

Emissions Summary
One Siemens SGT-6 5000FCombustion Turbine
Fuel in Turbine: Natural Gas
Fuel in Duct Burner: Natural Gas or Refinery Fuel Gas

Hourly emissions out of stack for one turbine

Case	Turbine Inlet Temperature	Load	Duct Burning	NO _x	CO (2 ppm)	PM ₁₀	SO ₂ (0.8 gr S)	SO ₂ (1.6 gr S)	Stack Flow Rate	Stack Exit Temperature
	F	%	MM Btu/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	acfm	F
1AA	5	100	0	20.4	9.9	11.0	4.8	9.6	1,288,672	195
1AB	50	100	0	18.6	9.1	10.8	4.4	8.8	1,200,100	195
1AC	85	100	0	16.9	8.2	9.6	4.0	7.9	1,099,721	195
1BA	5	75	0	16.3	7.9	9.6	3.8	7.7	1,065,123	195
1BB	50	75	0	14.8	7.2	9.4	3.5	7.0	991,846	195
1BC	85	75	0	13.5	6.6	9.3	3.2	6.3	909,530	195
1CA	5	50	0	13.8	6.7	9.3	3.2	6.5	935,142	195
1CB	50	50	0	12.6	6.1	9.2	3.0	5.9	873,775	195
1CC	85	50	0	11.5	5.6	9.1	2.7	5.4	807,769	195
7A	5	100	600	26.5	12.9	21.5	6.2	12.5	1,274,788	180
7B	50	100	600	24.7	12.0	21.3	5.8	11.6	1,188,155	180
7C	85	100	600	23.0	11.2	20.1	5.4	10.8	1,089,974	180
Generator	NA	NA	NA	27.5	6.9	0.7	0.8	0.8	12,745	899
Firepump	NA	NA	NA	3.3	0.2	0.1	0.3	0.0	1,404	840
Cooling Tower	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	101,167	90

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.
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 - Siemens SGT-6 5000F Turbines, 6x16 Schedule

Plant Emissions

(does not include auxiliary equipment)

Annual Emissions Tons/Year	2x1 Project 8760 Hrs Operation	2x1 Project Full Dispatch*	2x1 Project Partial Dispatch	Maximum Case
NOx	217	204	157	216.5
CO	105	100	101	105.5
VOC	57	54	39	57.0
PM	187	176	137	186.6
SO2 (1)	51	48	38	51.0

* Includes downtime allowance for scheduled maintenance per below

Short Term Emissions Lbs/Hr	2x1 Project 620 MMBtu/hr DB
NOx	53.0
CO	25.8
VOC	13.3
PM	43.0
SO2 (2)	25.0

(1) 0.8 gr/100 cf annual average sulfur

(2) 1.6 gr/100 cf short term sulfur

Annual Average Emissions from one turbine	2x1 Project Emissions 620 MMBtu/hr	Controlled Emissions per Event (2 Turbines)				
		Hot Start	Warm Start 28 hours down	Warm Start 52 hours down	Cold Start	Shutdown
	Lbs/hr	Lbs/Start	Lbs/Start	Lbs/Start	Lbs/Start	Lbs/Shutdown
Margin	0%	20%	20%	20%	20%	20%
NOx	24.7	141.6	176.4	251.1	297.6	51.7
CO	12.0	319.5	388.8	524.3	533.9	87.7
VOC	6.5	12.4	12.0	16.3	33.6	7.6
PM	21.3	132.1	153.4	200.0	209.1	63.3
SO2	5.8	37.8	41.6	55.2	91.7	24.2
Hours/event		2.0	2.0	2.5	4.5	1.0

8760 Hrs Operation

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

24 Hour/Day Run		Operating Mode				Total	Hours/Year
Events/Yr	Start End	Shutdown	Hours Down	Startup	Run 22:00 Day 1 22:00 Day 2		
		365.0	Hours/Event	0.0	0.0	0.0	24.0
Compound						Total lbs/Event	Tons/Year
NOx	0.0			0.0	1186	1186	217
CO	0.0			0.0	578	578	105
VOC	0.0			0.0	312	312	57
PM	0.0			0.0	1023	1023	187
SO2	0.0		0.0	280	280	51	

Partial Dispatch

Assumptions	
Hours per Year	8,760
Number of turbines:	2
Plant Starts Allowed	145
Duct Burner Duty/Train, MMBTU/HR HHV	600
Calculated Percent Dispatch	66%

Operating Modes 24 Hour/Day Run		Operating Mode				Total	Hours/Year
Events/Yr	Start End	Shutdown	Hours Down	Startup	Run 22:00 Day 1 22:00 Day 2		
		143.0	Hours/Event	0.0	0.0	0.0	24.0
Compound						Total lbs/Event	Tons/Year
NOx	0.0			0.0	1186.5	1186.5	85
CO	0.0			0.0	577.9	577.9	41
VOC	0.0			0.0	312.5	312.5	22
PM	0.0			0.0	1022.5	1022.5	73
SO2	0.0		0.0	279.6	279.6	20	

Daily Peak Operation Only - 16 Hr Run		(Hot Start)							
Events/Yr	95.0	Start End	Operating Mode				Total	Hours/Year	
			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	51.7		141.6	791.0	984.3	47			
CO	87.7		319.5	385.3	792.5	38			
VOC	7.6		12.4	208.3	228.3	11			
PM	63.3		132.1	681.7	877.1	42			
SO2	24.2		37.8	186.4	248.3	12			

Weekend Shutdown - Peak Operation Only		(Warm Start 16 hrs)							
Events/Yr	43	Start End	Operating Mode				Total	Hours/Year	
			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	29.0	2.0	16.0	48.0	2064		
Compound					Total lbs/Event	Tons/Year			
NOx	51.7		176.4	791.0	1019.1	22			
CO	87.7		388.8	385.3	861.9	19			
VOC	7.6		12.0	208.3	227.9	5			
PM	63.3		153.4	681.7	898.4	19			
SO2	24.2		41.6	186.4	252.1	5			

NERC Holiday Weekend Shutdown		(Warm Start 48 hrs)							
Events/Yr	6	Start End	Operating Mode				Total	Hours/Year	
			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	52.5	2.5	16.0	72.0	432		
Compound					Total lbs/Event	Tons/Year			
NOx	51.7		176.4	791.0	1019.1	3			
CO	87.7		388.8	385.3	861.9	3			
VOC	7.6		12.0	208.3	227.9	1			
PM	63.3		153.4	681.7	898.4	3			
SO2	24.2		41.6	186.4	252.1	1			

Maintenance Outage		(Cold Start)							
Days/Yr	22	Start End	Operating Mode				Total	Hours/Year	
			Shutdown 22:00 23:00	Hours Down 23:00 01:30	Startup 01:30 06:00	Run 06:00 22:00			
	Hours	1.0	530.5	4.5	16.0	552.00	552.0		
Compound					Total lbs/Event	Tons/Year			
NOx	51.7		297.6	791.0	1140.3	1			
CO	87.7		533.9	385.3	1006.9	1			
VOC	7.6		33.6	208.3	249.5	0			
PM	63.3		209.1	681.7	954.2	0			
SO2	24.2		91.7	186.4	302.2	0			

Hours per category	Shutdown	Hours Down	Startup	Run	total
24 Hour/Day Run	0	0	0	3432	
Daily Peak Operation Only	95	475	190	1520	
Weekend Shutdown	43	1247	86	688	
NERC Holiday Weekend Shu	6	315	15	96	
Maintenance Outage	1	531	5	16	
Total	145.0	2567.5	295.5	5752.0	8760

Tons/category	Shurdown	Hotstart	Warm Start	Coldstart	Run	
NOx	3.7	6.7	4.3	0.1	142.2	157.1
CO	6.4	15.2	9.5	0.3	69.3	100.6
VOC	0.5	0.6	0.3	0.0	37.4	38.9
PM	4.6	6.3	3.8	0.1	122.5	137.3
SO2	1.8	1.8	1.0	0.0	33.5	38.1

BP Cherry Point Cogeneration Project with Siemens SGT6 5000F CTGs
2x1 Reference Plant Hot Start (8 or less hour downtime)

ISO Conditions - Best Case, Consider Adding 10-20% Margin

CGT 1	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4	
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)
Aux online	-10 to 0	10													
Ramp to 60% load per Siemens table	0 to 48	48	0	0		50	50		131	131		2.0	9.0		53.0
Ramp to 70% load	48 to 53	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5
Hold at 70% load	53 to 97	44	80	85	0.9	37	7	0.2	10	2	3.8	2.8	5.9	2.0	1.5
Ramp to 100% load	97 to 107	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4
Sub Total		97				101	60		146	133		5.7	16.9		55

CGT 2	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4	
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)
Ramp to 60% load per Siemens table	18 to 65	47	0	0		50	50		131	131		2.0	9.0		53.0
Ramp to 70% load	65 to 70	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5
Hold at 70% load	70 to 97	27	80	85	0.9	23	5	0.2	6	1	3.8	1.7	3.6	2.0	0.9
Ramp to 100% load	97 to 107	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4
Sub Total		79				87	58		142	133		4.6	14.6		55

Totals 188 118 288 266 10 31 110

Summary, lbs/event	Uncontrolled	Controlled
NOx	188	118
CO	288	266
SO2	10	10
VOC	110	110
PM10	31	31

BP Cherry Point Cogeneration Project with Siemens SGT6 5000F CTGs
2x1 Reference Plant Warm Start (9-16 hour downtime)

ISO Conditions - Best Case, Consider Adding 10-20% Margin

CGT 1	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4	
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)
Aux online	-10 to 0	10													
Ramp to 60% load per Siemens table	0 to 59	59	0	0		65	65		160	160	2.0	11.0		62.0	
Ramp to 70% load	59 to 64	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5
Hold at 70% load	64 to 104	40	80	85	0.9	34	7	0.2	9	1	3.8	2.5	5.3	2.0	1.3
Ramp to 100% load	104 to 114	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4
Sub Total		104				113	75		174	162	5.5	18.3		64	

CGT 2	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4	
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)
Ramp to 60% load per Siemens table	18 to 74	56	0	0		65	65		160	160	2.0	11.0		62.0	
Ramp to 70% load	74 to 79	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5
Hold at 70% load	79 to 104	25	80	85	0.9	21	4	0.2	6	1	3.8	1.6	3.3	2.0	0.8
Ramp to 100% load	104 to 114	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4
Sub Total		86				100	72		170	162	4.5	16.3		64	

Totals 213 147 344 324 10 35 128

Summary, lbs/event	Uncontrolled	Controlled
NO x	213	147
CO	344	324
SO2	10	10
VOC	128	128
PM10	35	35

BP Cherry Point Cogeneration Project with Siemens SGT6 5000F CTGs
2x1 Reference Plant Warm Start (17-48 hour downtime)

ISO Conditions - Best Case, Consider Adding 10-20% Margin

CGT 1	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4		
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)	
Aux online	-10 to 0	10														
Ramp to 60% load per Siemens table	0 to 78	78	0	0		94	94		216	216		3.0	15.0		81.0	
Ramp to 70% load	78 to 83	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5	
Hold at 70% load	83 to 136	53	80	85	0.9	45	9	0.2	12	2	3.8	3.4	7.1	2.0	1.8	
Ramp to 100% load	136 to 146	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4	
Sub Total		136				153	106		233	219		7.3	24.1		84	

CGT 2	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4		
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)	
Ramp to 60% load per Siemens table	18 to 94	76	0	0		94	94		216	216		3.0	15.0		81.0	
Ramp to 70% load	94 to 99	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5	
Hold at 70% load	99 to 136	37	80	85	0.9	31	6	0.2	9	1	3.8	2.3	4.9	2.0	1.2	
Ramp to 100% load	136 to 146	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4	
Sub Total		118				139	103		229	218		6.3	21.9		83	

Totals 292 209 462 437 14 46 167

Summary, lbs/event	Uncontrolled	Controlled
NO x	292	209
CO	462	437
SO2	14	14
VOC	167	167
PM10	46	46

BP Cherry Point Cogeneration Project with Siemens SGT6 5000F CTGs
2x1 Reference Plant Cold Start (> 64 hour downtime)

ISO Conditions - Best Case, Consider Adding 10-20% Margin

CGT 1	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4		
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)	
Aux online	-10 to 0	10														
Ramp to 60% load per Siemens table	0 to 78	78	0	0		94	94		216	216		3.0	15.0		81.0	
Ramp to 70% load	78 to 83	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5	
Hold at 70% load	83 to 250	167	80	85	0.9	142	28	0.2	39	6	3.8	10.6	22.3	2.0	5.6	
Ramp to 100% load	250 to 260	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4	
Sub Total		250				250	125		260	223		14.5	39.3		87	

CGT 2	Time start up	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4		
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)	
Ramp to 60% load per Siemens table	18 to 94	76	0	0		94	94		216	216		3.0	15.0		81.0	
Ramp to 70% load	94 to 99	5	75	75	0.8	4	1	0.4	2	0	3.3	0.3	0.7	5.5	0.5	
Hold at 70% load	99 to 250	151	80	85	0.9	128	26	0.2	35	5	3.8	9.6	20.1	2.0	5.0	
Ramp to 100% load	250 to 260	10	80	85	0.98	10	2	0.3	3	0	4.0	0.7	1.3	2.3	0.4	
Sub Total		232				236	123		256	222		13.5	37.1		87	

Totals 486 248 515 445 28 76 174

Summary, lbs/event	Uncontrolled	Controlled
NO x	486	248
CO	515	445
SO2	28	28
VOC	174	174
PM10	76	76

BP Cherry Point Cogeneration Project with Siemens SGT6 5000F CTGs

2x1 Reference Plant Shutdown Case

ISO Conditions - Best Case, Consider Adding 10-20% Margin

CGT 1	Time	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4	
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)
Ramp to 60% load	0 to 16	16	80	85	0.9	15	3	0.3	4	1	3.8	1.0	2.1	2.2	0.6
Hold at 60% load	16 to 38	22	70	70	0.8	17	5	0.5	11	3	3.1	1.1	2.9	2.2	0.8
Shutdown per Siemens table	38 to 62	24	50	50		27	14		65	33		1.0	5.0		25.0
Sub Total		62				59	22		81	37		3.2	10.1		26

CGT 2	Time	Duration (min)	SCR Efficiency (%)	CO Catalyst Efficiency (%)	NOx as NO2			CO			SO2		PM-10 (lb)	VOC as CH4	
					(lb/min)	uncont. (lb)	controlled (lb)	(lb/min)	uncont. (lb)	controlled (lb)	(lb/h)	(lb)		(lb/h)	(lb)
Ramp to 60% load	0 to 16	16	80	85	0.9	15	3	0.3	4	1	3.8	1.0	2.1	2.2	0.6
Hold at 60% load	16 to 38	22	70	70	0.8	17	5	0.5	11	3	3.1	1.1	2.9	2.2	0.8
Shutdown per Siemens table	38 to 62	24	50	50		27	14		65	33		1.0	5.0		25.0
Sub Total		62				59	22		81	37		3.2	10.1		26

Totals 118 43 161 73 6 20 53

Summary, lbs/event	Uncontrolled	Controlled
NO x	118	43
CO	161	73
SO2	6	6
VOC	53	53
PM10	20	20

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	1.00	270
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 ($\mu\text{g}/\text{m}^3$)	Class A or B Toxic Compound		EPA Classified HAP (Yes/No)
VOC												
Acetaldehyde	0.013	0.00039	0.001553	0.015	NA	115.1	50	Yes	0.45	A	annual	Yes
Acrolein	0.029	0.000121	0.0001872	0.029	0.02	252.2	175	Yes	0.02	B	24-hr	Yes
Benzene	0.056	0.01192	0.001889	0.070	NA	494.4	20	Yes	0.12	A	annual	Yes
1,3-Butadiene	0.0019	0	0.0000791	0.0020	NA	17.0	0.5	Yes	0.0036	A	annual	Yes
Butane (isomers)	0.74	0	0	0.74	5.0	6,456	43,748	No	6,300	B	24-hr	No
Cyclohexane	0.0044	0	0	0.0044	5.0	38.2	43,748	No	3,400	B	24-hr	No
Cyclopentane	0.0087	0	0	0.009	5.0	76.4	43,748	No	5,700	B	24-hr	No
Ethylbenzene	0.0044	0	0	0.0044	5.0	38.2	43,748	No	1,000	B	24-hr	Yes
Formaldehyde	0.43	0.00121	0.00239	0.43	NA	3,748	20	Yes	0.077	A	annual	Yes
Heptane (isomers)	0.026	0	0	0.026	5.0	229.2	43,748	No	5,500	B	24-hr	No
N-Hexane	0.0087	0	0	0.009	2.6	76.4	22,750	No	200	B	24-hr	Yes
Hexane (isomers)	1.80	0	0	1.80	5.0	15,740	43,748	No	5,900	B	24-hr	Yes
Methylcyclohexane	0.0087	0	0	0.009	5.0	76.4	43,748	No	5,400	B	24-hr	No
Naphthalene	0.0065	0.00200	0	0.0084	2.6	57.0	22,750	No	170	B	24-hr	Yes
Nonane	0.0087	0	0	0.009	5.0	76.4	43,748	No	3,500	B	24-hr	No
Octane (isomers)	0.017	0	0	0.017	5.0	152.8	43,748	No	4,700	B	24-hr	No
PAH	0.0100	0.00326	0.000340	0.014	NA	88.3	NA	Yes	0.000480	A	annual	Yes
Pentane (isomers)	2.70	0	0	2.70	5.0	23,618	43,748	No	6,000	B	24-hr	No
Toluene	0.021	0.00432	0.000828	0.026	5.0	183.7	43,748	No	400	B	24-hr	Yes
1,2,3-Trimethylbenzene	0.017	0	0	0.017	5.0	152.8	43,748	No	420	B	24-hr	No
Xylene	0.017	0.00296	0.000577	0.021	5.0	153.7	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	0.010	0.003710	0.000265	0.014	0.02	92.0	175	No	1.7	B	24-hr	Yes
Cobalt	0.009	0	0	0.009	0.02	79.6	175	No	0.17	B	24-hr	Yes
Copper	0.010	0	0	0.010	0.02	86.2	175	No	0.67	B	24-hr	No
Manganese	0.009	0	0	0.009	0.02	82.1	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	0.011	0.000350	0.0000250	0.011	NA	97.2	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	0.038	0.003850	0.000275	0.042	0.2	332.2	1750	No	17	B	24-hr	No
Ammonia	30.1	0	0	30.1	2.0	263,951	17,500	Yes	100	B	24-hr	No
Sulfuric Acid	7.7	0.2437	0.0321	7.93	0.02	67108	175	Yes	3.3	B	24-hr	No
Total Annual Hours	8,760	250	250								Total HAPs (tons/yr)	10.66
Total Toxics (lbs/yr)						52,693						

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 = 2,248.2		VOC = 2.0		10⁶ scf NG input/hr = 0.4967		0.4967		
Acetaldehyde	NA	0	0.003222	0.006541	NA	0	0	0.006541	0.006541
Acrolein	0.0000064	0.014389	NA	0	NA	0	0	0.014389	0.014389
Benzene	0.0000120	0.0270	NA	0	0.00210	0.0010430	0.0010430	0.028022	0.028022
1,3-Butadiene	0.00000043	0.000967	NA	0	NA	0	0	0.000967	0.000967
Butane (isomers)	NA	0	0.181525	0.368496	NA	0	0	0.368	0.368
Cyclohexane	NA	0	0.001074	0.002180	NA	0	0	0.002180	0.002180
Cyclopentane	NA	0	0.002148	0.004361	NA	0	0	0.004361	0.004361
Ethylbenzene	NA	0	0.001074	0.002180	NA	0	0	0.002180	0.002180
Formaldehyde	NA	0	0.087003	0.176617	0.0750	0.0372517	0.0372517	0.214	0.214
Heptane (isomers)	NA	0	0.006445	0.013083	NA	0	0	0.013083	0.013083
N-Hexane	NA	0	0.002148	0.004361	NA	0	0	0.004361	0.004361
Hexane (isomers)	NA	0	0.002148	0.004361	1.80	0.8940397	0.8940397	0.90	0.90
Methylcyclohexane	NA	0	0.002148	0.004361	NA	0	0	0.004361	0.004361
Naphthalene	0.0000013	0.002923	NA	0	0.000610	0.0003030	0.0003030	0.003226	0.003226
Nonane	NA	0	0.002148	0.004361	NA	0	0	0.004361	0.004361
Octane (isomers)	NA	0	0.004296	0.008722	NA	0	0	0.008722	0.008722
PAH	0.00000220	0.004946	NA	0	0.0000882	0.0000438	0.0000438	0.004990	0.004990
Pentane (isomers)	NA	0	0.027927	0.056692	2.60	1.2913907	1.2913907	1.35	1.348
Toluene	NA	0	0.004296	0.008722	0.00340	0.0016887	0.0016887	0.010411	0.010411
1,2,3-Trimethylbenzene	NA	0	0.004296	0.008722	NA	0	0	0.008722	0.008722
Xylene	NA	0	0.004296	0.008722	NA	0	0	0.008722	0.008722
PM	MMBtu/hr = 2,248.2		PM = 9.0		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	0.004500	0.00140	0.00069536	0.0006954	0.0051954	0.0051954
Cobalt	NA	0	0.00050	0.004500	0.0000840	0.00004172	0.0000417	0.0045417	0.0045417
Copper	NA	0	0.00050	0.004500	0.000850	0.00042219	0.0004222	0.0049222	0.0049222
Manganese	NA	0	0.00050	0.004500	0.000380	0.00018874	0.0001887	0.0046887	0.0046887
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	0.004500	0.00210	0.00104305	0.0010430	0.0055430	0.0055430
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	0.004500	0.0290	0.01440397	0.0144040	0.0189040	0.0189040
Ammonia	NA	0	NA	0	NA	0	0	15.1	15.1
Sulfuric Acid ^d	NA	0	NA	0	NA	0	0	3.83	3.83
			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
NA = Not Applicable - 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 SO ₂ emissions.		