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PFAS AND RTAP EMISSIONS FROM PROCESS EQUIPMENT

RTO Stack (As Built)

Stack Parameters		Notes	
Deposition (PFAS)	Dispersion (RTAPs)		
Height (ft)	60	Height (ft)	60
Temperature (F)	350	Temperature (F)	351
Diameter (inches)	72	Diameter (inches)	72
Flow (SCFM)	63,500	Flow (SCFM)	66,900
Flow (ACFM)	98,300	Flow (ACFM)	103,600
Values for stack parameters come from both applications; Table 1 - RTO As-Built Emission Parameters; and 2021 stack test report			
Stack test used 71"; Applications stated 6 ft (72")			
Values for RTAP stack parameters come from average of stack test runs 2-4.			
Values for flow rates come from stack tests and used in model (see Table 1 - RTO As-Built Emission Parameters); both applications stated 100,000 ACFM max			
Height (m)	18.29	Height (m)	18.29
Temperature (K)	450	Temperature (K)	450
Diameter (m)	1.829	Diameter (m)	1.829
Velocity (m/s)	17.68	Velocity (m/s)	18.64
Calculated values.			

Antenna Coating Lines

Stack Parameters		Notes	
Dispersion (RTAPs)			
Height (ft)	3	Height (ft)	3
Temperature (F)	62	Temperature (F)	62
Diameter (inches)	33.6	Diameter (inches)	33.6
Flow (SCFM)		Flow (SCFM)	
Flow (ACFM)	3,400	Flow (ACFM)	3,400
Discharge	Horizontal	Discharge	Horizontal
Height (m)	0.91	Height (m)	0.91
Temperature (K)	290	Temperature (K)	290
Diameter (m)	0.85	Diameter (m)	0.85
Velocity (m/s)	2.81	Velocity (m/s)	2.81
There are 3 identical antenna coating line stacks. No change has been made to antenna coating line stack parameters since the 2019 modeling.			

Emission Rates (lb/hr) [Prior to EU24 modification]			
PFOA	2.54E-06	APFO	2.64E-06
PFOS	6.80E-08	HF	0.012
PFNA	6.66E-07	Ethylene Glycol	0.94
PFHxS	ND	Toluene	0.33
		Isopropanol	0.033
		Ethanol	0.00088
		1,4-Dioxane	0.0017
		Benzene	0.00011
		Polyethylene Glycol	0.18
		Tetrafluoroethylene	0.30
		Methanol	0.037
		MEK	0.016
		n-Methyl-2-Pyrrolidone	0.014
		Hexane	0.00087
		Ammonia	0.10
		Ethyl Acetate	--
		Xylene	--
		Ethyl Benzene	--
Barr modeling looked at PFOA, PFOS, APFO and HF based on 2021 stack test results. These numbers reflect the higher of the 2021 or 2022 stack test results.			
RTAPs come from highest actual emission rate from 2012 - 2021 scaled based on scaling factors in application. The only RTAPs that changed (increased) since the October 4, 2019 modeling memo by NHDES (see engineering summary for App #18-0227) were methanol and ammonia. Assumed no destruction efficiency from RTO for RTAPs.			
Additional PFAS emissions also based on 2021 stack test results.			

Emission Rates (lb/hr)			
PFAS	n/a	No PFAS emissions from antenna coating lines.	
Ethylene Glycol	--		
Toluene	0.49		
Isopropanol	--		
Ethanol	--		
1,4-Dioxane	--		
Benzene	0.0002		
Polyethylene Glycol	--		
Tetrafluoroethylene	--		
Methanol	--		
MEK	0.12		
n-Methyl-2-Pyrrolidone	--		
Hexane	0.015		
Ammonia	--		
Ethyl Acetate	0.0075		
Xylene	0.00094		
Ethyl Benzene	0.0002		

Emission Rates (lb/hr) [Including Emissions from EU24 modification]			
PFOA	2.54E-06	APFO	2.64E-06
PFOS	6.80E-08	HF	0.012
PFNA	6.66E-07	Ethylene Glycol	1.00
PFHxS	ND	Toluene	0.36
		Isopropanol	0.036
		Ethanol	0.00094
		1,4-Dioxane	0.0018
		Benzene	0.00012
		Polyethylene Glycol	0.19
		Tetrafluoroethylene	0.32
		Methanol	0.04
		MEK	0.017
		n-Methyl-2-Pyrrolidone	0.015
		Hexane	0.00093
		Ammonia	0.11
		Ethyl Acetate	--
		Xylene	--
		Ethyl Benzene	--
Barr modeling looked at PFOA, PFOS, APFO and HF based on 2021 stack test results. These numbers reflect the higher of the 2021 or 2022 stack test results.			
RTAPs emissions were calculated as a 6.9% increase in fabric coating potential due to the addition of coating capability on EU24.			
Additional PFAS emissions also based on 2021 stack test results.			

Bypass Stack (As Built)

Stack Parameters		Notes	
Deposition (PFAS)	Dispersion (RTAPs)		
Height (ft)	63.52	Height (ft)	63.52
Temperature (F)	236	Temperature (F)	236
Diameter (inches)	60	Diameter (inches)	60
Flow (SCFM)	57,559	Flow (SCFM)	57,559
Flow (ACFM)	76,868	Flow (ACFM)	76,868
Height (m)	19.37	Height (m)	19.37
Temperature (K)	386	Temperature (K)	386
Diameter (m)	1.524	Diameter (m)	1.524
Velocity (m/s)	19.91	Velocity (m/s)	19.91
Values come from Table 4 - Bypass Stack Air Dispersion and Deposition Modeling Report, ARD-3 form dated 02/28/2022, and 2021 stack test report			

Antenna Coating Lines

Stack Parameters		Notes	
Dispersion (RTAPs)			
Height (ft)	3	Height (ft)	3
Temperature (F)	62	Temperature (F)	62
Diameter (inches)	33.6	Diameter (inches)	33.6
Flow (SCFM)		Flow (SCFM)	
Flow (ACFM)	3,400	Flow (ACFM)	3,400
Discharge	Horizontal	Discharge	Horizontal
Height (m)	0.91	Height (m)	0.91
Temperature (K)	290	Temperature (K)	290
Diameter (m)	0.85	Diameter (m)	0.85
Velocity (m/s)	2.81	Velocity (m/s)	2.81
There are 3 identical antenna coating line stacks. No change has been made to antenna coating line emissions or stacks since the modeling was done in 2019.			

Emission Rates (lb/hr) [Prior to EU24 modification]			
PFOA	2.06E-05	APFO	2.14E-05
PFOS	2.77E-07	HF	0.012
PFNA	7.26E-06	Ethylene Glycol	0.94
PFHxS	2.23E-08	Toluene	0.33
		Isopropanol	0.033
		Ethanol	0.00088
		1,4-Dioxane	0.0017
		Benzene	0.00011
		Polyethylene Glycol	0.18
		Tetrafluoroethylene	0.30
		Methanol	0.037
		MEK	0.016
		n-Methyl-2-Pyrrolidone	0.014
		Hexane	0.00087
		Ammonia	0.10
		Ethyl Acetate	--
		Xylene	--
		Ethyl Benzene	--
Barr modeling looked at PFOA, PFOS, APFO and HF based on 2021 stack test results. Assumed HF to bypass = HF from RTO (conservative) None of the RTO inlet numbers increased from 2021 to 2022 stack test.			
RTAPs come from highest actual emission rate from 2012 - 2021 scaled based on scaling factors in application. The only RTAPs that changed (increased) since the October 4, 2019 modeling memo by NHDES (see engineering summary for App #18-0227) were methanol and ammonia. Assumed no destruction efficiency from RTO for RTAPs.			
Additional PFAS analyte emissions (PFNA and PFHxS) also based on 2021 stack test results.			

Emission Rates (lb/hr)			
PFAS	n/a	No PFAS emissions from antenna coating lines.	
Ethylene Glycol	--		
Toluene	0.49		
Isopropanol	--		
Ethanol	--		
1,4-Dioxane	--		
Benzene	0.0002		
Polyethylene Glycol	--		
Tetrafluoroethylene	--		
Methanol	--		
MEK	0.12		
n-Methyl-2-Pyrrolidone	--		
Hexane	0.015		
Ammonia	--		
Ethyl Acetate	0.0075		
Xylene	0.00094		
Ethyl Benzene	0.0002		

Emission Rates (lb/hr) [Including Emissions from EU24 modification]			
PFOA	2.06E-05	APFO	2.14E-05
PFOS	2.77E-07	HF	0.012
PFNA	7.26E-06	Ethylene Glycol	1.00
PFHxS	2.23E-08	Toluene	0.36
		Isopropanol	0.036
		Ethanol	0.00094
		1,4-Dioxane	0.0018
		Benzene	0.00012
		Polyethylene Glycol	0.19
		Tetrafluoroethylene	0.32
		Methanol	0.04
		MEK	0.017
		n-Methyl-2-Pyrrolidone	0.015
		Hexane	0.00093
		Ammonia	0.11
		Ethyl Acetate	--
		Xylene	--
		Ethyl Benzene	--
Barr modeling looked at PFOA, PFOS, APFO and HF based on 2021 stack test results. Assumed HF to bypass = HF from RTO (conservative) None of the RTO inlet numbers increased from 2021 to 2022 stack test.			
RTAPs emissions were calculated as a 6.9% increase in fabric coating potential due to the addition of coating capability on EU24.			
Additional PFAS emissions also based on 2021 stack test results.			

Calculation of Facility-wide PFAS Emission Limitations

		LCMRL	MC _{PFAS}	IR	MDR _{PFAS}	UIR (from NHDES model)	UIR (converted to µg)	Maximum Calculated Allowable Emission			
		µg/m ³	µg/m ³	m/yr	µg/m ² /yr	g/m ² /yr per g/s	µg/m ² /yr per g/s	g/s	lb/hr	lb/yr (8760 hr/yr)	lb/yr (8,585 hr/yr)
		2022 Model (As -Built RTO Stack #3) UIR Method 1	PFOA	3.4	3.4	0.53	1.8	0.178	178000	1.01E-05	0.00008
	PFOS	4.4	4.4	0.53	2.3	0.178	178000	1.31E-05	0.00010	0.91	0.89
	PFNA	4.8	4.8	0.53	2.5	0.178	178000	1.43E-05	0.00011	0.99	0.97
	PFHxS	3.7	3.7	0.53	2.0	0.178	178000	1.10E-05	0.00009	0.77	0.75

		LCMRL	MC _{PFAS}	IR	MDR _{PFAS}	UIR (from NHDES model)	UIR (converted to µg)	Maximum Calculated Allowable Emission			
		µg/m ³	µg/m ³	m/yr	µg/m ² /yr	g/m ² /yr per g/s	µg/m ² /yr per g/s	g/s	lb/hr		lb/yr (175 hr/yr)
		2022 Model (Emergency Bypass Stack #6) UIR Method 1	PFOA	3.4	3.4	0.53	1.8	0.906	906000	1.99E-06	0.000016
	PFOS	4.4	4.4	0.53	2.3	0.906	906000	2.57E-06	0.000020		0.004
	PFNA	4.8	4.8	0.53	2.5	0.906	906000	2.81E-06	0.000022		0.004
	PFHxS	3.7	3.7	0.53	2.0	0.906	906000	2.16E-06	0.000017		0.003

		lb/yr
2022 Model (Facility-wide) UIR Method 1	PFOA	0.69
	PFOS	0.90
	PFNA	0.98
	PFHxS	0.75

LCMRL lowest concentration minimum reporting limits for lab analysis based on EPA Method 533 for PFAS in drinking water published in 2019 (µg/m³ or ppt)

MC_{PFAS} maximum concentration for each PFAS analyte (µg/m³ or ppt)

IR infiltration rate (m/yr)

21 inches/year (0.53 m/yr) infiltrates the ground in each m² area

MDR maximum deposition rate (µg/m²/yr)

UIR unit impact rate for each stack (µg/m²/yr per g/s)

AERMOD Method 1 deposition results

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2021 Stack Test Results

PFAS Analyte	Inlet	Outlet		Inlet	Outlet	DRE %
	lb/hr	lb/hr		lb/yr	lb/yr	
PFBA	1.88E-04	2.73E-05		1.647	0.239	85
PFPeA	2.93E-04	3.90E-05		2.567	0.342	87
PFHxA	5.08E-04	7.31E-05		4.450	0.640	86
PFHpA	1.00E-04	2.21E-06		0.876	0.019	98
PFOA	2.06E-05	1.64E-06		0.180	0.014	92
PFNA	7.26E-06	6.55E-08		0.064	0.001	99
PFDA	7.71E-07	6.68E-09		6.75E-03	5.85E-05	99
PFUnA	8.90E-07	ND		7.80E-03	ND	NC
PFDoA	1.02E-08	1.05E-08		8.94E-05	9.20E-05	-3
PFTriA	7.23E-07	1.88E-08		6.33E-03	1.65E-04	97
PFTeA	3.51E-08	1.17E-08		3.07E-04	1.02E-04	67
PFHxDA	1.77E-08	1.66E-08		1.55E-04	1.45E-04	6
PFODA	2.78E-08	2.99E-08		2.44E-04	2.62E-04	-8
PFBS	1.60E-08	2.99E-08		1.40E-04	2.62E-04	-87
PFPeS	3.15E-09	ND		2.76E-05	ND	NC
PFHxS	2.23E-08	ND		0.0002	ND	NC
PFOS	2.77E-07	6.80E-08		0.0024	5.96E-04	75
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	1.84E-08	2.96E-08		1.61E-04	2.59E-04	-61
NEtFOSAA	5.62E-09	ND		4.92E-05	ND	NC
6:2 FTS	7.50E-07	1.70E-07		6.57E-03	1.49E-03	77
8:2 FTS	3.27E-09	ND		2.86E-05	ND	NC
3-Perfluoropropylpropanoic acid	2.87E-05	ND		0.251	ND	NC
6:2 Fluorotelomer carboxylic acid	5.28E-04	6.11E-05		4.625	0.535	88
6:2 Fluorotelomer unsaturated acid	2.83E-04	4.96E-05		2.479	0.434	82
HFPO-DA	7.75E-06	1.58E-06		0.068	0.014	80
TOTAL PFAS	1.97E-03	2.56E-04		17.2	2.2	87

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2022 Stack Test Results

PFAS Analyte	Inlet	Outlet		Inlet	Outlet	DRE %
	lb/hr	lb/hr		lb/yr	lb/yr	
PFBA	2.58E-05	1.11E-06		0.23	0.010	96
PFPeA	5.19E-05	2.03E-06		0.45	0.018	96
PFHxA	1.23E-05	1.41E-06		0.11	0.012	89
PFHpA	1.36E-05	7.88E-07		0.12	0.0069	94
PFOA	1.10E-05	2.54E-06		0.096	0.022	77
PFNA	6.55E-06	6.66E-07		0.057	0.0058	90
PFDA	2.29E-06	3.42E-07		0.020	0.0030	85
PFUnA	8.56E-06	3.84E-07		0.075	0.0034	96
PFDoA	2.01E-06	1.94E-08		0.018	0.0002	99
PFTriA	2.50E-06	6.58E-08		0.022	0.0006	97
PFTeA	8.04E-08	4.19E-08		0.00070	0.00037	48
PFHxS	3.10E-09	ND		0.000027	ND	NC
PFOS	1.29E-07	5.88E-08		0.00113	0.00052	54
Perfluorooctanesulfonamide (FOSA)		7.36E-09			0.00006	NC
NEtFOSAA	4.59E-08	2.30E-08		0.00040	0.00020	50
6:2 FTS	2.79E-07	ND		0.0024	ND	NC
HFPO-DA	1.50E-05	2.95E-06		0.13	0.026	80
2-(N-ethylperfluoro-1-octanesulfonamido) ethanol	2.48E-07	ND		0.0022	ND	NC
Perfluoro-n-octadecanoic acid (PFODA)	3.87E-08	1.20E-07		0.00034	0.0011	-210
N-ethylperfluorooctane sulfonamide (NEtFOSA)	1.31E-08	ND		0.00011	ND	NC
Perfluoro-n-hexadecanoic acid (PFHxDA)	3.81E-08	8.21E-08		0.00033	0.00072	-115
6:2 Fluorotelomer carboxylic acid	2.74E-07	3.03E-07		0.0024	0.0027	-11
6:2 Fluorotelomer unsaturated acid	3.92E-07	1.12E-07		0.0034	0.0010	71
8:2 Fluorotelomer carboxylic acid	3.27E-07	ND		0.0029	ND	NC
5:3 Fluorotelomer carboxylic acid	7.28E-07	ND		0.0064	ND	NC
3-Perfluoropropylpropanoic acid	7.73E-06	ND		0.068	ND	NC
Perfluoro-3-methoxypropanoic acid (PFMPA)	8.10E-07	1.67E-07		0.0071	0.0015	79
TOTAL PFAS	1.63E-04	1.32E-05		1.42	0.12	92

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EMISSIONS OF AIR CONTAMINANTS FROM COMBUSTION SOURCES

Combustion Source	NO _x			SO ₂			CO			PM			VOC		
	Hourly		Annual	Hourly		Annual	Hourly		Annual	Hourly		Annual	Hourly		Annual
	(lb/hr)		(ton/yr)	(lb/hr)		(ton/yr)	(lb/hr)		(ton/yr)	(lb/hr)		(ton/yr)	(lb/hr)		(ton/yr)
Process Burners	6.46		28.3	0.04		0.2	5.43		23.8	0.49		2.2	0.36		1.6
RTO Burners	1.73		7.6	0.01		0.05	1.45		6.3	0.13		0.6	0.09		0.4
No. 2 Fuel Oil/Boiler	0.22		1.0	0.0024		0.01	0.056		0.2	0.022		0.10	0.004		0.02
Diesel Fuel/Generator	0.51		0.1	0.0007		1.7E-04	0.55		0.1	0.04		0.01	0.51		0.1
Diesel Fuel/Fire Pump	1.13		0.3	1.80E-03		4.50E-04	1.41		0.4	0.08		0.02	1.13		0.3
Total	10.05		37.2	0.05		0.23	8.89		30.9	0.77		2.9	2.1		2.4

* - Annual Emissions refer to annual limit based on 500 hours per year of operation of emergency generator and fire pump, all other annual based on 8,760 hours/year.

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EMISSIONS OF AIR CONTAMINANTS FROM NATURAL GAS COMBUSTION

Known Data:

1. Tower Coaters have natural gas-fired heaters, each having the heat input rating listed below
2. Additional combustion source associated with RTO is two (2) 8.8 MMBtu/hr burners

Listing of Combustion Sources at the Facility:

Identifier	Details	Heat Input	
Tower MA	Tower Heat Source	3,900,000	BTU/hr
Tower MB	Tower Heat Source	7,500,000	BTU/hr
Tower MC	Tower Heat Source	4,500,000	BTU/hr
Tower MR	Tower Heat Source	4,500,000	BTU/hr
Tower MD	Tower Heat Source	9,000,000	BTU/hr
Tower QX	Tower Heat Source	7,500,000	BTU/hr
Tower MG	Tower Heat Source	6,000,000	BTU/hr
Tower MP	Tower Heat Source	7,500,000	BTU/hr
Tower MQ	Tower Heat Source	4,500,000	BTU/hr
Tower MS	Tower Heat Source	4,500,000	BTU/hr
MTM Exhaust	MTM Heat Source	3,000,000	BTU/hr
R&D Coater	Coater Heat Source	2,000,000	BTU/hr
Heat Clean	Heat Clean Source	1,500,000	BTU/hr
RTO Burners	Final Design	17,600,000	BTU/hr
TOTAL COMBINED HEAT INPUT		83,500,000	BTU/hr

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65,900,000 (Without RTO)

Emission Factors:

As per AP-42, Chapter 1.4 for Small Boilers (<100 MMBtu/hr) (7/98 Edition)

Contaminant Name	Natural Gas Emission Factor (lb/Million SCF)	Natural Gas Emission Factor (lb/MMBTU)*
NO _x	100	0.098
SO ₂	0.6	0.00059
CO	84	0.082
PM	7.6	0.0075
VOC	5.5	0.0054

* - Per AP-42, divide Emission Factor (lb/Million SCF) by 1,020 to obtain Emission Factor (lb/MMBTU)

Hourly and Annual Potential to Emit:

PTE (lb/hr) = Max. firing rate (MMBtu/hr) * Emission Factor (lb/MMBTU); Annual PTE = Hourly PTE * 8,760 hr/yr

Contaminant Name	Hourly PTE Total (lb/hr)	Annual PTE Total (lb/yr)	Annual PTE Total (tons/yr)
NO _x	8.19	71,712	35.9
SO ₂	0.05	430.3	0.22
CO	6.88	60,238	30.1
PM	0.62	5,450	2.7
VOC	0.45	3,944	2.0

Contaminant Name	Hourly PTE Total (lb/hr) w/o RTO	Annual PTE Total (lb/yr) w/o RTO	Annual PTE Total (tons/yr) w/o RTO
NO _x	6.46	56596	28.3
SO ₂	0.04	340	0.2
CO	5.43	47541	23.8
PM	0.49	4301	2.2
VOC	0.36	3113	1.6

Contaminant Name	Hourly PTE Total (lb/hr) RTO only	Annual PTE Total (lb/yr) RTO only	Annual PTE Total (tons/yr) RTO only
NO _x	1.73	15115	7.6
SO ₂	0.01	91	0.05
CO	1.45	12697	6.3
PM	0.13	1149	0.6
VOC	0.09	831	0.4

EMISSIONS OF AIR CONTAMINANTS FROM BOILER

Known Data:

1. Heat input for existing No. 2 Fuel Oil Fired Boiler (permit exempt unit) listed below.
2. Actual amount of fuel oil combusted in Calendar Year 2018= 0 gallons.

Listing of Combustion Sources at the Facility:

Identifier	Details	Heat Input	
Boiler System	No. 2 Fuel Oil Fired	1,560,000	BTU/hr

Emission Factors:

As per AP-42, Chapter 1.3 for Boilers <100 MMBtu/hr (5/2010 Edition)

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Contaminant Name	No. 2 Fuel Oil Emission Factor (lb/1,000 Gal.)	No. 2 Fuel Oil Emission Factor (lb/MMBtu)*
NO _x	20	0.14
SO ₂ **	0.213	0.0015
CO	5.0	0.036
PM	2.0	0.014
VOC/NMTOC	0.34	0.0024

* - Per AP-42, divide Emission Factor (lb/1,000 gal.) by 140 to obtain Emission Factor (lb/MMBTU)

** - SO₂ emission factor per AP-42 is 142 x % Sulfur (assumed 15 ppm sulfur content in fuel oil)

Hourly and Annual Potential to Emit:

PTE (lb/hr) = Max. firing rate (MMBtu/hr) * Emission Factor (lb/MMBtu); Annual PTE = Hourly PTE * 8,760 hr/yr

Contaminant Name	Hourly PTE Total (lb/hr)	Annual PTE Total (lb/yr)	Annual PTE Total (tons/yr)
NO _x	0.22	1,952.23	1.0
SO ₂	0.0024	20.79	0.01
CO	0.056	488.06	0.2
PM	0.022	195.22	0.1
VOC/NMTOC	0.004	33.19	0.02

EMISSIONS OF AIR CONTAMINANTS FROM COMBUSTION IN EMERGENCY GENERATOR

Known Data:

- a. Emergency Generator Unit installed in 2015
- b. Unit is a Kohler generator 40REOZJC (80 hp/0.466 MMBtu/hr engine) combustion diesel fuel

Assumptions:

- a. Hours of operation capped at 500 hours per year per permit condition

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Emission Factors:

From EPA Tier 3 Limits or Sulfur Content Limit in Diesel Fuel

Contaminant Name	Emission Factor (g/hp-hr)	Emission Factor (lb/hp-hr)	Emission Factor (lb/MMBtu)	Notes
Particulate Matter (PM)	0.30	0.00066	0.094	Tier 3 Limit
Sulfur Dioxide (SO ₂)*			0.0015	15 ppm S Limit
Oxides of Nitrogen (NO _x)**	3.5	0.0077	1.1	Tier 3 Limit
Carbon Monoxide (CO)	3.7	0.0082	1.2	Tier 3 Limit
Total Organic Compounds (TOC)**	3.5	0.0077	1.1	Tier 3 Limit

* - Emission factor based on 15 PPM sulfur

** - Emission factors for VOC and NO_x each assumed to be total of Tier 3 Limit for NMHC + NO_x

Tier 3 limits (in g/kw-hr) = 4.7 for NO_x+NMHC; 5.0 for CO; and 0.4 for PM. Conversion factor from g/kw-hr to g/hp-hr = 0.7457

Details of Emergency Generator Unit at Facility

Identifier	Manufacturer	Fuel Type	Rating (hp)	Rating (BTU/hr)
40REOZJC	Kohler/John Deere	Diesel Fuel	80	466,000

Emission Calculations

Hourly Emissions (lb/hr) = (Max. Firing Rate {MMBtu/hr}) * (Emission Factor {lb/MBTU})

Potential Annual Emission (tpy) = Max. Firing Rate (MMBtu/hr) * 500 (hr/year) * Emission Factor (lb/MMBTU) / 2000 (lb/ton)

Contaminant Name	Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
Particulate Matter (PM)	0.04	0.01
Sulfur Dioxide (SO ₂)	0.0007	1.7E-04
Oxides of Nitrogen (NO _x)	0.51	0.1
Carbon Monoxide (CO)	0.55	0.1
Total Organic Compounds (TOC)	0.51	0.1

EMISSIONS OF AIR CONTAMINANTS FROM COMBUSTION IN FIRE PUMP

Known Data:

- a. Fire Pump Unit installed in 2015
- b. 110 HP emergency Clarke Model JU4H-UF AD 5G emergency fire pump combusting diesel fuel

Assumptions:

- a. Hours of operation capped at 500 hours per year per permit condition

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Emission Factors:

From EPA Tier 3 Limits or Sulfur Content Limit in Diesel Fuel

Contaminant Name	Emission Factor (g/hp-hr)	Emission Factor (lb/hp-hr)	Emission Factor (lb/MMBtu)	Notes
Particulate Matter (PM)	0.22	0.00049	0.070	Tier 3 Limit
Sulfur Dioxide (SO ₂)*			0.0015	15 ppm S Limit
Oxides of Nitrogen (NO _x)**	3.0	0.0066	0.94	Tier 3 Limit
Carbon Monoxide (CO)	3.7	0.0082	1.2	Tier 3 Limit
Total Organic Compounds (TOC)**	3.0	0.0066	0.94	Tier 3 Limit

* - Emission factor based on 15 PPM sulfur

** - Emission factors for VOC and NO_x each assumed to be total of Tier 3 Limit for NMHC + NO_x

Tier 3 limits (in g/kw-hr) = 4.0 for NO_x+NMHC; 5.0 for CO; and 0.3 for PM. Conversion factor from g/kw-hr to g/hp-hr = 0.7457

Details of Emergency Generator Unit at Facility

Identifier	Manufacturer	Fuel Type	Rating (hp)	Rating (BTU/hr)
JU4H-UF AD 5G	Clarke	Diesel Fuel	110	1,200,000

Emission Calculations

Hourly Emissions (lb/hr) = (Max. Firing Rate {MMBtu/hr}) * (Emission Factor {lb/MBTU})

Potential Annual Emission (tpy) = Max. Firing Rate (MMBtu/hr) * 500 (hr/year) * Emission Factor (lb/MMBTU) / 2000 (lb/ton)

Contaminant Name	Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
Particulate Matter (PM)	0.08	0.02
Sulfur Dioxide (SO ₂)	1.80E-03	4.50E-04
Oxides of Nitrogen (NO _x)	1.13	0.3
Carbon Monoxide (CO)	1.41	0.4
Total Organic Compounds (TOC)	1.13	0.3

SGPP, Maximum Predicted RTAP Impacts for the Bypass and Antenna Coating (µg/m³)

RTAP	Max 24-hr Impact	24-hr AAL	Max Annual Impact	Annual AAL	Pass/Fail
APFO	0.0001	0.05	0.00002	0.024	Pass
HF	0.0615	1.5	0.00983	0.98	Pass
Ethylene Glycol	5.0000	319	1.00000	213	Pass
Toluene	22.0000	5,000	5.00000	5,000	Pass
Isopropanol	0.1710	1,757	0.02740	1,171	Pass
Ethanol	0.0045	6,714	0.00072	4,476	Pass
1,4-Dioxane	0.0086	258	0.00138	30	Pass
Benzene	0.0009	5.7	0.00021	3.8	Pass
Polyethylene Glycol	0.9320	50	0.14900	24	Pass
Tetrafluoroethylene	1.5500	171	0.24700	81	Pass
Methanol	0.1900	20,000	0.03030	20,000	Pass
MEK	5.0000	5,000	1.00000	5,000	Pass
n-Methyl-2-Pyrrolidone	0.0727	1,429	0.01160	952	Pass
Hexane	0.6620	885	0.15100	700	Pass
Ammonia	0.5170	500	0.08280	500	Pass
Ethyl Acetate	0.3310	10,141	0.07530	4,829	Pass
Xylene	0.0414	1,550	0.00942	100	Pass
Ethyl Benzene	0.0089	1,000	0.00202	1,000	Pass

SGPP, Maximum Predicted RTAP Impacts for the As-Built RTO and Antenna Coating (µg/m³)

RTAP	Max 24-hr Impact	24-hr AAL	Max Annual Impact	Annual AAL	Pass/Fail
APFO	0.0000	0.05	0.00000	0.024	Pass
HF	0.0332	1.5	0.00275	0.98	Pass
Ethylene Glycol	2.5900	319	0.21000	213	Pass
Toluene	22.0000	5,000	5.00000	5,000	Pass
Isopropanol	0.0923	1,757	0.00765	1,171	Pass
Ethanol	0.0024	6,714	0.00020	4,476	Pass
1,4-Dioxane	0.0046	258	0.00038	30	Pass
Benzene	0.0009	5.7	0.00020	3.8	Pass
Polyethylene Glycol	0.5030	50	0.04170	24	Pass
Tetrafluoroethylene	0.8340	171	0.06920	81	Pass
Methanol	0.1020	20,000	0.00848	20,000	Pass
MEK	5.0000	5,000	1.00000	5,000	Pass
n-Methyl-2-Pyrrolidone	0.0392	1,429	0.00325	952	Pass
Hexane	0.6620	885	0.15100	700	Pass
Ammonia	0.2790	500	0.02320	500	Pass
Ethyl Acetate	0.3310	10,141	0.07530	4,829	Pass
Xylene	0.0414	1,550	0.00942	100	Pass
Ethyl Benzene	0.0089	1,000	0.00202	1,000	Pass

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SGPP, Maximum Predicted RTAP Impacts for the Bypass and Antenna Coating (µg/m³) WITH EU24 (+ 6.9%)

RTAP	Max 24-hr Impact	24-hr AAL	Max Annual Impact	Annual AAL	Pass/Fail
APFO	0.0001	0.05	0.00002	0.024	Pass
HF	0.0657	1.5	0.01051	0.98	Pass
Ethylene Glycol	5.3450	319	1.06900	213	Pass
Toluene	23.5180	5,000	5.34500	5,000	Pass
Isopropanol	0.1828	1,757	0.02929	1,171	Pass
Ethanol	0.0048	6,714	0.00077	4,476	Pass
1,4-Dioxane	0.0092	258	0.00148	30	Pass
Benzene	0.0010	5.7	0.00022	3.8	Pass
Polyethylene Glycol	0.9963	50	0.15928	24	Pass
Tetrafluoroethylene	1.6570	171	0.26404	81	Pass
Methanol	0.2031	20,000	0.03239	20,000	Pass
MEK	5.3450	5,000	1.06900	5,000	Pass
n-Methyl-2-Pyrrolidone	0.0777	1,429	0.01240	952	Pass
Hexane	0.7077	885	0.16142	700	Pass
Ammonia	0.5527	500	0.08851	500	Pass
Ethyl Acetate	0.3538	10,141	0.08050	4,829	Pass
Xylene	0.0443	1,550	0.01007	100	Pass
Ethyl Benzene	0.0095	1,000	0.00216	1,000	Pass

SGPP, Maximum Predicted RTAP Impacts for the As-Built RTO and Antenna Coating (µg/m³) WITH EU24 (+ 6.9%)

RTAP	Max 24-hr Impact	24-hr AAL	Max Annual Impact	Annual AAL	Pass/Fail
APFO	0.0000	0.05	0.00000	0.024	Pass
HF	0.0355	1.5	0.00294	0.98	Pass
Ethylene Glycol	2.7687	319	0.22449	213	Pass
Toluene	23.5180	5,000	5.34500	5,000	Pass
Isopropanol	0.0987	1,757	0.00818	1,171	Pass
Ethanol	0.0026	6,714	0.00021	4,476	Pass
1,4-Dioxane	0.0050	258	0.00041	30	Pass
Benzene	0.0010	5.7	0.00021	3.8	Pass
Polyethylene Glycol	0.5377	50	0.04458	24	Pass
Tetrafluoroethylene	0.8915	171	0.07397	81	Pass
Methanol	0.1090	20,000	0.00907	20,000	Pass
MEK	5.3450	5,000	1.06900	5,000	Pass
n-Methyl-2-Pyrrolidone	0.0419	1,429	0.00347	952	Pass
Hexane	0.7077	885	0.16142	700	Pass
Ammonia	0.2983	500	0.02480	500	Pass
Ethyl Acetate	0.3538	10,141	0.08050	4,829	Pass
Xylene	0.0443	1,550	0.01007	100	Pass
Ethyl Benzene	0.0095	1,000	0.00216	1,000	Pass