0.00118 lb formaldehyde/MMBtu) ÷ 1,000,000 = 0.022 lb/hr
0.022 lb/hr × (400 hr/yr ÷ 2,000 lb/ton) = 0.0044 tons/yr

Diesel-fired Emergency Generator EG-014 Emission Limits

Pollutant	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	0.26	0.05
PM_{10}	0.26	0.05
$PM_{2.5}$	0.26	0.05
SO_2	0.64	0.13
NO_X	32.92	6.58
CO	1.35	0.27
VOCs	1.48	0.30
CH_2O	0.022	0.0044
CO_2	3360.3	672.06

[1] A year is defined as any 12 consecutive months.

CATALYTIC OXIDIZER FOR THE ETHYLENE OXIDE (ETO) STERILIZERS
Two (2) Sterilizers
16 hours/cycle for each sterilizer
170 grams of ETO used for each cycle
99% efficiency for the catalytic oxidizer

Ethylene Oxide:
2 sterilizers × (8760 hr/yr ÷ 16 hr/cycle) = 1095 cycles/yr
1095 cycles/yr × (170 g ETO/cycle ÷ (1 lb/454 g)) = 410.02 lb/yr round to 410 lb/yr
410 lb/yr ÷ 8760 hr/yr = 0.047 lb/hr
410 lb/yr ÷ 2000 lb/ton = 0.21 tons/yr
410.02 × (1.00 – 0.99) = 4.1 lb/yr
4.l lb/yr ÷ 8760 hr/yr = 0.0047 lb/hr
4.1 lb/yr ÷ 2000 lb/ton = 0.0021 tpy

Ethylene Oxide Catalytic Oxidizer

Pollutant	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
Ethylene Oxide	0.0047	0.0021

[1] A year is defined as any 12 consecutive months.

No. 2 FUEL OIL FIRED FIRE PUMP FP-001:

The information upon which emissions for PM, NOx CO and HC are calculated comes from data in the Technical Data Sheet for the Clark Model JU4H-UFADW8 Fire Pump powered by a 144 hp John Deere compression ignition engine. Emissions for SO_2, formaldehyde and CO_2 are based on data from AP-42. The emission factors are:
PM – 0.09 g/hp-hr
NOx – 2.8 g/hp-hr
CO – 1.0 g/hp-hr
HC – 0.1 g/hp-hr
SO_2 – 0.00205 lb/hp-hr; Table 3.3-1
Formaldehyde – 0.00118 lb/MMBtu; Table 3.3-2
CO_2 – 1.15 lb/hp-hr; Table 3.3-1
From the spec sheet:
144 hp
10 gal/hr @ 100% load
Diesel fuel Btu = 140,000

PM/PM10/PM2.5:
0.09 g/hp-hr lb/hr × 144 hp × (1 lb/453.59 g) = **0.029 lb/hr**
0.029 lb/hr × 500 hr/yr = 14.5 lb/yr
14.5 lb/yr ÷ 2000 lb/ton = **0.0073 tons/yr**
SO_2:
0.00205 lb/hp-hr × 144 hp = **0.30 lb/hr**
0.30 lb/hr × 500 hr = 150 lb/yr
150 lb/yr ÷ 2000 lb/ton = **0.075 tons/yr**
NOx:
2.8 g/hp-hr lb/hr × 144 hp × (1 lb/453.59 g) = **0.89 lb/hr**
0.89 lb/hr × 500 hr/yr = 445 lb/yr
445 lb/yr ÷ 2000 lb/ton = **0.22 tons/yr**
CO:
1.0 g/hp-hr lb/hr × 144 hp × (1 lb/453.59 g) = **0.32 lb/hr**
0.32 lb/hr × 500 hr/yr = 160 lb/yr
160 lb/yr ÷ 2000 lb/ton = **0.08 tons/yr**
VOCs:
0.1 g/hp-hr lb/hr × 144 hp × (1 lb/453.59 g) = **0.032 lb/hr**
0.032 lb/hr × 500 hr/yr = 16 lb/yr
16 lb/yr ÷ 2000 lb/ton = **0.008 tons/yr**
CO_2
1.15 lb/hp-hr × 144 hp = **165.6 lb/hr**
165.6 lb/hr × 500 hr = 82,800 lb/yr
82,800 lb/yr ÷ 2000 lb/ton = **41.4 tons/yr**
Formaldehyde:
(140,000 Btu/gal × 10 gal/hr × 0.00118 lb formaldehyde/MMBtu) ÷ 1,000,000 = **0.0017 lb/hr**
0.0017 lb/hr × (500 hr/yr ÷ 2,000 lb/ton) = **0.0004 tons/yr**

Diesel-fired Emergency Fire Pump FP-001 Emission Limits

Pollutant	Hourly Emissions (lb/hr)	Yearly Emissions (tons/yr)[1]
PM	0.029	0.0073
PM_{10}	0.029	0.0073
$PM_{2.5}$	0.029	0.0073
SO_2	0.30	0.075
NO_X	0.89	0.22
CO	0.32	0.08
VOCs	0.032	0.008
CH_2O	0.0017	0.0004
CO_2	165.60	41.40

[1] A year is defined as any 12 consecutive months.

COOLING TOWERS:

There are three (3) cooling towers at this facility. Changes in the cooling towers resulted in reduced emissions compared to the previous operating permit. To calculate the cooling tower emissions, the average of the three cooling tower total dissolved solids was used. (1360 ppm + 1444ppm + 1444 ppm) ÷ 3 = 1416 ppm

Circulation Flow Rate (gal/min): 1,000
Total Drift (%): 0.016%
Total Dissolved Solids (ppm): 1,416
Density (lbs/gal): 8.345
Total Day of Operation (all CT): 8,760

Single cooling tower:
1000 gpm circulation rate × 60 sec/min × 0.00016 drift rate × (1416 ppm tds ÷ 1,000,000) ×8.345 lbs/gal = 0.11343 round to **0.11 lb/hr**
Single cooling tower:
0.11 lb/hr × (8760 ÷ 2000) = 0.4818 tpy round to **0.48 tpy**
Combined cooling towers:
0.48 tpy × 3 = **1.44 tpy**

Cooling Towers

Pollutant	Hourly Emission Limit (lbs/hr)	Annual Emission Limit (tons/year)	Combined Annual Emission Limit (tons/year)
PM	0.11	0.48	1.44
PM_{10}	0.11	0.48	1.44
$PM_{2.5}$	0.11	0.48	1.44