DNREC – Division of Air Quality
Application to Construct, Operate, or Modify Stationary Sources)

Emissions Information Application

If you are using this form electronically, press F1 at any time for help

Process Information

1.	Number of Individual Pieces of Process Equipment in Process: **1**
2.	Number of Individual Control Devices in Process: **N/A**

Emissions Information for First Emission Point/Stack

3.	Emission Point Name: **EG-5**
4.	Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **EG-5 (Emission Unit)**
5.	Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 5.10 through 5.18)	CAS Number (Not required for 5.1 through 5.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
5.1.	Particulate Matter (PM)		**0.1618 lbs/hour**	**lbs/hour**	**0.0404** tons/year	**0.0081** tons/year
5.2.	PM_{10}		**N/A lbs/hour**	**lbs/hour**	**N/A** tons/year	**N/A** tons/year
5.3.	$PM_{2.5}$		**N/A lbs/hour**	**lbs/hour**	**N/A** tons/year	**N/A** tons/year
5.4.	Sulfur Oxides (SO_X)		**0.0034 lbs/hour**	**lbs/hour**	**0.0009** tons/year	**0.0002** tons/year
5.5.	Nitrogen Oxides (NO_X)	**NOX+NMHC**	**9.0729 lbs/hour**	**lbs/hour**	**2.2682** tons/year	**0.4536** tons/year
5.6.	Carbon Monoxide (CO)		**1.1470 lbs/hour**	**lbs/hour**	**0.2867** tons/year	**0.0573** tons/year
5.7.	Total Volatile Organic Compounds (VOCs)		**0.4264 lbs/hour**	**lbs/hour**	**0.1066** tons/year	**0.0213** tons/year

Emissions Information for First Emission Point/Stack

5.8.	Total Hazardous Air Pollutants (HAPs)		**N/A lbs/hour**	**lbs/hour**	**N/A** tons/year	**N/A** tons/year
5.9.	CO_2		**949.5948 lbs/hour**	**lbs/hour**	**237.3987** tons/year	**47.4797** tons/year
5.10.	CO_{2e}		**N/A lbs/hour**	**lbs/hour**	**N/A** tons/year	**N/A** tons/year
5.11.	**CH4**	**74-82-8**	**0.2048 lbs/hour**	**lbs/hour**	**0.0512** tons/year	**0.0102** tons/year
5.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

6. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above: **See spreadsheet with calculations using manufacturer's emissions and AP-42 factors for cases where manufacturer did not provide that information.**

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Second Emission Point/Stack

7. Emission Point Name:

8. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

9. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 9.10 through 9.18)	CAS Number (Not required for 9.1 through 9.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
9.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Second Emission Point/Stack

9.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

10. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Third Emission Point/Stack

11. Emission Point Name:

12. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

Emissions Information for Third Emission Point/Stack

13. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 13.10 through 13.18)	CAS Number (Not required for 13.1 through 13.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
13.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Third Emission Point/Stack

14. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Fourth Emission Point/Stack

15. Emission Point Name:

16. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

17. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 17.10 through 17.18)	CAS Number (Not required for 17.1 through 17.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
17.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.7.	Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Fourth Emission Point/Stack

17.10. CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.11.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.12.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.13.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.14.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.15.		**lbs/hour**	**lbs/hour**	tons/year	tons/year

18. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

If there are more than four Emission Points/Stacks, attach additional copies of this form as needed.

Overall Process Emissions

19. Pollutant Emissions

If more than 15 pollutants are emitted from this Process, attach additional copies of this page as needed.

Pollutant Name (Specify VOCs and HAPs Individually in 19.10 through 19.18)	CAS Number (Not required for 19.1 through 19.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
19.1. Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.2. PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.3. $PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.4. Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.5. Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Overall Process Emissions

19.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

20. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Minor New Source Review Information

21. Does the Process Have the Potential to Emit More Than Five Tons Per Year of Any Pollutant? ☒ YES ☐ NO

22. Is the Source New or Existing? ☒ NEW ☐ EXISTING
See Question 11 of AQM-1

If the Process has the Potential to Emit more than five tons per year of any pollutant, and is a New Source, a Control Technology Analysis pursuant to Regulation No. 1125 Section 4 must be conducted and attached to this application.

Major New Source Review Information

23. Does the Process Have the Potential to Emit More Than the Significance Level for Any Pollutant? *(Check All That Apply)*

- ☐ Greater Than 25 Tons Per Year of Particulate Matter (PM)
- ☐ Greater Than 15 Tons Per Year of PM_{10}
- ☐ Greater Than 10 Tons Per Year of $PM_{2.5}$
- ☐ Greater Than 40 Tons Per Year of Sulfur Dioxide(SO_2)
- ☐ Greater Than 25 Tons Per Year of Nitrogen Oxides (NO_X) in New Castle and Kent County
- ☐ Greater Than 100 Tons Per Year of Nitrogen Oxides (NO_X) in Sussex County
- ☐ Greater Than 100 Tons Per Year of Carbon Monoxide (CO)
- ☐ Greater Than 25 Tons Per Year of Total Volatile Organic Compounds (VOCs) in New Castle and Kent County
- ☐ Greater Than 50 Tons Per Year of Total Volatile Organic Compounds (VOCs) in Sussex County
- ☐ Greater Than 75,000 Tons Per Year of Equivalent Carbon Dioxide (CO_{2e})

If the Process has the Potential to Emit greater than any of the amounts listed above 7 DE Admin. Code 1125 Sections 2 and/or 3 apply. Contact the Department at (302) 323-4542 or (302) 739-9402 for additional information

Additional Information

24. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO

If YES, complete the rest of Question 24.

24.1. Describe: **Calculations of emissions have been attached in Excel spreadsheet.**

EMERGENCY GENERATOR CALCULATIONS

COMPANY NAME	FMC STINE RESEARCH CENTER
FACILITY ID NUMBER	1000300279
TITLE V PERMIT NUMBER	AQM-003/00279 (Renewal 4) expiring on on 05/01/25
FACILITY CITY	NEWARK
FACILITY COUNTY	NEW CASTLE
CALCULATIONS DONE BY	LUPE REYNOLDS (SITE ENVIRONMENTAL ENGINEER)
EMISSIONS SOURCE ID No.	EG No. 5
FUEL TYPE	ULTRA-LOW SULFUR DIESEL
FUEL RATE	
SULFUR CONTENT OF DIESEL (%)	0.0015
ACTUAL HOURS OF OPERATION PER YEAR	100
MAXIMUM HOURS OF OPERATION PER YEAR	500
EMERGENCY GENERATOR (KW)	667 input
EMERGENCY GENERATOR (HP)	907
ENGINE (BHP)	894.46
ENGINE (MMBTU/hr)	2.28

Certificate of Compliance - Stationary Emergency Diesel Generator Set (manufacturer)

See tab of Manufacturer's factors and weighted average calculations

1 Brake **horsepower** [**bhp**] =	1.013869665424	Horsepower [HP]
1 Brake **horsepower** [**bhp**] =	2544.433578	BTU/hr
1 lb	453.592	grams
1KW	1.341	HP

Final weighted average calculations

Pollutants	Vendor calc
NOx	5.88
NMHC=VOC	0.29
NOX+NMHC	6.17
CO	0.78
PM	0.11
SO2	0.15
CO2	645.77

Emergency Generators - Emission Factors **>600 HP engines**

Diesel heating value	19300	BTU/lb
Diesel density	7.1	lb/gallon
1 MMBTU	1000000	BTU

Chemical Acronym	Chemical Name	EF1	Units	EF2	Units	PTE (lbs)	PTE (tons)	Estimated (lbs)	Estimated (tons)	
NOx +NMHC	**Nitrogen Dioxide +Non-Methane Hydrocarbons**	6.17	GRAMS/KW-hr	9.0729	lb/hr	4,536.4446	2.2682	907.2889	0.4536	**NOx +NMHC**
NOx	**Nitrogen oxides**	5.88	GRAMS/KW-hr	8.6464	lb/hr	4,323.2244	2.1616	864.6449	0.4323	**NOx**
CO	**Carbon Monoxide**	0.78	GRAMS/KW-hr	1.1470	lb/hr	573.4890	0.2867	114.6978	0.0573	**CO**
PM	**Particulate matter**	0.11	GRAMS/KW-hr	0.1618	lb/hr	80.8766	0.0404	16.1753	0.0081	**PM**
SO2 (better factor using fuel %)	**Sulfur Dioxide**	0.001515	lb/MMBTU	0.0034	lb/hr	1.7240	0.0009	0.3448	0.0002	**SO2 (better factor using fuel %)**
SO2	**Sulfur Dioxide**	0.15	GRAMS/KW-hr	0.2206	lb/hr	110.2863	0.0551	22.0573	0.0110	**SO2**
VOC	**Volatile Organic Compounds**	0.29	GRAMS/KW-hr	0.4264	lb/hr	213.2203	0.1066	42.6441	0.0213	**VOC**
CO2	**Carbon Dioxide**	645.77	GRAMS/KW-hr	949.5948	lb/hr	474,797.3840	237.3987	94,959.4768	47.4797	**CO2**
CH4	**Methane**	0.09	lb/MMBTU	0.2048	lb/hr	102.4157	0.0512	20.4831	0.0102	**CH4**

EF2 in lb/hour: (EF1 in Grams/KW-hr) X (1 lb/453.592 grams) X (667 KW)
EF2 in lb/hour: (EF1 in lb/MMBTU) X (2.28 MMBTU/hr)

https://www.epa.gov/sites/production/files/2020-10/documents/c03s04.pdf

Table 3.4-1. GASEOUS EMISSION FACTORS FOR LARGE STATIONARY DIESEL AND ALL STATIONARY DUAL-FUEL ENGINES[a]

Pollutant	Diesel Fuel (SCC 2-02-004-01)			Dual Fuel[b] (SCC 2-02-004-02)		
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	EMISSION FACTOR RATING	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	EMISSION FACTOR RATING
NO_x						
Uncontrolled	0.024	3.2	B	0.018	2.7	D
Controlled	0.013[c]	1.9[c]	B	ND	ND	NA
CO	5.5 E-03	0.85	C	7.5 E-03	1.16	D
SO_x[d]	8.09 E-03S_1	1.01S_1	B	4.06 E-04S_1 + 9.57 E-03S_2	0.05S_1 + 0.895S_2	B
CO_2[e]	1.16	165	B	0.772	110	B
PM	0.0007[c]	0.1[c]	B	ND	ND	NA
TOC (as CH_4)	7.05 E-04	0.09	C	5.29 E-03	0.8	D
Methane	f	f	E	3.97 E-03	0.6	E
Nonmethane	f	f	E	1.32 E-03	0.2[g]	E

[a] Based on uncontrolled levels for each fuel, from References 2,6-7. When necessary, the average heating value of diesel was assumed to be 19,300 Btu/lb with a density of 7.1 lb/gallon. The power output and fuel input values were averaged independently from each other, because of the use of actual brake-specific fuel consumption (BSFC) values for each data point and of the use of data possibly sufficient to calculate only 1 of the 2 emission factors (e. g., enough information to calculate lb/MMBtu, but not lb/hp-hr). Factors are based on averages across all manufacturers and duty cycles. The actual emissions from a particular engine or manufacturer could vary considerably from these levels. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code.

[b] Dual fuel assumes 95% natural gas and 5% diesel fuel.

[c] References 8-26. Controlled NO_x is by ignition timing retard.

[d] Assumes that all sulfur in the fuel is converted to SO_2. S_1 = % sulfur in fuel oil; S_2 = % sulfur in natural gas. For example, if sulfer content is 1.5%, then S = 1.5.

[e] Assumes 100% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 70 weight % carbon in natural gas, dual-fuel mixture of 5% diesel with 95% natural gas, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and natural gas heating value of 1050 Btu/scf.

[f] Based on data from 1 engine, TOC is by weight 9% methane and 91% nonmethane.

[g] Assumes that nonmethane organic compounds are 25% of TOC emissions from dual-fuel engines. Molecular weight of nonmethane gas stream is assumed to be that of methane.

Table 3.4-2. PARTICULATE AND PARTICLE-SIZING EMISSION FACTORS FOR LARGE UNCONTROLLED STATIONARY DIESEL ENGINES[a]

EMISSION FACTOR RATING: E

Pollutant	Emission Factor (lb/MMBtu) (fuel input)
Filterable particulate[b]	
< 1 µm	0.0478
< 3 µm	0.0479
< 10 µm	0.0496
Total filterable particulate	0.0620
Condensable particulate	0.0077
Total PM-10[c]	0.0573
Total particulate[d]	0.0697

[a] Based on 1 uncontrolled diesel engine from Reference 6. Source Classification Code 2-02-004-01. The data for the particulate emissions were collected using Method 5, and the particle size distributions were collected using a Source Assessment Sampling System. To convert from lb/MMBtu to ng/J, multiply by 430. PM-10 = particulate matter ≤ 10 micrometers (µm) aerometric diameter.

[b] Particle size is expressed as aerodynamic diameter.

[c] Total PM-10 is the sum of filterable particulate less than 10 µm aerodynamic diameter and condensable particulate.

[d] Total particulate is the sum of the total filterable particulate and condensable particulate.

Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	12V1600G80S				
Applicationgroup	3D				
Legislative body	EPA Stationary EMERG T2 (40CFR60)				
Test cycle	D2				
Fuel sulphur content [ppm]	372				
mg/mN^3 values base on residual oxygen value of [%]	Measured				

Engine raw emissions*

Cycle point	[-]	n1	n2	n3	n4	n5
Power	kW	667	501	335	167	67
Power relative	[-]	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1800	1800	1800	1800	1800
Engine speed relative	[-]	1	1	1	1	1
Filter smoke number	[-]	0.23	0.675	0.69	0.448	0.083
Exhaust temperature after ETC	grdC	408.9	366.9	356.2	308	208.7
Exhaust back pressure after ETC (static)	mbar	30	24	17	8	4
Exhaust mass flow wet	kg/h	3992	3462.6	2687.5	1834.5	1430.5
NOX-Emissions specific	g/kWh	7.03	6.05	5.38	5.23	9.27
SO2-Emissions specific	g/kWh	0.148	0.149	0.157	0.176	0.227
CO-Emissions specific	g/kWh	0.4	0.53	0.61	1.49	4.41
HC1-Emissions specific	g/kWh	0.18	0.2	0.24	0.52	1.6
NMHC-Emissions specific	g/kWh	0.18	0.2	0.24	0.51	1.56
NOX+HC1-Emissions specific	g/kWh	7.21	6.25	5.62	5.75	10.86
NOX+NMHC-Emissions specific	g/kWh	7.21	6.25	5.61	5.74	10.83
CO2-Emissions specific	g/kWh	627.4	630.8	664.4	744	952.9
PM-Emissions specific (Meas.)	g/kWh	0.038	0.107	0.118	0.138	0.09
Carbon dioxide (CO2)	Vol%	7.512	6.485	5.837	4.737	3.071
Oxygen (O2)	Vol%	10.422	11.833	12.713	14.221	16.547

EMERGENCY GENERATOR CALCULATIONS

COMPANY NAME	FMC STINE RESEARCH CENTER
FACILITY ID NUMBER	1000300279
TITLE V PERMIT NUMBER	AQM-003/00279 (Renewal 4) expiring on on 05/01/25
FACILITY CITY	NEWARK
FACILITY COUNTY	NEW CASTLE
CALCULATIONS DONE BY	LUPE REYNOLDS (SITE ENVIRONMENTAL ENGINEER)
EMISSIONS SOURCE ID No.	EG No. 5
FUEL TYPE	ULTRA-LOW SULFUR DIESEL
FUEL RATE	
SULFUR CONTENT OF DIESEL (%)	0.0015
ACTUAL HOURS OF OPERATION PER YEAR	100
MAXIMUM HOURS OF OPERATION PER YEAR	500
EMERGENCY GENERATOR (KW)	667 input
EMERGENCY GENERATOR (HP)	907
ENGINE (BHP)	894.46
ENGINE (MMBTU/hr)	2.28

Certificate of Compliance - Stationary Emergency Diesel Generator Set (manufacturer)

See tab of Manufacturer's factors

1 Brake **horsepower** [**bhp**] =	1.013869665424	Horsepower [HP]
1 Brake **horsepower** [**bhp**] =	2544.433578	BTU/hr
1 lb	453.592	grams
1KW	1.341	HP

Emergency Generators - Emission Factors **>600 HP engines**

Diesel heating value	19300	BTU/lb
Diesel density	7.1	lb/gallon
1 MMBTU	1000000	BTU

Chemical Acronym	Chemical Name	EF1	Units	EF2	Units	PTE (lbs)	PTE (tons)	Estimated (lbs)	Estimated (tons)
NOx +NMHC	**Nitrogen Dioxide +Non-Methane Hydrocarbons**	7.21	GRAMS/KW-hr	10.6022	lb/hr	5,301.0966	2.6505	1,060.2193	0.5301
NOx	**Nitrogen oxides**	7.03	GRAMS/KW-hr	10.3375	lb/hr	5,168.7530	2.5844	1,033.7506	0.5169
CO	**Carbon Monoxide**	0.40	GRAMS/KW-hr	0.5882	lb/hr	294.0969	0.1470	58.8194	0.0294
PM	**Particulate matter**	0.04	GRAMS/KW-hr	0.0559	lb/hr	27.9392	0.0140	5.5878	0.0028
SO2 (better factor using fuel %)	**Sulfur Dioxide**	0.001515	lb/MMBTU	0.0034	lb/hr	1.7240	0.0009	0.3448	0.0002
SO2	**Sulfur Dioxide**	0.148	GRAMS/KW-hr	0.2176	lb/hr	108.8159	0.0544	21.7632	0.0109
VOC	**Volatile Organic Compounds**	0.91	lb/MMBTU	2.0711	lb/hr	1,035.5365	0.5178	207.1073	0.1036
CO2	**Carbon Dioxide**	627.4	GRAMS/KW-hr	922.5820	lb/hr	461,290.9840	230.6455	92,258.1968	46.1291
CH4	**Methane**	0.09	lb/MMBTU	0.2048	lb/hr	102.4157	0.0512	20.4831	0.0102

EF2 in lb/hour: (EF1 in Grams/KW-hr) X (1 lb/453.592 grams) X (667 KW)
EF2 in lb/hour: (EF1 in lb/MMBTU) X (2.28 MMBTU/hr)

Information added on 10/11/21
Rolls Royce
Diesel Generator Set
MTU 12V1600 DS600

Chemical Acronym	Chemical Name	Vendor Sheet	Units	Vendor Sheet	Units
NOx +NMHC	**Nitrogen Dioxide +Non-Methane Hydrocarbons**	5.36	GRAMS/hp-hr	7.19	GRAMS/KW-hr
CO	**Carbon Monoxide**	0.30	GRAMS/hp-hr	0.40	GRAMS/KW-hr
PM	**Particulate matter**	0.03	GRAMS/hp-hr	0.04	GRAMS/KW-hr

Data extracted from Vendor letter

Raw measured emissions values

Load (%)	100	75	50	25	10
KW	667	501	335	167	67
BHP (calc)	894	672	449	224	90
MMBTU/Hr	2.27	1.71	1.14	0.57	0.23
NOx (g/kWh)	7.03	6.05	5.38	5.23	9.27
NMHC (g/kWh)	0.18	0.2	0.24	0.51	1.56
CO (g/kWh)	0.4	0.53	0.61	1.49	4.41
PM (g/kWh)	0.038	0.107	0.118	0.065	0.09

Weighted average emission values for EPA Tier 2 compliance

	g/kWh	g/bhp-h
NOx	5.88	4.384
NMHC	0.29	0.215
CO	0.78	0.579
PM	0.10	0.072
NOx + NMHC	6.17	4.60

EPA Conversion factors

kW to BHP	1.341
g/kWh to g/bhp-h	0.7457
KW to MMBTU/Hr	0.0034

$$E_{D2} = \frac{(P_{100} * E_{100} * 0{,}05) + (P_{75} * E_{75} * 0{,}25) + (P_{50} * E_{50} * 0{,}3) + (P_{25} * E_{25} * 0{,}3) + (P_{10} * E_{10} * 0{,}1)}{(P_{100} * 0{,}05) + (P_{75} * 0{,}25) + (P_{50} * 0{,}3) + (P_{25} * 0{,}3) + (P_{10} * 0{,}1)}$$

P=Power
E=Emissions

Data extracted from EPA Tier 2 compliant page submitted for permit application. These are raw numbers used in formula

Emissions (g/KW-hr)	E100	E75	E50	E25	E10
Load (%)	100	75	50	25	10
KW = Power	667	501	335	167	67
NOx	7.03	6.05	5.38	5.23	9.27
NMHC	0.18	0.2	0.24	0.51	1.56
NOX+NMHC	7.21	6.25	5.61	5.74	10.83
CO	0.4	0.53	0.61	1.49	4.41
PM	0.038	0.107	0.118	0.138	0.09
SO2	0.148	0.149	0.157	0.176	0.227
CO2	627.4	630.8	664.4	744	952.9

Weighted Average Calculations perfomed to confirm numbers provided by the vendor

Calculations	P100x E100x0.05	P75xE75x0.25	P50XE50X0.3	P25XE25x0.3	P10xE10X0.1	P100x0.05	P75x0.25	P50X0.3	P25x0.3	P10X0.1	Weighted average
NOx	234.4505	757.7625	540.69	262.023	62.109	33.35	125.25	100.5	50.1	6.7	5.88
NMHC	6.003	25.05	24.12	25.551	1.44612	33.35	125.25	100.5	50.1	6.7	0.26
NOX+NMHC	240.4535	782.8125	563.805	287.574	1.68948	33.35	125.25	100.5	50.1	6.7	5.94
CO	13.34	66.3825	61.305	74.649	4.77603	33.35	125.25	100.5	50.1	6.7	0.70
PM	1.2673	13.40175	11.859	6.9138	0.03969	33.35	125.25	100.5	50.1	6.7	0.11
SO2	4.9358	18.66225	15.7785	8.8176	0.002043	33.35	125.25	100.5	50.1	6.7	0.15
CO2	20923.79	79007.7	66772.2	37274.4	21.63083	33.35	125.25	100.5	50.1	6.7	645.77

Final Weighted Average Calculations

In compliance with EPA Tier 2

Pollutants	My calc	Vendor calc
NOx	5.88	5.88
NMHC	0.26	0.29
NOX+NMHC	5.94	6.17
CO	0.70	0.78
PM	0.11	0.11
SO2	0.15	N/A
CO2	645.77	N/A