

Modeled Emissions
GE 7FA Combustion Turbines with Duct Firing
Fuel in Turbine: Natural Gas
Fuel in Duct Burner: Natural Gas or Refinery Fuel Gas

Hourly emissions out of stack for each turbine

Case	Turbine Inlet Temperature	Load	Duct Burning	NO _x	CO	PM ₁₀	SO ₂ (0.8 gr S)	SO ₂ (1.6 gr S)	NO _x	SO ₂ ³	SO ₄ ⁴	PM ₁₀ ⁵	Stack Flow Rate	Stack Exit Temperature	Stack Velocity
				Emissions for CalPuff visibility modeling											
	F	%	MM Btu/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	acfm	F	ft/s
1AA	5	100	0	17.5	8.5	18.7	4.2	8.3	17.5	3.9	0.3	17.0	1,109,118	195	65.20
1AB	50	100	0	16.3	8.0	18.6	3.9	7.7	16.3	3.7	0.3	17.0	1,029,463	195	60.51
1AC	85	100	0	15.0	7.3	18.5	3.5	7.1	15.0	3.4	0.3	17.0	949,296	195	55.80
1BA	5	75	0	14.1	6.8	18.4	3.4	6.7	14.1	3.2	0.3	17.0	854,903	190	50.25
1BB	50	75	0	13.1	6.4	18.3	3.1	6.3	13.1	3.0	0.2	17.0	811,008	190	47.67
1BC	85	75	0	12.2	5.9	18.2	2.9	5.8	12.2	2.8	0.2	17.0	771,866	190	45.37
1CA	5	50	0	11.0	5.4	18.1	2.7	5.3	11.0	2.5	0.2	17.0	681,285	180	40.05
1CB	50	50	0	10.4	5.1	18.0	2.5	5.0	10.4	2.4	0.2	17.0	659,851	180	38.79
1CC	85	50	0	9.6	4.7	18.0	2.3	4.7	9.6	2.2	0.2	17.0	637,675	180	37.48
7A	5	100	600	23.8	11.6	29.2	5.6	11.2	23.8	5.3	0.4	26.9	1,145,741	180	67.35
7B	50	100	600	22.6	11.0	29.1	5.3	10.6	22.6	5.0	0.4	26.9	1,064,491	180	62.57
7C	85	100	600	21.2	10.3	29.0	5.0	10.0	21.2	4.7	0.4	26.9	982,715	180	57.77
Generator	NA	NA	NA	27.5	6.9	0.7	0.8	0.8	2.3	0.063	0.0050	0.058	12,745	899	602
Firepump	NA	NA	NA	3.3	0.2	0.1	0.1	0.1	0.28	0.0083	0.00066	0.0042	1,404	840	119
Cooling Tower	NA	NA	NA	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	1.6	101,167	90	2.15

Notes:

Diameter = 19 feet

1. Annual SO₂ emissions are calculated using 0.8 gr S/100scf natural gas
2. Short-term SO₂ emissions are calculated using 1.6 gr S/100scf natural gas
3. SO₂ emissions for CalPuff visibility modeling are calculated using 0.8 gr S/100scf natural gas and by subtracting the 5% sulfur converted to SO₄.
4. SO₄ emissions for CalPuff visibility modeling are calculated using 0.8 gr S/100scf natural gas and by assuming a 5% conversion from SO₂ and multiplying by the ratio of molecular weights (96/64).
5. PM₁₀ emissions for CalPuff visibility modeling do not include ammonium sulfate emissions that are included in the ISCST3 modeling.
6. Emissions from the generator and firepump for CalPuff visibility modeling are divided by 12 to account for only 2 hours run in a 24-hour period.

Cherry Point Cogeneration Project

Annual Emissions Budget - GE 7FA DLN 6.2 Turbines, 6x16 Schedule*

Plant Emissions

(does not include auxiliary equipment)

Annual Emissions Tons/Year	2x1 Project Full Operation	2x1 Project Partial Dispatch	2x1 Project Full Dispatch	Maximum	Maximum with Auxillary Equipment
NOx	198	153	187	198	201
CO	96	158	92	158	158
VOC	58	50	55	58	58
PM	255	172	241	255	262
SO2 (1)	47	32	44	47	47

Short Term Emissions Lbs/Hr	2x1 Project 600 MMBtu/hr
NOx	45.1
CO	22.0
VOC	13.3
PM	58.2
SO2 (2)	10.6

Turbine Emissions

GE 7FA emissions from one turbine	Turbine Emissions 600 MMBtu/hr	Req'd SCR/CO Cat Efficiency At Max DB	Controlled Emissions per Event			
			Hot Start	Warm start	Cold Start	Shutdown
	Lbs/hr		Lbs/Start	Lbs/Start	Lbs/Start	Lbs/Shutdown
Margin	0%		50%	50%	50%	50%
NOx	22.6	80%	101.0	141.0	245.8	34.7
CO	11.0	87%	294.8	688.6	442.8	223.7
VOC	6.6		41.5	83.7	55.8	26.9
PM	29.1		14.0	24.0	52.3	6.8
SO2	5.3		3.2	5.5	11.9	1.5
Hours/event			1.0	1.4	2.5	0.5

Full time operation

Assumptions	
Hours per Year	8,760
Number of turbines:	2
Plant Starts Allowed	0
Duct Burner Duty/Train, MMBTU/HR HHV	600

24 Hour/Day Run		Operating Mode				Total	Hours/Year
Events/Yr	365.0	Shutdown	Hours Down	Startup	Run 22:00 Day 1 22:00 Day 2		
				0.0	0.0	0.0	24.0
		Compound				Total lbs/Event	Tons/Year
		0.0		0.0	1083	1083	197.6
		0.0		0.0	527	527	96.2
		0.0		0.0	319	319	58.2
		0.0		0.0	1396	1396	254.8
		0.0		0.0	255	255	46.6

Partial Dispatch/Full Dispatch

Assumptions	
Hours per Year	8,760
Number of turbines:	2
Plant Starts Allowed	143
Duct Burner Duty/Train, MMBTU/HR HHV	600
Calculated Percent Dispatch for Partial Case	66%

Operating Modes		Operating Mode				Total	Hours/Year
Events/Yr	146.0	Shutdown	Hours Down	Startup	Run 22:00 Day 1 22:00 Day 2		
				0.0	0.0	0.0	24.0
		Compound				Total lbs/Event	Tons/Year
		0.0		0.0	1082.7	1082.7	79
		0.0		0.0	527.4	527.4	38
		0.0		0.0	318.7	318.7	23
		0.0		0.0	1396.4	1396.4	102
		0.0		0.0	255.1	255.1	19

Daily Peak Operation Only - 16 Hr Run		(Hot Start)						
Events/Yr	95.0	Operating Mode				Total	Hours/Year	
		Start End	Shutdown 22:00 Day 1 23:00 Day 2	Hours Down 23:00 Day 1 04:00 Day 2	Startup 04:00 Day 2 06:00 Day 2			Run 06:00 Day 2 22:00 Day 2
		Hours/Event	1.0	5.0	2.0	16.0	24.0	2280
		Compound					Total lbs/Event	Tons/Year
		NOx	69.5		201.9	721.8	993.1	47
		CO	447.5		589.7	351.6	1388.7	66
		VOC	53.7		83.0	212.5	349.1	17
		PM	13.6		28.1	931.0	972.6	46
		SO2	3.1		6.4	170.1	179.6	9

Weekend Shutdown - Peak Operation Only		(Warm Start)						
Events/Yr	42	Operating Mode				Total	Hours/Year	
		Start End	Shutdown 22:00 Sat 23:00 Sat	Hours Down 23:00 Sat 03:00 Mon	Startup 03:00 Mon 06:00 Mon			Run 06:00 Mon 22:00 Mon
		Hours	1.0	28.0	3.0	16.0	48.0	2016
		Compound					Total lbs/Event	Tons/Year
		NOx	69.5		282.0	721.8	1073.2	23
		CO	447.5		1377.2	351.6	2176.2	46
		VOC	53.7		167.4	212.5	433.6	9
		PM	13.6		48.0	931.0	992.6	21
		SO2	3.1		10.9	170.1	184.1	4

NERC Holiday Weekend Shutdown		(Warm Start)						
Events/Yr	6	Operating Mode				Total	Hours/Year	
		Start End	Shutdown 22:00 Sat 23:00 Sat	Hours Down 23:00 Sat 03:00 Tues	Startup 03:00 Tues 06:00 Tues			Run 06:00 Tues 22:00 Tues
		Hours	1.0	52.0	3.0	16.0	72.0	432
		Compound					Total lbs/Event	Tons/Year
		NOx	69.5		282.0	721.8	1073.2	3
		CO	447.5		1377.2	351.6	2176.2	7
		VOC	53.7		167.4	212.5	433.6	1
		PM	13.6		48.0	931.0	992.6	3
		SO2	3.1		10.9	170.1	184.1	1

Maintenance Outage		(Cold Start)						
Days/Yr	21	Operating Mode				Total	Hours/Year	
		Start End	Shutdown 22:00 23:00	Hours Down 23:00 01:30	Startup 01:30 06:00			Run 06:00 22:00
		Hours	1.0	506.5	4.5	16.0	528.00	528.0
		Compound					Total lbs/Event	Tons/Year
		NOx	69.5		491.7	721.8	1282.9	1
		CO	447.5		885.5	351.6	1684.6	1
		VOC	53.7		111.6	212.5	377.8	0
		PM	13.6		104.6	931.0	1049.1	1
		SO2	3.1		23.8	170.1	197.0	0

Hours per category	Shutdown	Hours Down	Startup	Run	total
24 Hour/Day Run	0	0	0	3504	
Daily Peak Operation Only	95	475	190	1520	
Weekend Shutdown	42	1176	126	672	
NERC Holiday Weekend Shutdown	6	312	18	96	
Maintenance Outage	1	507	5	16	
Total	144.0	2469.5	338.5	5808.0	8760

Tons/category	Shutdown	Hotstart	Warm Start	Coldstart	Run	
NOx	5.0	9.6	6.8	0.2	131.0	152.6
CO	32.2	28.0	33.1	0.4	63.8	157.5
VOC	3.9	3.9	4.0	0.1	38.6	50.4
PM	1.0	1.3	1.2	0.1	169.0	172.5
SO2	0.2	0.3	0.3	0.0	30.9	31.7

ESTIMATED PLANT STARTUP EMISSIONS

S/U Emission Estimates for S207FA (2-on-1 configuration)

Approximate Emission Distribution								
Percent of Total Plant S/U & S/D Emission (2) (4)								
	Hot Start		Warm Start		Cold Start		Shutdown	
	CTG 1	CTG 2	CTG 1	CTG 2	CTG 1	CTG 2	CTG 1	CTG 2
	NOx	63	37	54	46	56	44	50
CO	50	50	80	20	74	26	50	50
VOC	50	50	75	25	72	28	50	50

Approximate Uncontrolled Emission per Train per Event								Total Plant Emission (2 CTGs) (1)			
	Hot Start		Warm Start		Cold Start		Shutdown	Startup			Shutdown
	CTG 1	CTG 2	CTG 1	CTG 2	CTG 1	CTG 2	CTG1 or CTG2	Hot	Warm	Cold	
S/U Total Duration (min)	62	52	102	70	210	90	30	84	124	241	30
S/U Emissions Duration (min)	38	28	67	46	167	79	16	66	113	246	16
NOx (lb)	93	65	129	130	335	169	46	158	259	504	93
CO (lb)	332	323	1382	378	882	396	298	655	1761	1278	597
VOC (lb)	28	27	81	31	45	30	18	55	112	74	36

S/U Emission Estimates for S307FA (3-on-1 configuration)

Approximate Uncontrolled Emission per Train per Event											Total Plant Emission (3 CTG startup & shutdown)		
	Hot Start			Warm Start			Cold Start			Shutdown	Hot	Warm	Cold
	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3				
NOx (lb)	93	65	65	129	130	130	335	169	169	46.3	362	528	812
CO (lb)	332	323	323	1382	378	378	882	396	396	298.3	1873	3034	2569
VOC (lb)	28	27	27	81	31	31	45	30	30	17.9	136	196	158

ASSUMED Average Catalyst Removal Efficiencies During S/U & SD (3)										
	Hot Start			Warm Start			Cold Start			Shutdown
	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3	
SCR (%)	25	0	0	30	25	25	40	25	25	50
CO ox cat (%)	40	40	40	50	40	40	60	40	40	50

Approximate Controlled Emission per Train per Event										
	Hot Start			Warm Start			Cold Start			Shutdown
	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3	
NOx (lb)	70	65	65	91	98	98	201	127	127	23
CO (lb)	199	194	194	691	227	227	353	238	238	149

- Notes:
- (1) Uncontrolled S207FA plant startup and shutdown emission estimates furnished by GE.
 - (2) Distribution of total emissions for 2-on-1 plant between the two CTGs estimated from cumulative emission curves developed by GE for a previous project.
 - (3) Average overall efficiency of SCR and oxidation catalysts during startup and shutdown are assumed, to be confirmed by HRSG supplier. VOC control efficiency is conservatively assumed to be zero.
 - (4) Hot, warm, and cold starts as defined by GE.

Emissions of pollutants not supplied by the turbine manufacturer											Total Plant Emission		
	Hot Start			Warm Start			Cold Start			Shutdown			
	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3	CTG 1	CTG 2	CTG 3				
PM10 (lb)	10.8	7.9	7.9	19.0	13.0	13.0	47.3	22.4	22.4	4.5	40	59	106
SO2 (lb)	2.5	1.8	1.8	4.3	3.0	3.0	10.8	5.1	5.1	1.0	9	13	24

- Notes:
- (1) PM10 emissions are calculated assuming full load emissions and the fraction of the minutes of startup or shutdown in an hour.
 - (2) SO2 emissions are calculated using a fuel use of half that of Case 1AB and the fraction of the minutes of startup or shutdown in an hour.

	Hotstart per turbine per start lbs	Warm Start per turbine per start lbs	Cold Start per turbine per start lbs	Shutdown per turbine per shutdown lbs
NOx	67	94	164	23
CO	197	459	295	149
VOC	28	56	37	18
PM	9	16	35	5
SO2	2	4	8	1
min (avg)	57	86	150	30

Criteria Pollutant Emissions Summary For Auxiliary Equipment

Sulfur content of distillate oil = 0.0500 weight %

SO₂ emission factor (lb/MMBtu) = 0.0518 Based on HHV

Equipment	Fuel	Annual Operating Hours	kW	Capacity hp	Heat Input MMBtu/hr
Emergency Generator (1500 kW)	Diesel	250	1,500	2,011	15.36
Firewater Pump (265 HP)	Diesel	250	n/a	265	2.02

Hourly Emission Rates (lb/hr)

Equipment	NO _x	CO	VOC	PM ₁₀	SO ₂	H ₂ SO ₄
Emergency Generator	27.5	6.9	1.3	0.7	0.796	0.2437
Firewater Pump	3.33	0.17	0.14	0.05	0.1049	0.0321

Source: Southworth-Milton, Inc.

Source: Clarke Fire Protection Products

H₂SO₄ Emissions are calculated based on a 20% conversion rate

Annual Emissions (tons/yr)

Equipment	NO _x	CO	VOC	PM ₁₀	SO ₂	H ₂ SO ₄
Emergency Generator	3.4	0.9	0.16	0.09	0.0995	0.03046
Firewater Pump	0.42	0.021	0.018	0.006	0.01311	0.004015

Stack Information

Equipment	Flow Rate (acfm)	Temp. (deg. F)	Stack Height (ft)	Stack Diameter (ft)	Velocity (ft/s)
Emergency Generator	12,745	899	11.67	0.67	602
Firewater Pump	1,404	840	12	0.50	119

Cooling Tower PM10 Calculation				
Measure	Value	Units	Comments	Calculation
Drift	0.001%		% of Circ. Water Lost as Drift	Mfg. Guarantee
Circ Water Flow	143400	gpm	Total Circulating Water Flow Rate	System Design Requirement
Drift Flow	1.434	gpm	Total Water Lost as Drift, gpm	(Drift %) X (Circ Water Flow)
Drift Flow	716.7	lb/hr	Hourly Total Water Lost as Drift	(Drift Flow)gal/min X 8.33lb/gal X 60min/hr
Drift Flow	17201	lb/day	Daily Total Water Lost as Drift	(Drift Flow)gal/min X 8.33lb/gal X 1440min/day
CT Cycles	15		CT Cycles of Concentration	Maximum Expected
TDS	2193	ppm	Total Dissolved Solids	
TSS	78	ppm	Total Suspended Solids	
TS	2271	ppm	Circulating Water Total Solids	(TDS)+(TSS)
TS wt%	0.2271%		% by Weight	(TS)ppm X 1,000,000
PM10 per hour	1.628	lb/hr	Hourly TS Lost Through Drift	(TS wt%) X (Drift Flow)lb/hr
PM10 per year	7.129	tons/yr	Hourly TS Lost Through Drift	lb/hr X 8,760 hrs / 2,000 lb/ton

Summary of Toxic Emissions

Toxic Compound	Maximum Emission Rate for 2 GTs (lb/hr)	Emission Rate for Emergency Generator (lb/hr)	Emission Rate for Fire Pump (lb/hr)	Maximum Hourly Emissions (lb/hr)	Small Quantity Emission Rate (lb/hr)	Total Annual Emissions (lb/yr)	Small Quantity Emission Rate (lb/yr)	Modeling Required (Yes/No)	ASIL (µg/m ³)	Class A or B Toxic Compound		EPA Classified HAP (Yes/No)
VOC												
Acetaldehyde	0.044	0.00039	0.001553	0.046	NA	384.2	50	Yes	0.45	A	annual	Yes
Acrolein	0.025	0.000121	0.0001872	0.025	0.02	218.1	175	Yes	0.02	B	24-hr	Yes
Benzene	0.049	0.01192	0.001889	0.063	NA	430.5	20	Yes	0.12	A	annual	Yes
1,3-Butadiene	0.0017	0	0.0000791	0.0018	NA	14.7	0.5	Yes	0.0036	A	annual	Yes
Butane (isomers)	2.47	0	0	2.47	5.0	21,614	43,748	No	6,300	B	24-hr	No
Cyclohexane	0.0146	0	0	0.0146	5.0	127.9	43,748	No	3,400	B	24-hr	No
Cyclopentane	0.0292	0	0	0.029	5.0	255.8	43,748	No	5,700	B	24-hr	No
Ethylbenzene	0.0146	0	0	0.0146	5.0	127.9	43,748	No	1,000	B	24-hr	Yes
Formaldehyde	1.26	0.00121	0.00239	1.26	NA	11,013	20	Yes	0.077	A	annual	Yes
Heptane (isomers)	0.088	0	0	0.088	5.0	767.4	43,748	No	5,500	B	24-hr	No
N-Hexane	0.0292	0	0	0.029	2.6	255.8	22,750	No	200	B	24-hr	Yes
Hexane (isomers)	1.82	0	0	1.82	5.0	15,919	43,748	No	5,900	B	24-hr	Yes
Methylcyclohexane	0.0292	0	0	0.029	5.0	255.8	43,748	No	5,400	B	24-hr	No
Naphthalene	0.0057	0.00200	0	0.0077	2.6	50.1	22,750	No	170	B	24-hr	Yes
Nonane	0.0292	0	0	0.029	5.0	255.8	43,748	No	3,500	B	24-hr	No
Octane (isomers)	0.058	0	0	0.058	5.0	511.6	43,748	No	4,700	B	24-hr	No
PAH	0.0086	0.00326	0.000340	0.012	NA	76.6	NA	Yes	0.000480	A	annual	Yes
Pentane (isomers)	2.96	0	0	2.96	5.0	25,950	43,748	No	6,000	B	24-hr	No
Toluene	0.062	0.00432	0.000828	0.067	5.0	542.5	43,748	No	400	B	24-hr	Yes
1,2,3-Trimethylbenzene	0.058	0	0	0.058	5.0	511.6	43,748	No	420	B	24-hr	No
Xylene	0.058	0.00296	0.000577	0.062	5.0	512.5	43,748	No	1,500	B	24-hr	Yes
PM												
Arsenic	0.00020	0.003710	0.000265	0.00417	NA	2.7	NA	Yes	0.00023	A	annual	Yes
Barium	0.0044	0	0	0.00437	0.02	38.3	175	No	1.7	B	24-hr	No
Beryllium	0.000012	0	0	0.000012	NA	0.10	NA	Yes	0.00042	A	annual	Yes
Cadmium	0.0011	0.000350	0.0000250	0.00147	NA	9.7	NA	Yes	0.00056	A	annual	Yes
Chromium	0.018	0.003710	0.000265	0.022	0.02	162.1	175	Yes	1.7	B	24-hr	Yes
Cobalt	0.017	0	0	0.017	0.02	149.7	175	No	0.17	B	24-hr	Yes
Copper	0.018	0	0	0.018	0.02	156.3	175	No	0.67	B	24-hr	No
Manganese	0.017	0	0	0.017	0.02	152.2	175	No	0.4	B	24-hr	Yes
Mercury	0.00026	0	0	0.00026	0.02	2.3	175	No	0.17	B	24-hr	Yes
Molybdenum	0.0011	0	0	0.00109	0.20	9.6	1,750	No	17	B	24-hr	No
Nickel	0.019	0.000350	0.0000250	0.019	NA	167.3	0.5	Yes	0.0021	A	annual	Yes
Selenium	0.000024	0.000350	0.0000250	0.00040	0.02	0.30	175	No	0.67	B	24-hr	No
Vanadium	0.0023	0	0	0.00228	0.02	20.0	175	No	0.17	B	24-hr	No
Zinc	0.046	0.003850	0.000275	0.050	0.2	402.3	1750	No	17	B	24-hr	No
Ammonia	27.1	0	0	27.1	2.0	237,228	17,500	Yes	100	B	24-hr	No
Sulfuric Acid	6.9	0.2437	0.0321	7.13	0.02	60136	175	Yes	3.3	B	24-hr	No
Total Annual Hours	8,760	250	250								Total HAPs (tons/yr)	15.10
Total toxics (lbs/yr)						81,069						

NA = Not applicable

The maximum toxics emissions are calculated from Case 6A. These represent worst-case toxic emissions.

Hourly Toxic Emissions from One Gas Turbine and Duct Burner

Toxic Compound	Gas Turbine Emission Factors (lb/MMBtu) ^a	Gas Turbine Emissions (lb/hr)	Weight Fraction for Gas Turbine ^b	Emission Rate for Gas Turbine (lb/hr)	Emission Factor (lb/10 ⁶ scf fuel gas input) ^c	Maximum Emission Rate for Duct Burner (lb/hr)	Average Emission Rate for Duct Burner (lb/hr)	Maximum Total Emission Rate for GT Plus DB (lb/hr)	Average Total Emission Rate for GT Plus DB (lb/hr)
VOC	MMBtu/hr = 1,944.4		VOC = 6.8		10⁶ scf NG input/hr = 0.4967		0.4967		
Acetaldehyde	NA	0	0.003222	0.021900	NA	0	0	0.021900	0.021900
Acrolein	0.000064	0.012444	NA	0	NA	0	0	0.012444	0.012444
Benzene	0.0000120	0.0233	NA	0	0.00210	0.0010430	0.0010430	0.024375	0.024375
1,3-Butadiene	0.00000043	0.000836	NA	0	NA	0	0	0.000836	0.000836
Butane (isomers)	NA	0	0.181525	1.233700	NA	0	0	1.234	1.234
Cyclohexane	NA	0	0.001074	0.007300	NA	0	0	0.007300	0.007300
Cyclopentane	NA	0	0.002148	0.014600	NA	0	0	0.014600	0.014600
Ethylbenzene	NA	0	0.001074	0.007300	NA	0	0	0.007300	0.007300
Formaldehyde	NA	0	0.087003	0.591300	0.0750	0.0372517	0.0372517	0.629	0.629
Heptane (isomers)	NA	0	0.006445	0.043800	NA	0	0	0.043800	0.043800
N-Hexane	NA	0	0.002148	0.014600	NA	0	0	0.014600	0.014600
Hexane (isomers)	NA	0	0.002148	0.014600	1.80	0.8940397	0.8940397	0.91	0.91
Methylcyclohexane	NA	0	0.002148	0.014600	NA	0	0	0.014600	0.014600
Naphthalene	0.0000013	0.002528	NA	0	0.000610	0.0003030	0.0003030	0.002831	0.002831
Nonane	NA	0	0.002148	0.014600	NA	0	0	0.014600	0.014600
Octane (isomers)	NA	0	0.004296	0.029200	NA	0	0	0.029200	0.029200
PAH	0.00000220	0.004278	NA	0	0.0000882	0.0000438	0.0000438	0.004322	0.004322
Pentane (isomers)	NA	0	0.027927	0.189800	2.60	1.2913907	1.2913907	1.48	1.481
Toluene	NA	0	0.004296	0.029200	0.00340	0.0016887	0.0016887	0.030889	0.030889
1,2,3-Trimethylbenzene	NA	0	0.004296	0.029200	NA	0	0	0.029200	0.029200
Xylene	NA	0	0.004296	0.029200	NA	0	0	0.029200	0.029200
PM	MMBtu/hr = 1,944.4		PM = 17.0		10⁶ scf NG input/hr = 0.4967		0.4967		
Arsenic	NA	0	NA	0	0.000200	0.00009934	0.0000993	0.0000993	0.0000993
Barium	NA	0	NA	0	0.00440	0.00218543	0.0021854	0.0021854	0.0021854
Beryllium	NA	0	NA	0	0.0000120	0.00000596	0.0000060	0.0000060	0.0000060
Cadmium	NA	0	NA	0	0.00110	0.00054636	0.0005464	0.0005464	0.0005464
Chromium	NA	0	0.00050	0.008500	0.00140	0.00069536	0.0006954	0.0091954	0.0091954
Cobalt	NA	0	0.00050	0.008500	0.0000840	0.00004172	0.0000417	0.0085417	0.0085417
Copper	NA	0	0.00050	0.008500	0.000850	0.00042219	0.0004222	0.0089222	0.0089222
Manganese	NA	0	0.00050	0.008500	0.000380	0.00018874	0.0001887	0.0086887	0.0086887
Mercury	NA	0	NA	0	0.000260	0.00012914	0.0001291	0.0001291	0.0001291
Molybdenum	NA	0	NA	0	0.00110	0.00054636	0.0005464	0.0005464	0.0005464
Nickel	NA	0	0.00050	0.008500	0.00210	0.00104305	0.0010430	0.0095430	0.0095430
Selenium	NA	0	NA	0	0.0000240	0.00001192	0.0000119	0.0000119	0.0000119
Vanadium	NA	0	NA	0	0.00230	0.00114238	0.0011424	0.0011424	0.0011424
Zinc	NA	0	0.00050	0.008500	0.0290	0.01440397	0.0144040	0.0229040	0.0229040
Ammonia	NA	0	NA	0	NA	0	0	13.5	12.7
Sulfuric Acid ^d	NA	0	NA	0	NA	0	0	3.43	1.71
			0.0931						

NA = Not Applicable

The maximum toxics emissions are calculated from Case 6A. These represent worst-case toxic emissions.

a - USEPA, AP-42, Table 3.1-3, April 2000

b - The weight fractions of VOC have been corrected to a non-methane, non-ethane value by dividing with 0.0931 which is the non-methane, non-ethane fraction of the total sample reported in the EPA speciation table.

- The VOC weight fractions are from the EPA speciation table for natural gas fired internal combustion source.

USEPA, Air Emissions Species Manual, Vol I: Volatile Organic Compound Species Profile, January 1990. EPA-450/2-90-001a

- The PM weight fractions are from the CARB speciation table for natural gas fired internal combustion source. California Air Resources

Board (CARB), Identification of Particulate Matter Species Profiles, ARB Speciation Manual, Second Edition, Vol. 2, August 1991.

c - The DB emission factors are from AP-42, Tables 1.4-3 and 1.4-4. It is assumed that RFG behaves similar to NG with respect to toxic emissions.

d - The emission rate for sulfuric acid was calculated by assuming 20% of the total SO₂ emissions are converted to sulfuric acid.

This assumption was suggested by Alan Newman of Washington Department of Ecology on March 21, 2002.

Toxic Emissions for Emergency Generator

Toxic Compound	Emission Factor (lb/MMBtu)	Emission Rate for One Emergency Generator (lb/hr)
VOC	MMBtu/hr = 15.36	
Acetaldehyde	0.0000252	0.00039
Acrolein	0.00000788	0.000121
Ammonia	NA	0
Benzene	0.000776	0.01192
1,3-Butadiene	NA	0
Butane (isomers)	NA	0
Cyclohexane	NA	0
Cyclopentane	NA	0
Ethylbenzene	NA	0
Formaldehyde	0.0000789	0.00121
Heptane (isomers)	NA	0
N-Hexane	NA	0
Hexane (isomers)	NA	0
Methylcyclohexane	NA	0
Naphthalene	0.000130	0.00200
Nonane	NA	0
Octane (isomers)	NA	0
PAH	0.0002120	0.00326
Pentane (isomers)	NA	0
Toluene	0.000281	0.00432
1,2,3-Trimethylbenzene	NA	0
Xylene	0.000193	0.00296
PM	Emission Factor is Weight Fraction of PM; PM= 0.70	
Arsenic	0.00530	0.003710
Barium	NA	0
Beryllium	NA	0
Cadmium	0.00050	0.000350
Chromium	0.00530	0.003710
Cobalt	NA	0
Copper	NA	0
Manganese	NA	0
Mercury	NA	0
Molybdenum	NA	0
Nickel	0.00050	0.000350
Selenium	0.00050	0.000350
Vanadium	NA	0
Zinc	0.00550	0.003850
Sulfuric Acid	NA	0.2437
NA = Not Applicable - The VOC emission factors are from AP-42, Table 3.4-3 and 3.4-4, October 1996. - The PM weight fractions are from the CARB speciation table for oil fired internal combustion source. California Air Resources Board (CARB), Identification of Particulate Matter Species Profiles, ARB Speciation Manual, Second Edition, Vol. 2, August 1991. - The sulfuric acid emissions are calculated from the SO ₂ emissions.		

Toxic Emissions for Firewater Pump

Toxic Compound	Emission Factor (lb/MMBtu)	Emission Rate for One Firewater Pump (lb/hr)
VOC	MMBtu/hr = 2.02	
Acetaldehyde	0.000767	0.001553
Acrolein	0.0000925	0.0001872
Ammonia	NA	0
Benzene	0.000933	0.001889
1,3-Butadiene	0.0000391	0.0000791
Butane (isomers)	NA	0
Cyclohexane	NA	0
Cyclopentane	NA	0
Ethylbenzene	NA	0
Formaldehyde	0.00118	0.00239
Heptane (isomers)	NA	0
N-Hexane	NA	0
Hexane (isomers)	NA	0
Methylcyclohexane	NA	0
Naphthalene	NA	0
Nonane	NA	0
Octane (isomers)	NA	0
PAH	0.000168	0.000340
Pentane (isomers)	NA	0
Toluene	0.000409	0.000828
1,2,3-Trimethylbenzene	NA	0
Xylene	0.000285	0.000577
PM	Emission Factor is Weight Fraction of PM; PM= 0.050	
Arsenic	0.00530	0.000265
Barium	NA	0
Beryllium	NA	0
Cadmium	0.000500	0.0000250
Chromium	0.00530	0.000265
Cobalt	NA	0
Copper	NA	0
Manganese	NA	0
Mercury	NA	0
Molybdenum	NA	0
Nickel	0.000500	0.0000250
Selenium	0.000500	0.0000250
Vanadium	NA	0
Zinc	0.00550	0.000275
Sulfuric Acid	NA	0.0321
<p>NA = Not Applicable</p> <ul style="list-style-type: none"> - The VOC emission factors are from AP-42, Table 3.3-2, October 1996. - The PM weight fractions are from the CARB speciation table for oil fired internal combustion source. California Air Resources Board (CARB), Identification of Particulate Matter Species Profiles, ARB Speciation Manual, Second Edition, Vol. 2, August 1991. - The sulfuric acid emissions are calculated from the SO₂ emissions. 		