APPENDIX 8.1A

Emissions and Operating Parameters

Table 8.1A-1
Emissions and Operating Parameters for New Turbines
San Francisco Electric Reliability Project

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
	36 deg full load, no chilling	59 deg full load, w/chilling	80 deg full load, w/chilling	36 deg 50% load	59 deg 50% load	80 deg 50% load
Ambient Temp, F	36	59	80	36	59	80
GT Load, %	100	100	100	50	50	50
GT heat input, MMBtu/hr (HHV)	484.6	487.3	487.2	273.8	274.0	272.2
Stack flow, lb/hr	1,128,201	1,107,509	1,107,154	745,437	768,865	787,074
Stack flow, dscfm	228,475	222,850	222,710	152,936	158,413	162,980
Stack flow, acfm	619,922	620,308	620,356	412,259	411,857	407,798
Stack temp, F	805	826	826	819	782	744
Stack exhaust, vol %						
O2 (dry)	14.66	14.47	14.46	15.64	15.82	16.00
CO2 (dry)	3.59	3.70	3.70	3.03	2.93	2.83
H2O	10.33	11.18	11.22	8.73	8.16	7.48
Emissions						
NOx, ppmvd @ 15% O2	2.50	2.50	2.50	2.50	2.50	2.50
NOx, lb/hr	4.39	4.41	4.41	2.48	2.48	2.47
NOx, lb/MMBtu	0.0091	0.0090	0.0091	0.0091	0.0091	0.0091
SO2, ppmvd @ 15% O2	0.182	0.182	0.182	0.182	0.182	0.182
SO2, lb/hr	0.45	0.45	0.45	0.25	0.25	0.25
SO2, lb/MMBtu	0.00092	0.00092	0.00092	0.00092	0.00092	0.00092
CO, ppmvd @ 15% O2	4.00	4.00	4.00	4.00	4.00	4.00
CO, lb/hr	4.28	4.30	4.30	2.42	2.42	2.40
CO, lb/MMBtu	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
VOC, ppmvd @ 15% O2	2.00	2.00	2.00	2.00	2.00	2.00
VOC, lb/hr	1.22	1.23	1.23	0.69	0.69	0.69
VOC, lb/MMBtu	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
PM10, lb/hr	3.0	3.0	3.0	3.0	3.0	3.0
PM10, lb/MMBtu	0.0062	0.0062	0.0062	0.0110	0.0109	0.0110
PM10, gr/dscf	0.00153	0.00157	0.00157	0.00229	0.00221	0.00215
NH3, ppmvd@15% O2	10.0	10.0	10.0	10.0	10.0	10.0
NH3, lb/hr	6.50	6.54	6.53	3.67	3.67	3.65

Table 8.1A-2
Calculation of Cooling Tower Emissions
San Francisco Electric Reliability Project

Cooling Tower Design Parameters	
Water Flow Rate, 10E6 lbm/hr	1.96
Water Flow Rate, gal/min	3,912.0
Drift Rate, %	0.0010
Drift, lbm water/hr	19.55
PM10 Emissions based on TDS Level	
TDS level, ppm	2000
PM10, lb/hr (total, two cells)	0.04
PM10, tpy (total, two cells)	0.17

Table 8.1A-3
Calculation of Annual Fuel Use
San Francisco Electric Reliability Project

487.3	MMBtu/hr of natural gas per turbine at 36 deg F
1,017	Btu/cf
11,700	MMBtu/day of natural gas per turbine
8,760	hours per year of operation per turbine (equivalent)
4,268,700	MMBtu per year of natural gas per turbine
4,197.4	MMcf per year of natural gas per turbine
12,000	hours per year of operation, total, 3 turbines
5,847,600	MMBtu per year of natural gas total
5,750	MMcf per year of natural gas total

Table 8.1A-4
Detailed Calculations for Maximum Hourly, Daily and Annual Criteria Pollutant Emissions
San Francisco Electric Reliability Project

		Base Load		Startup/Shutdown		NOx Maximum	NOx Ann. Avg.	NOx Startup/Shutdown	SO2	CO Maximum	CO Ann. Avg.	CO Startup	POC Maximum	POC Startup	PM10
	max. hour	hrs/day	hrs/yr	hrs/day	hrs/yr	lb/hr	lb/hr	lb/hr (1)	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr (1)	lb/hr
Each Turbine	1	20	3750	4	250	4.41	4.41	40.0	0.45	4.30	4.30	10.00	1.23	2.00	3.0

	NOx			SO2			CO			POC			PM10		
	Max	Max	Total	Max	Max	Total	Max	Max	Total	Max	Max	Total	Max	Max	Total
	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy
Turbine 1	40.0	248.2	13.3	0.45	10.8	0.9	10.0	126.0	9.3	2.0	32.6	2.6	3.0	72.0	6.0
Turbine 2	40.0	248.2	13.3	0.45	10.8	0.9	10.0	126.0	9.3	2.0	32.6	2.6	3.0	72.0	6.0
Turbine 3	40.0	248.2	13.3	0.45	10.8	0.9	10.0	126.0	9.3	2.0	32.6	2.6	3.0	72.0	6.0
Total, 3 Turbines	120.0	744.6	39.8	1.35	32.3	2.7	30.0	378.0	27.9	6.0	97.8	7.67	9.0	216.0	18.0
Cooling Tower	--	--	--	--	--	--	--	--	--	--	--	--	0.04	0.9	0.2
Facility Total	120.0	744.6	39.8	1.3	32.3	2.7	30.0	378.0	27.9	6.0	97.8	7.7	9.0	216.9	18.2

Table 8.1A-5
Calculation of Noncriteria Pollutant Emissions from Gas Turbines
San Francisco Electric Reliability Project

Compound	Emission Factor, lb/MMscf (2)	Maximum Hourly Emissions, lb/hr Each CTG (3)	Total, 3 CTGs	Total Annual Emissions, 3 CTGs lb/yr	tpy
Ammonia	(5)	6.54	19.62	78,480.0	39.2
Propylene	7.71E-01	0.37	1.11	4,433.3	2.2
Hazardous Air Pollutants					
Acetaldehyde	4.08E-02	1.95E-02	5.86E-02	234.6	0.12
Acrolein	3.69E-03	1.77E-03	5.30E-03	21.2	1.06E-02
Benzene	3.33E-03	1.60E-03	4.79E-03	19.1	9.57E-03
1,3-Butadiene	4.39E-04	2.10E-04	6.31E-04	2.5	1.26E-03
Ethylbenzene	3.26E-02	1.56E-02	4.69E-02	187.5	9.37E-02
Formaldehyde	3.67E-01	0.18	0.53	2,110.3	1.06
Hexane	2.59E-01	0.12	0.37	1,489.3	0.74
Naphthalene	1.66E-03	7.95E-04	2.39E-03	9.5	4.77E-03
PAHs (listed individually below)	1.79E-04	8.58E-05	2.57E-04	1.0	5.15E-04
Anthracene	3.38E-05				
Benzo(a)anthracene	2.26E-05				
Benzo(a)pyrene	1.39E-05				
Benzo(b)fluoranthrene	1.13E-05				
Benzo(k)fluoranthrene	1.10E-05				
Chrysene	2.52E-05				
Dibenz(a,h)anthracene	2.35E-05				
Indeno(1,2,3-cd)pyrene	2.35E-05				
Propylene oxide	2.96E-02	1.42E-02	4.25E-02	170.2	0.09
Toluene	1.33E-01	6.37E-02	0.19	764.8	0.38
Xylene	6.53E-02	3.13E-02	0.09	375.5	0.19
Total HAPs			1.35	5,385.4	2.69

Notes:

(1) All factors except PAHs, hexane and propylene from AP-42, Table 3.4-1. Acrolein, benzene and formaldehyde reflect oxidation catalyst. Individual PAHs, hexane and propylene are CATEF mean results as AP-42 does not include factors for these compounds.

(2) Based on maximum hourly turbine fuel use of 487.3 MMBtu/hr and fuel HHV of 1017 Btu/scf. 0.48 MMscf/hr

(3) Based on total annual fuel use of 5,847,600 MMBtu/yr and fuel HHV of 1017 Btu/scf. 5,750.0 MMscf/yr

(4) Based on 10 ppm ammonia slip from SCR system.

Table 8.1A-6
Calculation of Noncriteria Pollutant Emissions from Cooling Tower (1)
San Francisco Electric Reliability Project

Constituent	Concentration in Cooling Tower Return Water	Emissions, lb/hr	Emissions, lb/day	Emissions, ton/yr	BAAQMD TAC Trigger Level, lb/yr
Ammonia	1 ppb	3.91E-08	9.39E-07	3.43E-04	1.93E+04
Arsenic	10 ppb	3.91E-07	9.39E-06	3.43E-03	2.40E-02
Cadmium	1.5 ppb	5.87E-08	1.41E-06	5.14E-04	4.60E-02
Chromium III (2)	6.5 ppb	2.54E-07	6.10E-06	2.23E-03	n/a
Copper	73 ppb	2.85E-06	6.85E-05	2.50E-02	4.63E+02
Lead	12.5 ppb	4.89E-07	1.17E-05	4.28E-03	2.90E+01
Mercury	0.1 ppb	3.91E-09	9.39E-08	3.43E-05	5.79E+01
Nickel	19.5 ppb	7.63E-07	1.83E-05	6.68E-03	7.30E-01
PAHs	0.8 ppb	3.13E-08	7.51E-07	2.74E-04	4.40E-02
PCBs	0.5 ppb	1.96E-08	4.69E-07	1.71E-04	6.80E-03
Zinc	309 ppb	1.21E-05	2.90E-04	1.06E-01	6.76E+03

Note: (1) Emissions calculated from maximum drift rate of 19.55 lb/hr
(2) Speciation of water sample indicates that all chromium is in the form of Cr3. Concentration of Cr6+ is non-detectable at the detection level of RL<0.1 micrograms/liter.

APPENDIX 8.1B

Modeling Analysis

POTRERO POWER PLANT 1992 METEOROLOGICAL DATA SET

1992 WIND FREQUENCY DISTRIBUTION: ANNUAL

WIND SPEED AT 10 M HEIGHT (M/S)

	WIND SPEED (M/S)											
SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	TOTAL
N	38.	129.	177.	98.	29.	9.	0.	0.	0.	0.	0.	480.
NNE	25.	121.	184.	69.	13.	6.	4.	0.	0.	0.	0.	422.
NE	24.	132.	74.	14.	10.	1.	3.	1.	0.	0.	0.	259.
ENE	24.	74.	22.	6.	4.	1.	0.	0.	0.	0.	0.	131.
E	25.	94.	32.	5.	3.	1.	0.	0.	0.	0.	0.	160.
ESE	15.	64.	54.	14.	6.	3.	1.	0.	0.	0.	0.	157.
SE	19.	56.	56.	34.	13.	19.	10.	9.	3.	3.	1.	223.
SSE	30.	62.	70.	63.	41.	56.	36.	26.	5.	7.	0.	396.
S	76.	88.	86.	61.	86.	38.	17.	17.	7.	8.	4.	488.
SSW	48.	83.	48.	31.	22.	7.	1.	1.	0.	0.	0.	241.
SW	81.	230.	238.	183.	43.	12.	3.	0.	0.	0.	0.	790.
WSW	103.	352.	831.	614.	321.	87.	11.	0.	0.	0.	0.	2319.
W	84.	229.	368.	292.	205.	102.	38.	8.	0.	0.	0.	1326.
WNW	60.	137.	147.	180.	107.	55.	24.	9.	1.	0.	0.	720.
NW	70.	103.	70.	41.	28.	3.	0.	0.	0.	0.	0.	315.
NNW	44.	87.	126.	66.	26.	7.	1.	0.	0.	0.	0.	357.
TOTAL	766.	2041.	2583.	1771.	957.	407.	149.	71.	16.	18.	5.	8784.

AVERAGE ANNUAL WIND SPEED (M/S) = 2.813

1992 WIND FREQUENCY DISTRIBUTION: FIRST QUARTER

WIND SPEED AT 10 M HEIGHT (M/S)

	WIND SPEED (M/S)											
SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	TOTAL
N	14.	75.	86.	65.	21.	5.	0.	0.	0.	0.	0.	266.
NNE	16.	57.	130.	54.	6.	3.	2.	0.	0.	0.	0.	268.
NE	15.	56.	48.	8.	5.	1.	0.	1.	0.	0.	0.	134.
ENE	12.	29.	9.	2.	1.	0.	0.	0.	0.	0.	0.	53.
E	13.	23.	8.	1.	0.	0.	0.	0.	0.	0.	0.	45.
ESE	4.	17.	15.	4.	1.	0.	0.	0.	0.	0.	0.	41.
SE	9.	33.	15.	11.	5.	2.	0.	0.	0.	0.	0.	75.
SSE	14.	29.	40.	28.	17.	27.	14.	7.	1.	5.	0.	182.
S	18.	51.	53.	46.	75.	33.	15.	16.	6.	8.	4.	325.
SSW	12.	35.	20.	18.	15.	6.	1.	1.	0.	0.	0.	108.
SW	25.	28.	18.	10.	3.	0.	0.	0.	0.	0.	0.	84.
WSW	17.	33.	31.	9.	6.	1.	0.	0.	0.	0.	0.	97.
W	20.	41.	42.	32.	15.	3.	2.	0.	0.	0.	0.	155.
WNW	15.	45.	29.	29.	16.	9.	1.	1.	0.	0.	0.	145.
NW	29.	23.	23.	20.	16.	3.	0.	0.	0.	0.	0.	114.
NNW	19.	44.	25.	2.	2.	0.	0.	0.	0.	0.	0.	92.
TOTAL	252.	619.	592.	339.	204.	93.	35.	26.	7.	13.	4.	2184.

1992 WIND FREQUENCY DISTRIBUTION: SECOND QUARTER
WIND SPEED AT 10 M HEIGHT (M/S)

	WIND SPEED (M/S)											
SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	TOTAL
N	1.	4.	9.	1.	0.	0.	0.	0.	0.	0.	0.	15.
NNE	0.	7.	14.	6.	0.	0.	0.	0.	0.	0.	0.	27.
NE	0.	14.	7.	1.	0.	0.	0.	0.	0.	0.	0.	22.
ENE	3.	13.	3.	0.	0.	0.	0.	0.	0.	0.	0.	19.
E	1.	16.	6.	0.	0.	0.	0.	0.	0.	0.	0.	23.
ESE	3.	20.	15.	3.	0.	0.	0.	0.	0.	0.	0.	41.
SE	1.	7.	13.	5.	0.	0.	3.	2.	1.	0.	0.	32.
SSE	5.	4.	4.	6.	5.	6.	0.	0.	0.	0.	0.	30.
S	6.	10.	11.	6.	4.	5.	0.	0.	0.	0.	0.	42.
SSW	11.	19.	14.	3.	0.	0.	0.	0.	0.	0.	0.	47.
SW	19.	77.	76.	79.	8.	2.	0.	0.	0.	0.	0.	261.
WSW	18.	86.	218.	255.	167.	60.	6.	0.	0.	0.	0.	810.
W	11.	54.	119.	122.	91.	63.	19.	4.	0.	0.	0.	483.
WNW	6.	27.	60.	78.	52.	34.	18.	8.	1.	0.	0.	284.
NW	4.	6.	8.	8.	2.	0.	0.	0.	0.	0.	0.	28.
NNW	1.	2.	8.	2.	3.	3.	1.	0.	0.	0.	0.	20.
TOTAL	90.	366.	585.	575.	332.	173.	47.	14.	2.	0.	0.	2184.

1992 WIND FREQUENCY DISTRIBUTION: THIRD QUARTER
WIND SPEED AT 10 M HEIGHT (M/S)

	WIND SPEED (M/S)											
SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	TOTAL
N	9.	2.	3.	2.	0.	0.	0.	0.	0.	0.	0.	16.
NNE	4.	6.	12.	1.	0.	0.	0.	0.	0.	0.	0.	23.
NE	3.	24.	7.	0.	0.	0.	0.	0.	0.	0.	0.	34.
ENE	4.	16.	1.	0.	0.	0.	0.	0.	0.	0.	0.	21.
E	4.	18.	3.	0.	0.	0.	0.	0.	0.	0.	0.	25.
ESE	2.	8.	6.	1.	0.	0.	0.	0.	0.	0.	0.	17.
SE	0.	6.	4.	3.	0.	0.	0.	0.	0.	0.	0.	13.
SSE	1.	6.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.
S	5.	8.	1.	0.	0.	0.	0.	0.	0.	0.	0.	14.
SSW	7.	11.	5.	0.	0.	0.	0.	0.	0.	0.	0.	23.
SW	9.	69.	104.	71.	17.	1.	0.	0.	0.	0.	0.	271.
WSW	14.	143.	501.	303.	128.	26.	5.	0.	0.	0.	0.	1120.
W	25.	68.	138.	102.	83.	34.	17.	4.	0.	0.	0.	471.
WNW	10.	19.	15.	34.	19.	8.	5.	0.	0.	0.	0.	110.
NW	6.	15.	8.	1.	7.	0.	0.	0.	0.	0.	0.	37.
NNW	4.	0.	2.	0.	0.	0.	0.	0.	0.	0.	0.	6.
TOTAL	107.	419.	810.	518.	254.	69.	27.	4.	0.	0.	0.	2208.

1992 WIND FREQUENCY DISTRIBUTION: FOURTH QUARTER
WIND SPEED AT 10 M HEIGHT (M/S)

	WIND SPEED (M/S)											
SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10+	TOTAL
N	14.	48.	79.	30.	8.	4.	0.	0.	0.	0.	0.	183.
NNE	5.	51.	28.	8.	7.	3.	2.	0.	0.	0.	0.	104.
NE	6.	38.	12.	5.	5.	0.	3.	0.	0.	0.	0.	69.
ENE	5.	16.	9.	4.	3.	1.	0.	0.	0.	0.	0.	38.
E	7.	37.	15.	4.	3.	1.	0.	0.	0.	0.	0.	67.
ESE	6.	19.	18.	6.	5.	3.	1.	0.	0.	0.	0.	58.
SE	9.	10.	24.	15.	8.	17.	7.	7.	2.	3.	1.	103.
SSE	10.	23.	26.	29.	19.	23.	22.	19.	4.	2.	0.	177.
S	47.	19.	21.	9.	7.	0.	2.	1.	1.	0.	0.	107.
SSW	18.	18.	9.	10.	7.	1.	0.	0.	0.	0.	0.	63.
SW	28.	56.	40.	23.	15.	9.	3.	0.	0.	0.	0.	174.
WSW	54.	90.	81.	47.	20.	0.	0.	0.	0.	0.	0.	292.
W	28.	66.	69.	36.	16.	2.	0.	0.	0.	0.	0.	217.
WNW	29.	46.	43.	39.	20.	4.	0.	0.	0.	0.	0.	181.
NW	31.	59.	31.	12.	3.	0.	0.	0.	0.	0.	0.	136.
NNW	20.	41.	91.	62.	21.	4.	0.	0.	0.	0.	0.	239.
TOTAL	317.	637.	596.	339.	167.	72.	40.	27.	7.	5.	1.	2208.

Table 8.1B-1
Dimensions of On-Site Structures
SFERP

Feature	Height (feet)	Length (feet)	Width (feet)	Diameter (feet)
CTGs				
Combustion turbines & generators (base unit)	14.5	114.4	28.0	--
SCR casings	33	28	18.2	--
Inlet air filters	35.8	59.5	11.2	--
CTG stacks	85	--	--	12
Chiller cooling tower	40	48.6	14.3	--
Tanks				
DI water storage tank	32	--	--	42
Treated water storage tank	32	--	--	60
Aqueous ammonia storage tank	10.0	38.5	18.5	8
Water treatment building	21	149	63.3	--
Admin/control bldg	28	181.6	105.0	--
Future MUNI Maintenance Building	41	549.3	345.5	--

Figure 8.1B-1

Building Layout for GEP Analysis

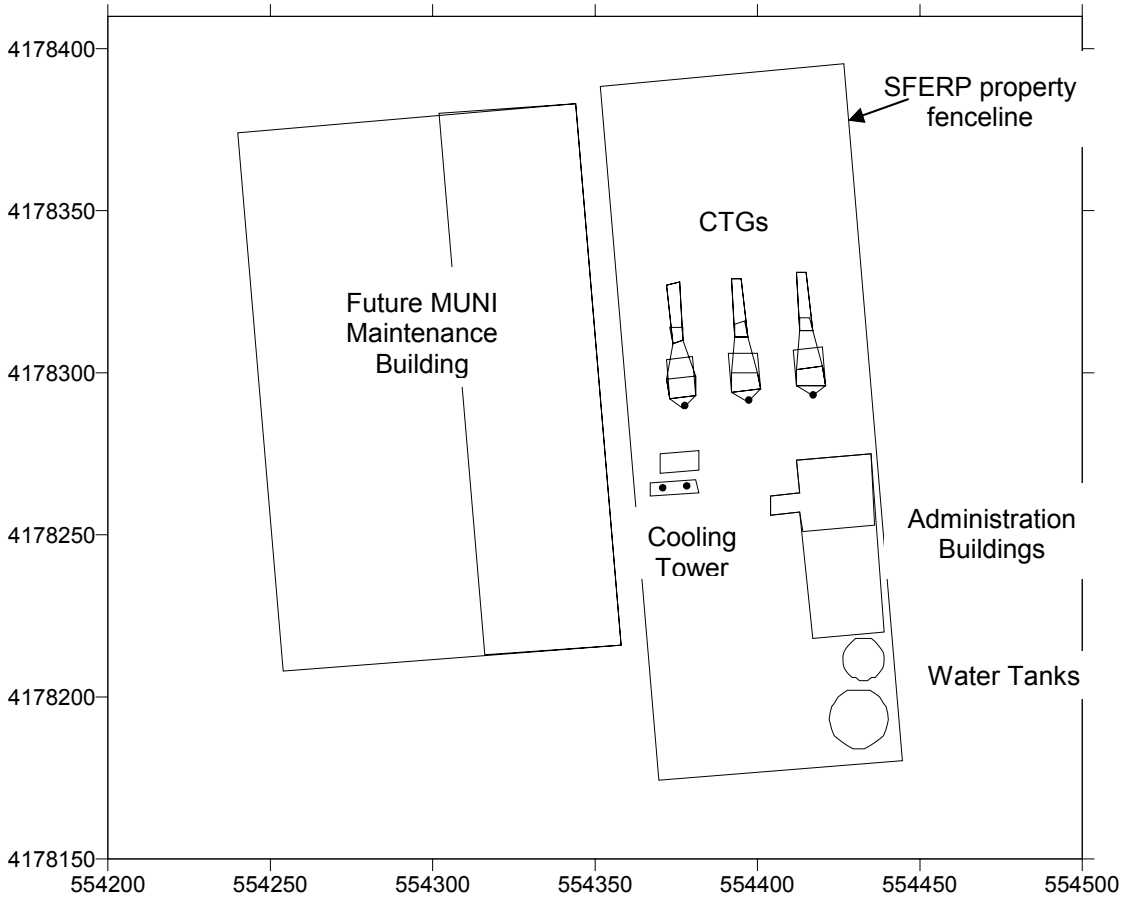


Table 8.1B-2
Emissions and Stack Parameters for Screening Modeling
San Francisco Electric Reliability Project

Turbine Case	Turbine Load, %	Ambient Temp (deg F)	Ambient Temp (deg K)	Stack Diam (m)	Stack Height (m)	Exhaust Temp (deg K)	Exhaust Velocity (m/s)
1	100	36	275.22	3.658	25.908	702.444	27.845
2	100	59	288.00	3.658	25.908	714.111	27.862
3	100	80	299.67	3.658	25.908	714.111	27.865
4	50	36	275.22	3.658	25.908	710.222	18.517
5	50	59	288.00	3.658	25.908	689.667	18.499
6	50	80	299.67	3.658	25.908	668.556	18.317

Note: Parameters are for each turbine.

Table 8.1B-3
Results of the Unit Impact and Turbine Screening Analysis
San Francisco Electric Reliability Project

Turbine Case	Modeled Unit Impact, ug/m3 per 3.0 g/s				
	1-hr	3-hr	8-hr	24-hr	annual
	1992 Potrero Met Data				
1	14.999	10.179	5.820	2.203	0.257
2	14.840	10.080	5.764	2.181	0.254
3	14.839	10.079	5.763	2.181	0.254
4	21.180	13.504	7.720	2.929	0.356
5	21.537	13.698	7.831	2.971	0.362
6	22.089	13.991	7.998	3.035	0.372

Emission Rates by Pollutant and Averaging Period Modeling (lb/hr)												
Turbine	NOx			SO2				CO			PM10	
Case	1-hr	Startup	ann avg	1-hr	3-hr	24-hr	ann avg	1-hr	Startup	8-hr	24-hr	ann avg
1	4.39	--	3.02	0.45	0.45	0.45	0.20	4.28	--	7.14	3.00	1.37
2	4.41	--	3.03	0.45	0.45	0.45	0.20	4.30	--	7.15	3.00	1.37
3	4.41	--	3.03	0.45	0.45	0.45	0.20	4.30	--	7.15	3.00	1.37
4	2.48	40	2.20	0.25	0.25	0.25	0.11	2.42	10	6.21	3.00	1.37
5	2.48	40	2.20	0.25	0.25	0.25	0.12	2.42	10	6.21	3.00	1.37
6	2.47	40	2.20	0.25	0.25	0.25	0.11	2.40	10	6.20	3.00	1.37

Emission Rates by Pollutant and Averaging Period Modeling (g/s)												
Turbine	NOx			SO2				CO			PM10	
Case	1-hr	Startup	ann avg	1-hr	3-hr	24-hr	ann avg	1-hr	Startup	8-hr	24-hr	ann avg
1	0.553	--	0.381	0.056	0.056	0.056	0.026	0.539	--	0.900	0.378	0.173
2	0.556	--	0.382	0.057	0.057	0.057	0.026	0.542	--	0.901	0.378	0.173
3	0.556	--	0.382	0.056	0.056	0.056	0.026	0.542	--	0.901	0.378	0.173
4	0.312	5.04	0.278	0.032	0.032	0.032	0.014	0.305	1.26	0.782	0.378	0.173
5	0.312	5.04	0.278	0.032	0.032	0.032	0.015	0.305	1.26	0.782	0.378	0.173
6	0.311	5.04	0.277	0.032	0.032	0.032	0.014	0.302	1.26	0.781	0.378	0.173

Turbine	Load/ Ambient	Modeled Impacts for Three CTGs, ug/m3, by Pollutant and Averaging Period											
		NOx			SO2				CO			PM10	
Case	Temp	1-hr	Startup	Annual	1-hr	3-hr	24-hr	Annual	1-hr	Startup	8-hr	24-hr	Annual
1	100% 36 deg	**8.30**	--	0.098	**0.842**	**0.572**	**0.1237**	**0.00659**	**8.09**	--	5.24	0.83	0.044
2	100% 59 deg w/ chilling	8.25	--	0.097	0.839	0.570	0.1233	0.00655	8.04	--	5.19	0.82	0.044
3	100% 80 deg w/ chilling	8.25	--	0.097	0.838	0.569	0.1232	0.00655	8.04	--	5.19	0.82	0.044
4	50% 36 deg	6.62	106.75	0.099	0.67	0.43	0.093	0.005	6.46	26.69	6.04	1.11	0.061
5	50% 59 deg	6.73	108.54	0.100	0.68	0.43	0.094	0.005	6.57	27.14	6.13	1.12	0.062
6	50% 80 deg	6.87	**111.33**	**0.103**	0.70	0.44	0.096	0.005	6.68	**27.83**	**6.25**	**1.15**	**0.064**

Table 8.1B-4
Emission Rates and Stack Parameters for Refined Modeling
San Francisco Electric Reliability Project

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Emission Rate, g/s			
						NOx	SO2	CO	PM10
Averaging Period: 24 hours, PM10									
Each Turbine	3.658	25.908	668.56	192.46	18.317	n/a	n/a	n/a	3.78E-01
Cooling Towers (each cell)	3.962	12.764	294.11	101.45	8.227	n/a	n/a	n/a	2.46E-03
Averaging Period: Annual, PM10									
Each Turbine	3.658	25.908	668.56	192.46	18.317	n/a	n/a	n/a	1.73E-01
Cooling Towers (each cell)	3.962	12.764	294.11	101.45	8.227	n/a	n/a	n/a	2.46E-03

Table 8.1B-5
Analysis of Impacts due to Inversion Breakup Fumigation
San Francisco Electric Reliability Project

CTG Emission Rates, g/s

	NOx	CO	PM10	SO2
Case 1	0.553	0.539	0.378	0.0562
Case 2	0.556	0.542	0.378	0.0565
Case 3	0.556	0.542	0.378	0.0565
Case 4	0.312	0.305	0.378	0.0317
Case 5	0.312	0.305	0.378	0.0318
Case 6	0.311	0.302	0.378	0.0316

Inversion Breakup Modeling Results from SCREEN3

	Unit Impacts, ug/m3	Maximum One-Hour Avg Impacts, ug/m3				Distance to
	per g/s	NOx	CO	PM10	SO2	Maximum (m)
Case 1	0.9943	0.5500	0.5362	0.3758	0.0558	19,058
Case 2	0.9858	0.5478	0.5341	0.3726	0.0557	19,178
Case 3	0.9857	0.5477	0.5341	0.3726	0.0557	19,179
Case 4	1.313	0.4103	0.4004	0.4963	0.0416	15,545
Case 5	1.333	0.4165	0.4065	0.5039	0.0423	15,373
Case 6	1.364	0.4245	0.4125	0.5156	0.0431	15,117

Flat Terrain Modeling Results from SCREEN3

	Unit Impacts, ug/m3	Maximum One-Hour Avg Impacts, ug/m3				Distance to
	per g/s	NOx	CO	PM10	SO2	Maximum (m)
Case 1	0.6965	0.3853	0.3756	0.2633	0.0391	1201
Case 2	0.6886	0.3826	0.3731	0.2603	0.0389	1205
Case 3	0.6885	0.3826	0.3730	0.2603	0.0389	1205
Case 4	1.006	0.3144	0.3067	0.3803	0.0319	1074
Case 5	1.014	0.3169	0.3092	0.3833	0.0322	1072
Case 6	1.018	0.3168	0.3078	0.3848	0.0321	1072

Adjust unit impacts for longer averaging periods to account for 90-minute duration of fumigation

	1-hr unit	3-hr unit	8-hr unit	24-hr unit
Case 1	0.9943	0.8454	0.7523	0.7151
Case 2	0.9858	0.8372	0.7443	0.7072
Case 3	0.9857	0.8371	0.7442	0.7071
Case 4	1.3130	1.1595	1.0636	1.0252
Case 5	1.3330	1.1735	1.0738	1.0339
Case 6	1.3640	1.1910	1.0829	1.0396

Table 8.1B-5 (cont'd)

Calculation of Fumigation Impacts for Three Units

Case/Avg Period	NOx	CO	PM10	SO2
One-Hour				
Case 1	1.6500	1.6086	-	0.1675
Case 2	1.6433	1.6023	-	0.1671
Case 3	1.6431	1.6022	-	0.1670
Case 4	1.2309	1.2011	-	0.1249
Case 5	1.2496	1.2194	-	0.1270
Case 6	1.2735	1.2374	-	0.1292
3 Hours				
Case 1	-	-	-	0.1282
Case 2	-	-	-	0.1504
Case 3	-	-	-	0.1503
Case 4	-	-	-	0.1124
Case 5	-	-	-	0.1143
Case 6	-	-	-	0.1162
8 Hours				
Case 1	-	0.8520	-	-
Case 2	-	0.8469	-	-
Case 3	-	0.8468	-	-
Case 4	-	0.6810	-	-
Case 5	-	0.6876	-	-
Case 6	-	0.6877	-	-
24 Hours				
Case 1	-	-	0.3244	0.0482
Case 2	-	-	0.3208	0.0480
Case 3	-	-	0.3207	0.0479
Case 4	-	-	0.4650	0.0390
Case 5	-	-	0.4690	0.0394
Case 6	-	-	0.4716	0.0394

NOTES TO TABLE 8.1B-5

INVERSION BREAKUP FUMIGATION ANALYSIS

Inversion breakup fumigation is generally a short-term phenomenon and was evaluated here as persisting for up to 90 minutes. SCREEN3 was used to model one-hour unit impacts from the turbines under 2.5 m/s winds and F stability (for fumigation impacts) and under all meteorological conditions (shown in the table as "Inversion Breakup Modeling Results from SCREEN3").

For longer-term averaging periods, impacts were calculated using the highest modeled impact from SCREEN3 for the corresponding averaging period. A sample calculation for 24-hour average PM_{10} for Case 1 is as follows:

- For a single turbine, Case 1, 1-hour average unit impact = 0.9943 ug/m3 per g/s
- For a single turbine, Case 1, max. 1-hour average unit impact from SCREEN3 = 0.6965 ug/m3 per g/s
- For a single turbine, the appropriate unit impact for the 24-hour averaging period is calculated as 1.5 hours of inversion breakup fumigation plus 22.5 hours of operation under typical conditions (from SCREEN3): [(1.5 * 0.9943 ug/m3 per g/s) + (22.5 * 0.6965 ug/m3 per g/s)] ÷ 24 hrs = 0.7151 ug/m^3 per g/s
- For three turbines with an emission rate of 0.378 g/s, the total 24-hour average PM_{10} impact under inversion breakup fumigation conditions is: 0.7151 ug/m^3 per g/s * 0.378 g/s per turbine* 0.4 [persistence factor for converting 1-hour average screening impact into 24-hour average concentration] * 3 turbines = 0.3244 ug/m^3

Table 8.1B-6
Analysis of Impacts due to Shoreline Fumigation
San Francisco Electric Reliability Project

CTG Emission Rates, g/s

	NOx	CO	PM10	SO2
Case 1	0.553	0.539	0.378	0.056
Case 2	0.556	0.542	0.378	0.057
Case 3	0.556	0.542	0.378	0.056
Case 4	0.312	0.305	0.378	0.032
Case 5	0.312	0.305	0.378	0.032
Case 6	0.311	0.302	0.378	0.032

Shoreline Fumigation Modeling Results from SCREEN3

	Unit Impacts,	Maximum One-Hour Avg Impacts, ug/m3				Distance to
	ug/m3 per g/s	NOx	CO	PM10	SO2	Maximum (m)
Case 1	6.635	3.6701	3.5781	2.5080	0.3726	1683
Case 2	6.572	3.6518	3.5607	2.4842	0.3714	1698
Case 3	6.572	3.6518	3.5607	2.4842	0.3711	1698
Case 4	9.046	2.8267	2.7583	3.4194	0.2869	1256
Case 5	9.2	2.8748	2.8053	3.4776	0.2922	1236
Case 6	9.439	2.9376	2.8544	3.5679	0.2979	1205

Flat Terrain Modeling Results from SCREEN3

	Unit Impacts,	Maximum One-Hour Avg Impacts, ug/m3				Distance to
	ug/m3 per g/s	NOx	CO	PM10	SO2	Maximum (m)
Case 1	0.6965	0.3853	0.3756	0.2633	0.0391	1201
Case 2	0.6886	0.3826	0.3731	0.2603	0.0389	1205
Case 3	0.6885	0.3826	0.3730	0.2603	0.0389	1205
Case 4	1.006	0.3144	0.3067	0.3803	0.0319	1074
Case 5	1.014	0.3169	0.3092	0.3833	0.0322	1072
Case 6	1.018	0.3168	0.3078	0.3848	0.0321	1072

Adjust unit impacts for longer averaging periods to account for three-hour duration of fumigation

	1-hr unit	3-hr unit	8-hr unit	24-hr unit
Case 1	6.6350	6.6350	2.9234	1.4388
Case 2	6.5720	6.5720	2.8949	1.4240
Case 3	6.5720	6.5720	2.8948	1.4239
Case 4	9.0460	9.0460	4.0210	2.0110
Case 5	9.2000	9.2000	4.0838	2.0373
Case 6	9.4390	9.4390	4.1759	2.0706

Table 8.1B-6 (cont'd)

Calculation of Shoreline Fumigation Impacts for Three Units

Case/Avg Period	NOx	CO	PM10	SO2
One-Hour				
Case 1	11.01	10.73	-	1.12
Case 2	10.96	10.68	-	1.11
Case 3	10.96	10.68	-	1.11
Case 4	8.48	8.27	-	0.86
Case 5	8.62	8.42	-	0.88
Case 6	8.81	8.56	-	0.89
3 Hours				
Case 1	-	-	-	1.006
Case 2	-	-	-	1.003
Case 3	-	-	-	1.002
Case 4	-	-	-	0.775
Case 5	-	-	-	0.789
Case 6	-	-	-	0.804
8 Hours				
Case 1	-	3.31	-	-
Case 2	-	3.29	-	-
Case 3	-	3.29	-	-
Case 4	-	2.57	-	-
Case 5	-	2.61	-	-
Case 6	-	2.65	-	-
24 Hours				
Case 1	-	-	0.653	0.097
Case 2	-	-	0.646	0.097
Case 3	-	-	0.646	0.096
Case 4	-	-	0.912	0.077
Case 5	-	-	0.924	0.078
Case 6	-	-	0.939	0.078

NOTES TO TABLE 8.1B-6

SHORELINE FUMIGATION ANALYSIS

Shoreline fumigation was modeled for the turbines using SCREEN3 TIBL factors ranging from 2 to 6 at a distance to shoreline of 280 meters. Based on the analysis of wind persistence in the meteorological data set that was performed by URS for the Potrero 7 project at the same location, shoreline fumigation conditions were assumed to persist for up to 3 hours. For longer-term averaging periods, impacts were calculated using the highest modeled impact from SCREEN3 for the corresponding averaging period. A sample calculation for 24-hour average PM_{10} for Case 3 is as follows:

- For a single turbine, Case 1, 1-hour average unit impact = 6.635 ug/m3 per g/s
- For a single turbine, Case 1, max. 1-hour average unit impact from SCREEN3 = 0.6965 ug/m3 per g/s
- For a single turbine, 24-hour unit impact is calculated as 3 hours of shoreline fumigation plus 21 hours of operation under typical conditions (from SCREEN3): [(3 * 6.635 ug/m3 per g/s) + (21 * 0.6965 ug/m3 per g/s)] ÷ 24 hrs = 1.4388 ug/m^3 per g/s
- For three turbines with an emission rate of 0.378 g/s, the total 24-hour average PM_{10} impact under shoreline fumigation conditions is: 1.4388 ug/m^3 per g/s * 0.378 g/s per turbine* 0.4 [persistence factor for converting 1-hour average screening impact into 24-hour average concentration] * 3 turbines = 0.653 ug/m^3

Table 8.1B-7
Gas Turbine Commissioning Profile
San Francisco Electric Reliability Project

Operating Mode	Hours of Operation(1)	Fuel Use MMBtu/hr (2) (HHV)	Emission Factors (lbs/MMBtu) NOx(3)	CO(4)	VOC(5)	PM10(6)	SOx(7)	Hourly Emissions (lbs/hr) NOx	CO	VOC	PM10
Turbine 1 - FSNL	4	96.9	0.3640	0.2650	0.0755	n/a	0.00092	35.28	25.68	7.32	3.0
Turbine 2 - FSNL	4	96.9	0.3640	0.2650	0.0755	n/a	0.00092	35.28	25.68	7.32	3.0
Turbine 3 - FSNL	4	96.9	0.3640	0.2650	0.0755	n/a	0.00092	35.28	25.68	7.32	3.0
Turbine 1 - Min. Load, no SCR or ox cat	20	96.9	0.15288	0.1501	0.0201	n/a	0.00092	14.82	14.55	1.95	3.0
Turbine 2 - Min. Load, no SCR or ox cat	20	96.9	0.15288	0.1501	0.0201	n/a	0.00092	14.82	14.55	1.95	3.0
Turbine 3 - Min. Load, no SCR or ox cat	20	96.9	0.15288	0.1501	0.0201	n/a	0.00092	14.82	14.55	1.95	3.0
Turbine 1 - FSNL (if necessary)	24	96.9	0.3640	0.2650	0.0755	n/a	0.00092	35.28	25.68	7.32	3.0
Turbine 2 - FSNL (if necessary)	24	96.9	0.3640	0.2650	0.0755	n/a	0.00092	35.28	25.68	7.32	3.0
Turbine 3 - FSNL (if necessary)	24	96.9	0.3640	0.2650	0.0755	n/a	0.00092	35.28	25.68	7.32	3.0
Turbine 1 - Multiple Load - Full SCR/ox cat	48	487.3	0.05915	0.0088	0.0025	n/a	0.00092	28.82	4.30	1.23	3.0
Turbine 2 - Multiple Load - Full SCR/ox cat	48	487.3	0.05915	0.0088	0.0025	n/a	0.00092	28.82	4.30	1.23	3.0
Turbine 3 - Multiple Load - Full SCR/ox cat	48	487.3	0.05915	0.0088	0.0025	n/a	0.00092	28.82	4.30	1.23	3.0
Total =	288										

Notes:
(1) Hours of Operation - based on information supplied by MID for the MEGS project.
(2) Fuel Use
- No Load test: Based on 20% of maximum heat input rating.
- Minimum Load test: Based on 20% of maximum heat input rating.
- Multiple Load test: Based on 100% of maximum heat input rating.
(3) NOx Emission Factors
- No Load test: Based on 100 ppm @ 15% O2.
- Minimum Load test: Based on maximum uncontrolled emission rate of 42 ppm @ 15% O2.
- Multiple Load Full SCR/ox cat test: Based on NOx emission levels at the midway point between 30 ppm and 2.5 ppm @ 15% O2.
(4) CO Emission Factors
- No Load test: Based on maximum uncontrolled emission rate of 30 times controlled level, or 120 ppm @ 15% O2.
- Minimum Load test: Based on maximum uncontrolled emission rate of 17 times controlled level, or 68 ppm @ 15% O2.
- Multiple Load Full SCR/ox cat test: Based on unit meeting the project design level of 4 ppm @ 15% O2 with oxidation catalyst installed and operating.
(5) VOC Emission Factors
- No Load test: Based on maximum uncontrolled emission rate of 30 times controlled level, or 60 ppm @ 15% O2.
- Minimum Load test: Based on maximum uncontrolled emission rate of 8 times controlled level, or 16 ppm @ 15% O2.
- Multiple Load Full SCR/ox cat test: Based on unit meeting the project design level of 2 ppm @ 15% O2 with oxidation catalyst installed and operating.
(6) PM10 Emission Factors
- For all tests, based on project design PM10 level of 3.0 lbs/hr.
(7) SOx Emission Factors
- For all tests, based on annual average natural gas sulfur content of 0.33 gr/100 scf.

Figure 8.1B-2

Layout of the Receptor Grids

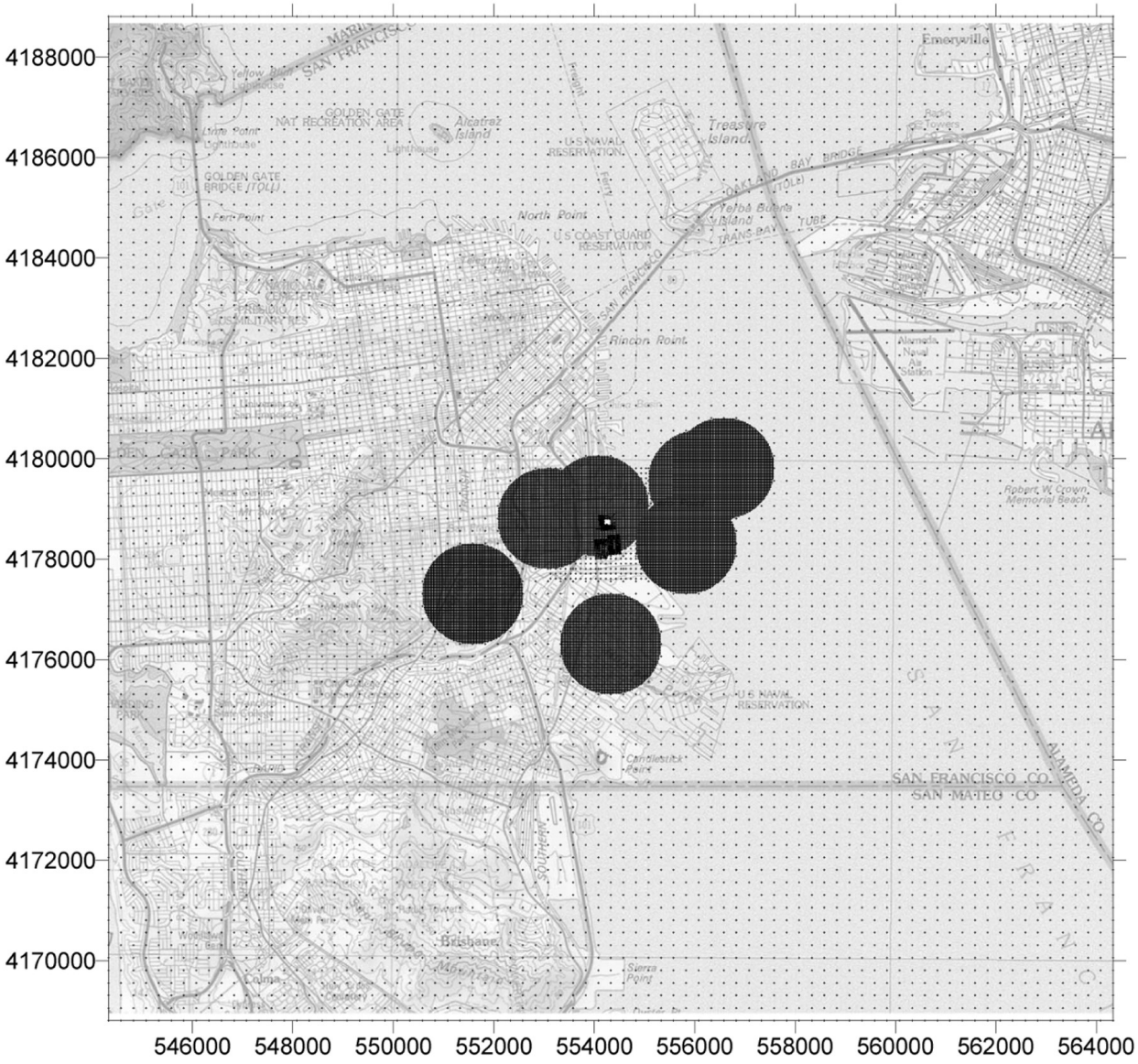
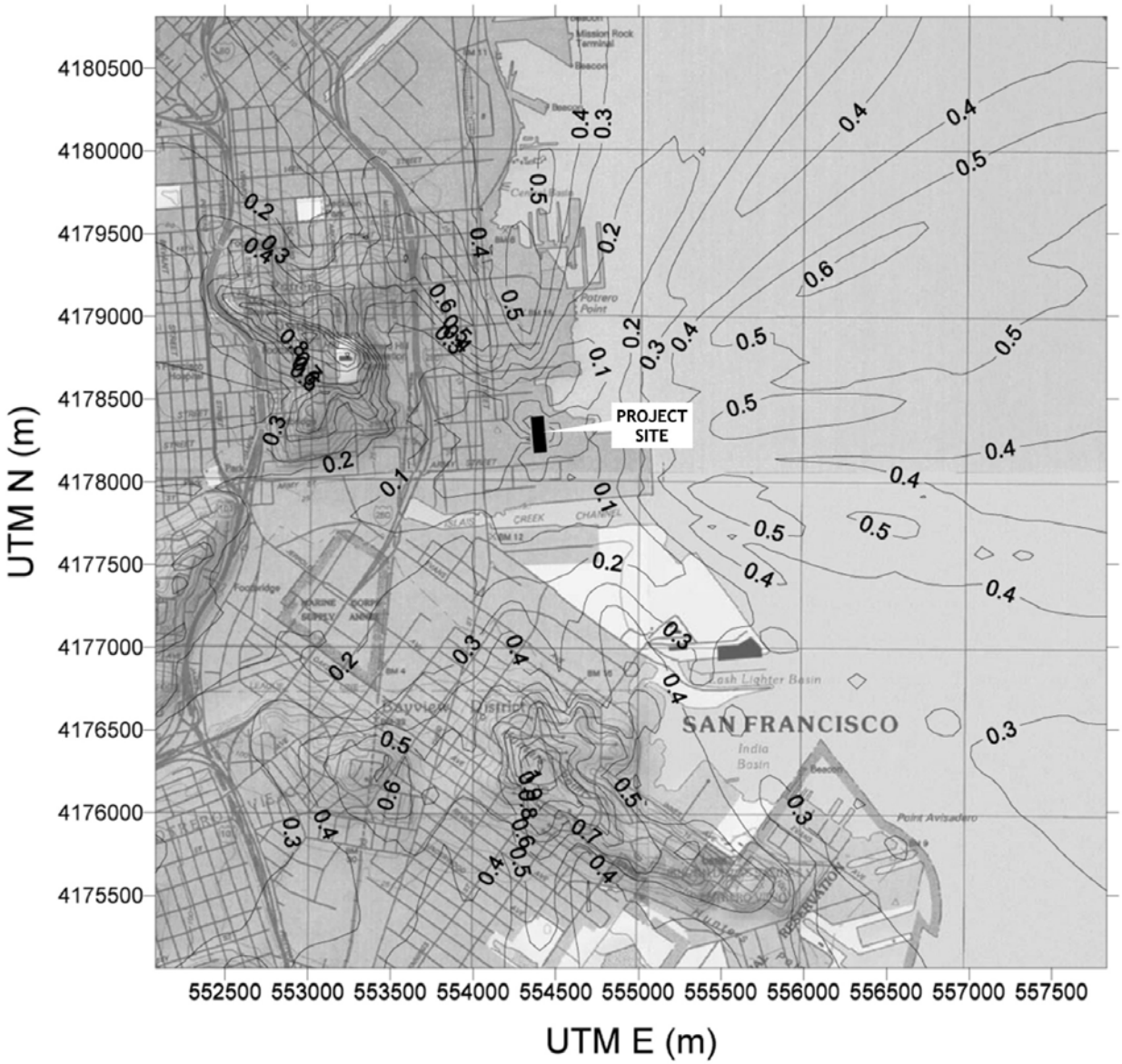


Figure 8.1B-3
Maximum 24-Hour Average PM_{10} Impacts During Project Operation

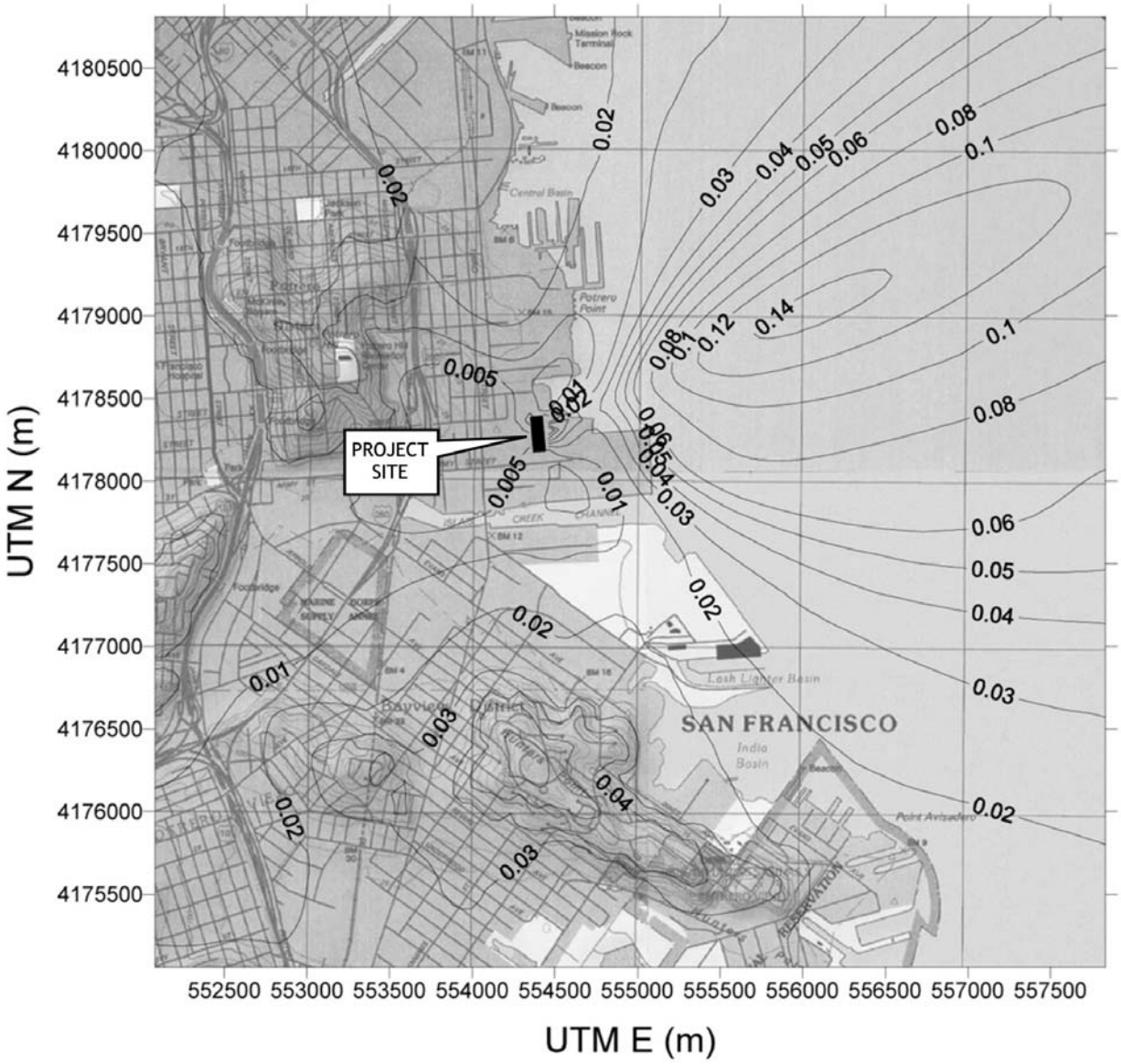


Units are $\mu g/m^3$.

The highest concentration of PM_{10} from the project under any conditions will be 1.2 $\mu g/m^3$. The concentration considered by the US EPA to be significant is 5 $\mu g/m^3$. Therefore, the highest concentration of PM_{10} from this project is less than ¼ of the level considered by EPA to be significant.

Figure 8.1B-4

Annual Average PM_{10} Impacts During Project Operation

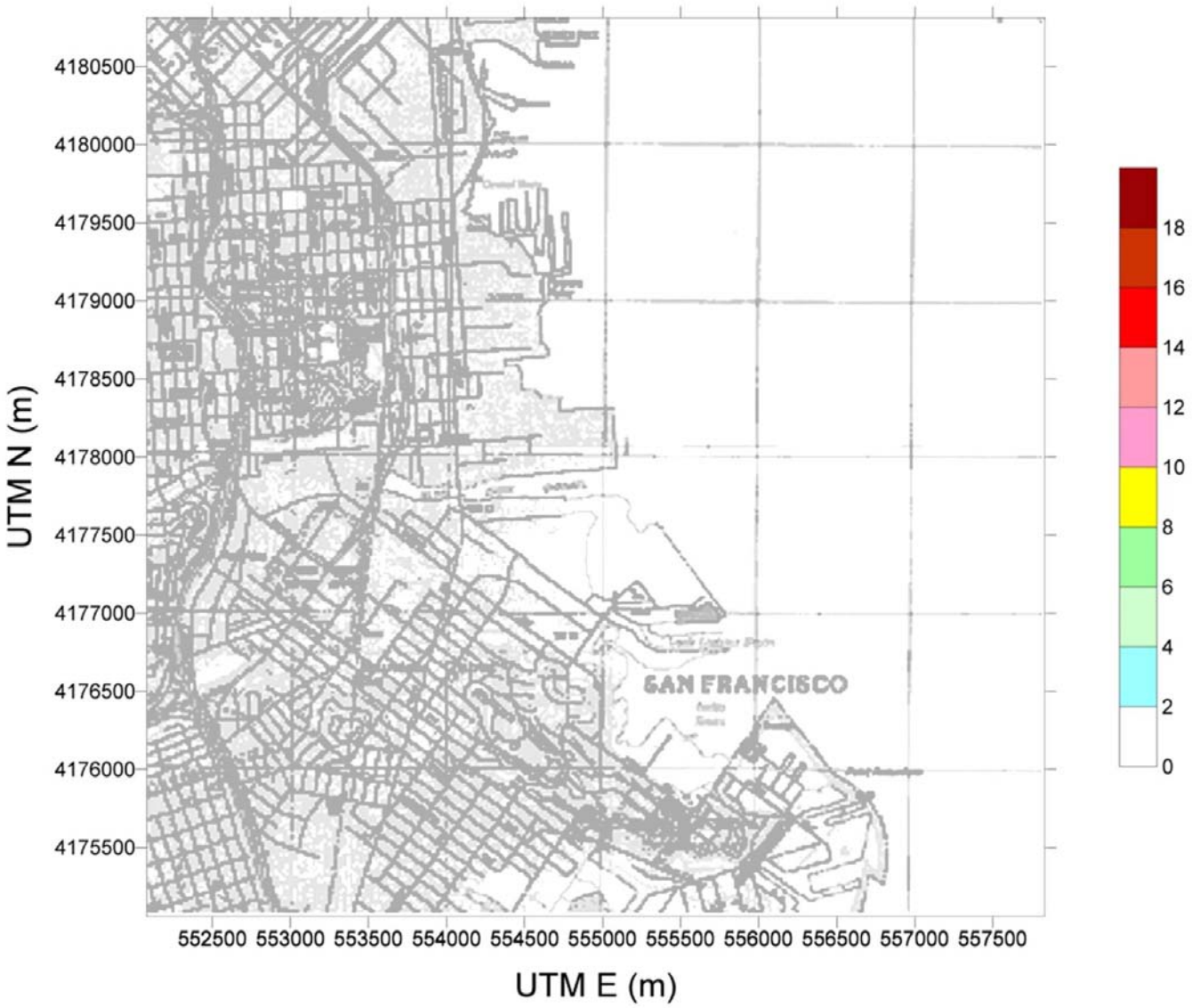


Note: Units are ug/m^3.

The highest concentration of PM_{10} from the project under any conditions will be 0.2 µg/m^3. The concentration considered by the US EPA to be significant is 1 µg/m^3. Therefore, the highest concentration of PM_{10} from this project is less than one-fifth of the level considered by EPA to be significant.

Figure 8.1B-5a

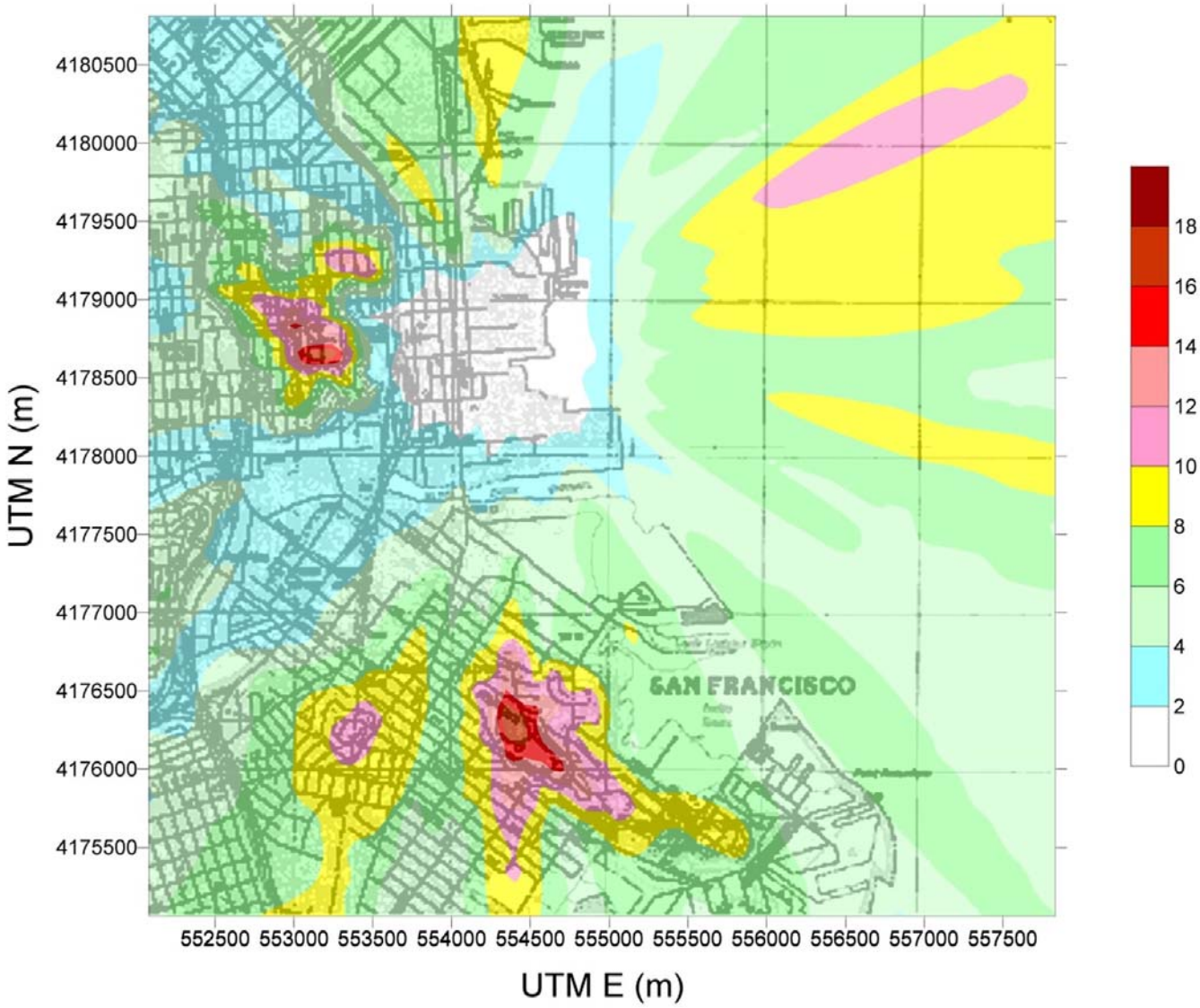
24-hr Average PM_{10} Concentrations, $\mu g/m^3$
SFERP



This figure shows the maximum modeled 24-hour average PM_{10} concentrations from the SFERP project in its current proposed location, with all units operating at full load for 24 hours. The concentrations in the colored areas correspond to the color scale on the right. The highest modeled concentration is less than 2 $\mu g/m^3$.

Figure 8.1B-5b

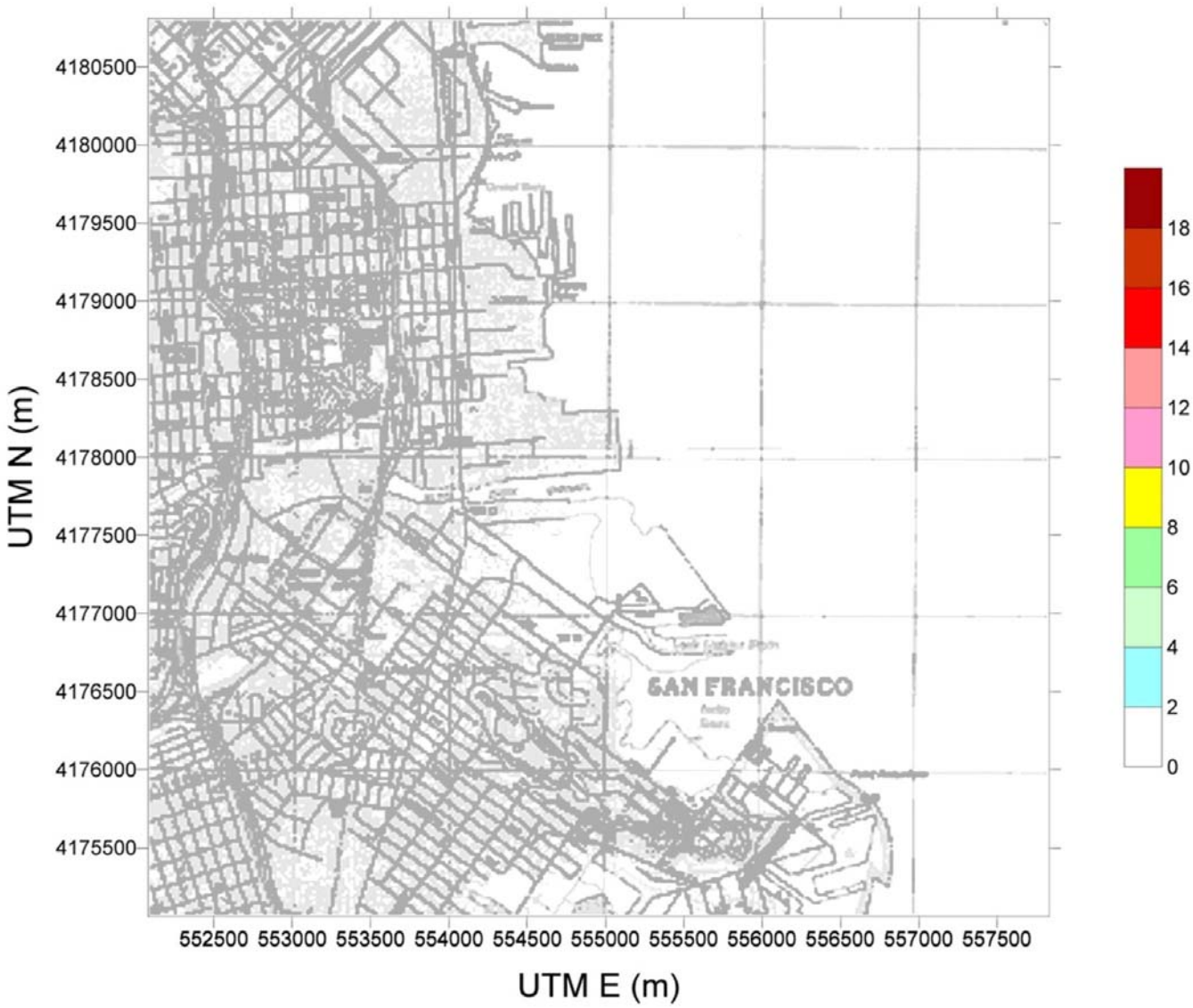
24-hr Average PM_{10} Concentrations, $\mu g/m^3$
Potrero and Hunters Point Power Plants



This figure shows the maximum modeled 24-hour average PM_{10} concentrations from the Potrero and Hunters Point Power Plants, with all units operating at full load for 24 hours. The concentrations in the colored areas correspond to the color scale on the right.

Figure 8.1B-5c

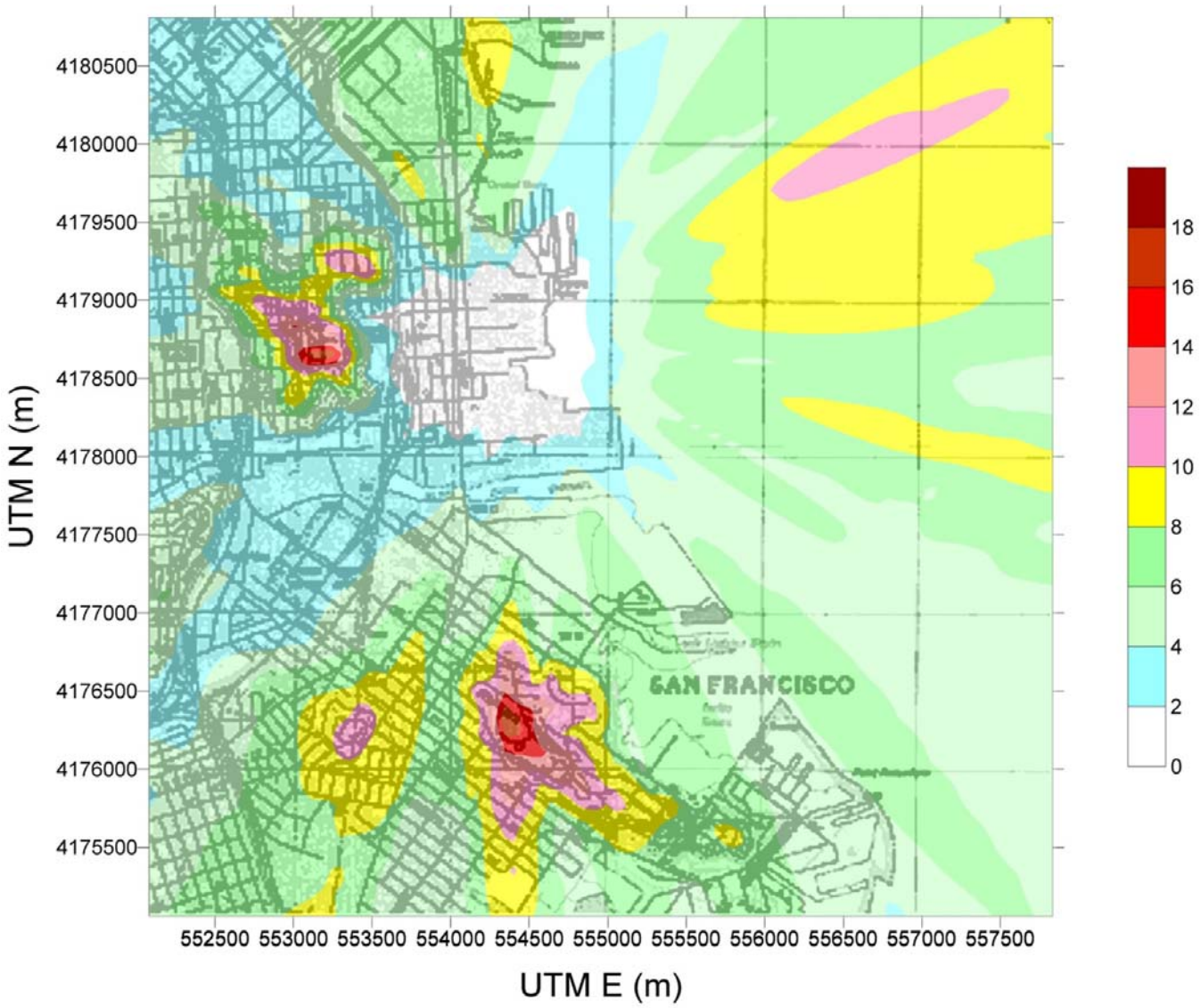
24-hr Average PM_{10} Concentrations, $\mu g/m^3$
Potrero Unit 3



This figure shows the maximum modeled 24-hour average PM_{10} concentrations from the Potrero Power Plant boiler, Unit 3, operating at full load for 24 hours. The concentrations in the colored areas correspond to the color scale on the right. The highest modeled concentration is less than 2 $\mu g/m^3$.

Figure 8.1B-5d

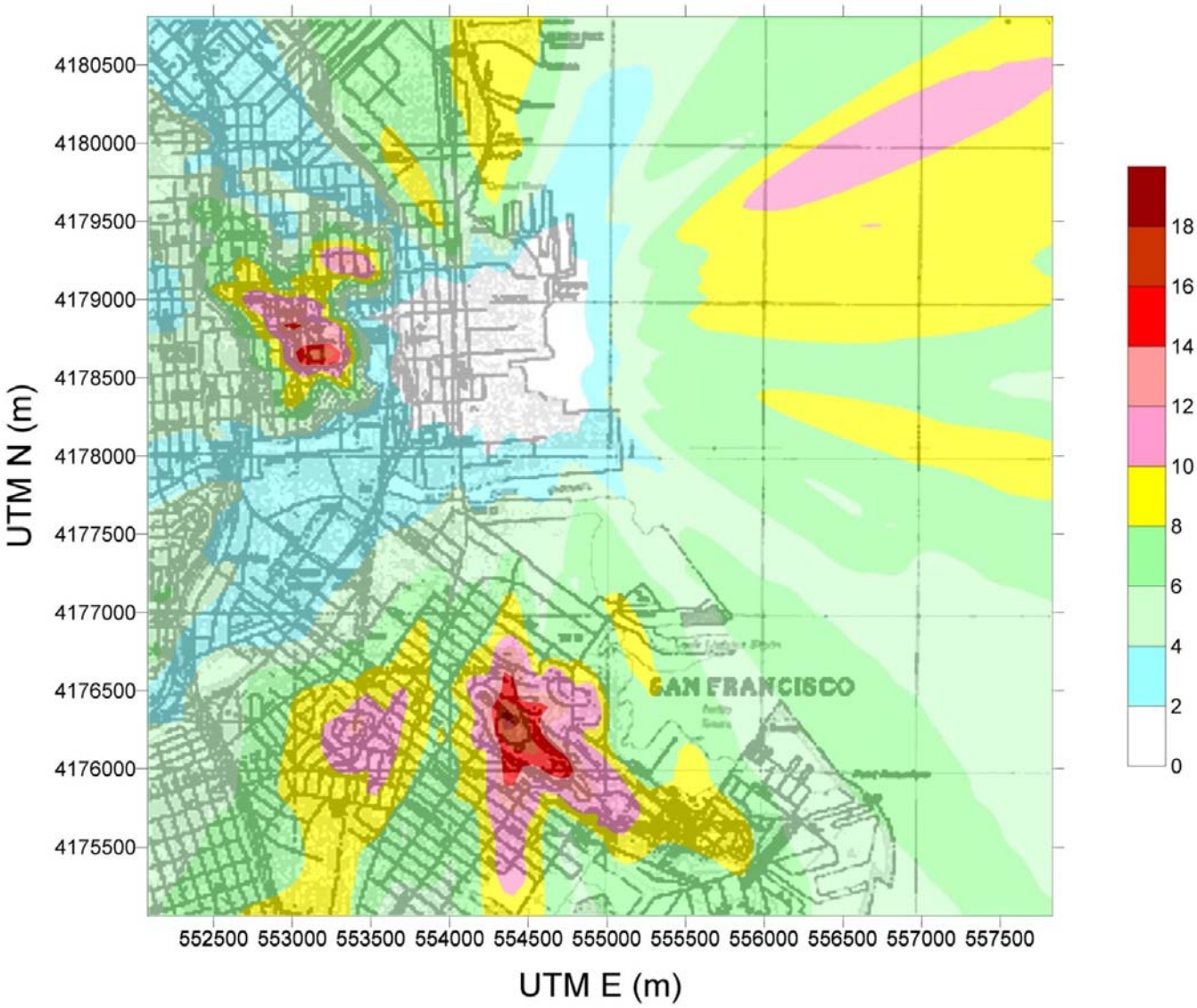
24-hr Average PM_{10} Concentrations, $\mu g/m^3$
Potrero Peaking Turbines



This figure shows the maximum modeled 24-hour average PM_{10} concentrations from the Potrero Power Plant peaking turbines operating at full load for 24 hours. The concentrations in the colored areas correspond to the color scale on the right.

Figure 8.1B-5e

24-hr Average PM_{10} Concentrations, $\mu g/m^3$
Potrero Power Plant and SFERP



This figure shows the maximum modeled 24-hour average PM_{10} concentrations from the Potrero Power Plant and SFERP together, with all units operating at full load for 24 hours. The concentrations in the colored areas correspond to the color scale on the right.

APPENDIX 8.1C

Screening Health Risk Assessment

APPENDIX 8.1C

SCREENING HEALTH RISK ASSESSMENT

8.1C-1 Modeling Methodology

The screening level health risk assessment has been prepared using CARB's Hotspots Analysis and Reporting Program (HARP) computer program and associated guidance in the OEHHA's *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (August 2003). The HARP model was used to assess cancer risk as well as chronic and acute risk impacts. The assessment shows that the cancer risk during operation of the project is below a level of one in one million. During project construction, cancer risk from Diesel construction equipment will range from 0.75 to 1.1 in one million, well below the level of 10 in one million level considered to be significant by CEC and BAAQMD staff. Acute and chronic health impacts are well below the BAAQMD significance level of one. The following paragraphs describe the procedures used to prepare this risk assessment.

8.1C-1.1 Modeling Inputs

The risk assessment module of the HARP model was run using unit ground level impacts to obtain derived cancer risks for each toxic chemical of interest.[1] Cancer risks were obtained for the derived (OEHHA) method, the derived (adjusted) method, average point estimate and high-end point estimate options. The HARP model output was cancer risk by pollutant and route for each type of analysis, based on an exposure of 1.0 $\mu g/m^3$. The emission rates of the toxic air contaminants (see Table 8.1-20) and the results of the turbine screening analysis (see Appendix 8.1B, Table 8.1B-3) were then combined with the HARP unit values to determine final actual cancer risk and hazard indices. HARP model output showing the unit values is included as Attachment HRA-1. Individual cancer risks are expressed in units of risk per $\mu g/m^3$ of exposure. To calculate the weighted risk for each source, the annual average emission rate in g/s for each pollutant was multiplied by the individual cancer risk for that pollutant in $(\mu g/m^3)^{-1}$. The resulting weighted cancer risks for each pollutant were then summed for the source. An identical approach was used to determine the acute and chronic health impacts associated with the proposed project.

Details of the calculations of risk "rates" for modeling are shown in Attachment HRA-2.

8.1C-1.2 Risk Analysis Method

The total weighted risk "rate" for each source was used in place of emission rates with the modeled unit impacts from the turbine screening analysis. The calculated value was then total cancer risk at each receptor. As discussed in Section 8.1.5.3.1, the turbine screening modeling analysis for the criteria pollutant modeling analysis was performed using the ISCST3 model, the 1992 Potrero meteorological data, specific receptor grids, and the stack parameters for six turbine operating cases. The highest full-load annual average unit impact from the screening analysis for was used to characterize cancer risks for the proposed project. A sample calculation for cancer risk follows:

[1] Procedure is described in Part B of Topic 8 of the HARP How-To Guides: How to Perform Health Analyses Using a Ground Level Concentration.

Maximum unit impact, full load operation:

Case 1: 0.257 $\mu g/m^3$ per 3.0 g/s

Derived (OEHHA) Method Cancer Risk (each turbine):

1.76×10^{-1} in one million per $\mu g/m^3$

Derived (OEHHA) Method Cancer Risk:

0.257 $\mu g/m^3$ per 3.0 g/s * 1.76×10^{-1} per ($\mu g/m^3$ per g/s)

= 4.52×10^{-2} in one million

The chronic health hazard index is calculated in the same manner using the same annual average modeled unit impact and the total weighted chronic HHI input value of 7.13×10^{-3}. The acute health hazard index is calculated using the maximum annual full load one-hour average unit impact of 14.999 $\mu g/m^3$ per 3.0 g/s and the total weighted acute HHI input value of 1.67×10^{-3} per $\mu g/m^3$.

The contribution of each toxic compound to total cancer risk and total HHI for each analysis method was then determined using the individual contribution of each compound to the total weighted risk "rate."

8.1C-2 Summary of Results

The results of the screening level health risk assessment are summarized in the following table.

Table 8.1C-1

Screening Level Risk Assessment Results

Risk Methodology	Gas Turbines
Modeled Residential Cancer Risk (in one million)	
Residential: Derived (OEHHA) Method	0.045
Residential: Average Point Estimate	0.022
Residential: High-end Point Estimate	0.046
Residential: Derived (adjusted) Method	0.040
Modeled Worker Cancer Risk (in one million)	
Worker Exposure: Derived (OEHHA) Method	0.011
Modeled Acute and Chronic Impacts	
Acute HHI	0.025
Chronic HHI	0.002

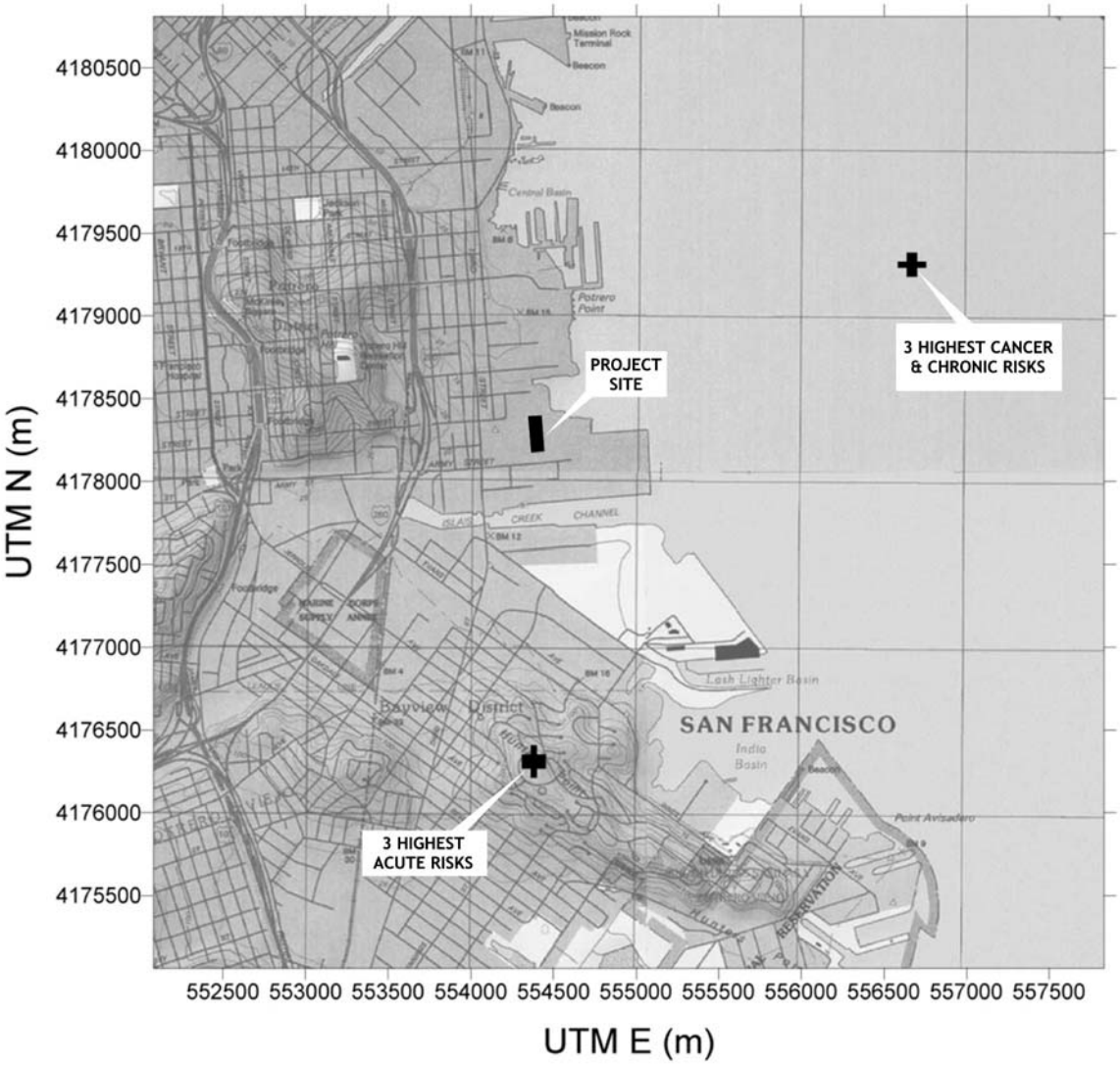
As shown in Table 8.1C-1, the cancer risk during project operation will be well below one in one million. During construction, the cancer risk from Diesel equipment operation will range from 0.75 to 1.1 in one million, well below the level of 10 in one million considered significant by the CEC and BAAQMD staffs. In addition, the acute and chronic health impacts are well below the BAAQMD

significance level of one. Consequently, there are no significant toxic air contaminant impacts issues associated with the proposed project.

The locations of the three maximum cancer, acute and chronic risks are shown in Figure 8.1C-1. Although toxic substance impacts are below the levels considered to be significant by regulatory agencies, the highest acute hazard from the project will be in Bayview/Hunters Point. To address this concern, the City will target the mitigation to the areas affected by the impacts of the project.

Figure 8.1C-1

Locations of Top Three Acute, Chronic and Cancer Risks from Project Operation



The figures in this chart relate to impacts from operation of the project.

The acute health hazard index for the project is 0.025, meaning that the highest concentration of toxic air contaminants in the air from the project is **40 times lower** than the level that would cause any acute (short-term, immediate) health effects. Although the impacts of toxic air contaminants from the project are below the levels considered to be significant by regulatory agencies, the City recognizes that the highest acute health hazard from the project will be in Bayview/Hunters Point. To address community concerns, the City is developing, with community input, a PM_{10} mitigation/community benefits package. The City will target the mitigation to the areas affected by the impacts from the project.

The chronic health hazard index for the project is 0.002, meaning that the highest concentration of toxic air contaminants in the air from the project is **500 times lower** than the level that would cause any chronic (long-term) health effects.

The highest cancer risk for the project is 0.045 in one million, which is **over 200 times lower** than the ten in one million risk that the regulatory agencies consider to be significant.

The + signs show the locations of the highest acute and chronic health hazard indexes and the highest cancer risk for the project. The health hazard index (HHI) is a ratio of the highest concentration of a toxic air contaminant to the Reference Exposure Level. The Reference Exposure Level (REL) is a concentration in air at or below which no adverse health effects are anticipated. When the HHI is less than one, the concentrations of the toxic air contaminants are so low that no adverse health effects are expected.

Attachment 8.1C-1

HARP Model Risk Assessment Module Output

This file: C:\HARP\projects\demo\PointEstimateRisk.txt

Created by HARP Risk Module Version: 21.7.30
Creation date: 6/21/2004 12:20:51 PM

EXCEPTION REPORT
(there have been no changes or exceptions)

Point Estimate
GLC source: values edited by user
Exposure Duration: 70 year (adult resident)
Analysis Method: Derived (OEHHA) Method

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME
0001	75070	Acetaldehyde	Acetaldehyde
0002	107028	Acrolein	Acrolein
0003	7664417	Ammonia	Ammonia
0004	71432	Benzene	Benzene
0005	106990	1,3-Butadiene	1,3-Butadiene
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter
0007	50000	Formaldehyde	Formaldehyde
0008	110543	Hexane	Hexane
0009	56553	B[a]anthracene	Benz[a]anthracene
0010	50328	B[a]P	Benzo[a]pyrene
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene
0013	218019	Chrysene	Chrysene
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene
0015	91203	Naphthalene	Naphthalene
0016	115071	Propylene	Propylene
0017	75569	Propylene Oxide	Propylene oxide
0018	108883	Toluene	Toluene
0019	1210	Xylenes	Xylenes (mixed)
0020	100414	Ethyl Benzene	Ethyl benzene
0021	120127	Anthracene	Anthracene
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3)

CHEM	CAS	ABBREVIATION	AVERAGE	HOURLY MAX	WATER	PASTURE	FISH
0001	75070	Acetaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0002	107028	Acrolein	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0003	7664417	Ammonia	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0004	71432	Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0005	106990	1,3-Butadiene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0006	9901	DieselExhPM	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0007	50000	Formaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0008	110543	Hexane	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0009	56553	B[a]anthracene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0010	50328	B[a]P	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0011	205992	B[b]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0012	207089	B[k]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0013	218019	Chrysene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0014	193395	In[1,2,3-cd]pyr	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0015	91203	Naphthalene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0016	115071	Propylene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0017	75569	Propylene Oxide	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0018	108883	Toluene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0019	1210	Xylenes	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0020	100414	Ethyl Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0021	120127	Anthracene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0022	53703	D[a,h]anthracen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

DOMINANT PATHWAYS FOR CANCER

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	YES	-	-	-	-	-	-	-	-	-	-	-
0002	-	-	-	-	-	-	-	-	-	-	-	-
0003	-	-	-	-	-	-	-	-	-	-	-	-
0004	YES	-	-	-	-	-	-	-	-	-	-	-
0005	YES	-	-	-	-	-	-	-	-	-	-	-
0006	YES	-	-	-	-	-	-	-	-	-	-	-
0007	YES	-	-	-	-	-	-	-	-	-	-	-
0008	-	-	-	-	-	-	-	-	-	-	-	-
0009	-	YES	YES	-	-	-	-	-	-	-	-	-
0010	-	YES	YES	-	-	-	-	-	-	-	-	-
0011	-	YES	YES	-	-	-	-	-	-	-	-	-
0012	-	YES	YES	-	-	-	-	-	-	-	-	-
0013	-	YES	YES	-	-	-	-	-	-	-	-	-
0014	-	YES	YES	-	-	-	-	-	-	-	-	-
0015	-	-	-	-	-	-	-	-	-	-	-	-
0016	-	-	-	-	-	-	-	-	-	-	-	-
0017	YES	-	-	-	-	-	-	-	-	-	-	-
0018	-	-	-	-	-	-	-	-	-	-	-	-
0019	-	-	-	-	-	-	-	-	-	-	-	-
0020	-	-	-	-	-	-	-	-	-	-	-	-
0021	-	-	-	-	-	-	-	-	-	-	-	-
0022	YES	YES	-	-	-	-	-	-	-	-	-	-

DERIVED DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	TOTAL
0001	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-04
0002	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.37E-04
0003	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.97E-04
0004	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E-03
0005	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-03
0006	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-03
0007	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E-03
0008	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-03
0009	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E-03
0010	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.77E-03
0011	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.32E-03
0012	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.87E-03
0013	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-02
0014	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-02
0015	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E-02
0016	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-02
0017	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-02
0018	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-02
0019	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-02
0020	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-02
0021	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-02
0022	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-02

DERIVED CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	3.77E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-06
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	3.77E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-05
0005	2.26E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-04
0006	4.15E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.15E-04
0007	7.91E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E-06
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0010	1.01E-03	1.35E-02	2.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-02	1.65E-02
0011	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0012	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0013	1.01E-05	1.35E-04	2.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-04	1.65E-04
0014	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	4.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-06
0018	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.55E-03	4.60E-03	6.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	6.84E-03
SUM	3.67E-03	2.36E-02	3.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-02	3.08E-02

DOMINANT PATHWAYS FOR CHRONIC

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	YES	-	-	-	-	-	-	-	-	-	-	-
0002	YES	-	-	-	-	-	-	-	-	-	-	-
0003	YES	-	-	-	-	-	-	-	-	-	-	-
0004	YES	-	-	-	-	-	-	-	-	-	-	-
0005	YES	-	-	-	-	-	-	-	-	-	-	-
0006	YES	-	-	-	-	-	-	-	-	-	-	-
0007	YES	-	-	-	-	-	-	-	-	-	-	-
0008	YES	-	-	-	-	-	-	-	-	-	-	-
0009	YES	YES	YES	-	-	-	-	-	-	-	-	-
0010	YES	YES	YES	-	-	-	-	-	-	-	-	-
0011	YES	YES	YES	-	-	-	-	-	-	-	-	-
0012	YES	YES	YES	-	-	-	-	-	-	-	-	-
0013	YES	YES	YES	-	-	-	-	-	-	-	-	-
0014	YES	YES	YES	-	-	-	-	-	-	-	-	-
0015	YES	-	-	-	-	-	-	-	-	-	-	-
0016	YES	-	-	-	-	-	-	-	-	-	-	-
0017	YES	-	-	-	-	-	-	-	-	-	-	-
0018	YES	-	-	-	-	-	-	-	-	-	-	-
0019	YES	-	-	-	-	-	-	-	-	-	-	-
0020	YES	-	-	-	-	-	-	-	-	-	-	-
0021	YES	-	-	-	-	-	-	-	-	-	-	-
0022	YES	YES	YES	-	-	-	-	-	-	-	-	-

INHALATION CONCENTRATION (ug/m^3) AND DERIVED DOSE BY PATHWAY (mg/(kg-d)) FOR CHRONIC CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0002	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0005	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0006	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0007	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0008	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0010	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0011	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0012	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0013	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0014	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0015	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0016	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0018	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.00E+00	1.17E-03	1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

DERIVED CHRONIC HI

CHEM	CV	CNS	BONE	DEVEL	ENDO	EYE	GILV	IMMUN	KIDN	REPRO	RESP	SKIN	BLOOD	MAX
0001	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-01	0.00E+00	0.00E+00	1.11E-01
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	0.00E+00	1.67E+01
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-03	0.00E+00	0.00E+00	5.00E-03
0004	0.00E+00	1.67E-02	0.00E+00	1.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-02	1.67E-02
0005	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-02	0.00E+00	0.00E+00	0.00E+00	5.00E-02

0006	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Q.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-01	0.00E+00	0.00E+00	2.00E-01
0007	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	3.33E-01
0008	0.00E+00	1.43E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-04
0009	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0010	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0011	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0012	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0013	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0014	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-01	0.00E+00	0.00E+00	1.11E-01
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-04	0.00E+00	0.00E+00	3.33E-04
0017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-02	0.00E+00	0.00E+00	3.33E-02
0018	0.00E+00	3.33E-03	0.00E+00	3.33E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-03	0.00E+00	0.00E+00	3.33E-03
0019	0.00E+00	1.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03	0.00E+00	0.00E+00	1.43E-03
0020	0.00E+00	0.00E+00	0.00E+00	5.00E-04	5.00E-04	0.00E+00	5.00E-04	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-04
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0022	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
SUM	0.00E+00	2.16E-02	0.00E+00	2.05E-02	5.00E-04	1.70E+01	5.00E-04	0.00E+00	5.00E-04	5.00E-02	1.75E+01	0.00E+00	1.67E-02	1.75E+01

ACUTE HI

CHEM	CV	CNS	BONE	DEVEL	ENDO	EYE	GILV	IMMUN	KIDN	REPRO	RESP	SKIN	BLOOD	MAX
0001	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E+00	0.00E+00	0.00E+00	5.26E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	3.13E-04
0004	0.00E+00	0.00E+00	0.00E+00	7.69E-04	0.00E+00	0.00E+00	0.00E+00	7.69E-04	0.00E+00	7.69E-04	0.00E+00	0.00E+00	7.69E-04	7.69E-04
0005	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0006	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0007	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-02	0.00E+00	1.06E-02	0.00E+00	0.00E+00	1.06E-02	0.00E+00	0.00E+00	1.06E-02
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0009	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0010	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0011	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0012	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0013	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0014	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0017	0.00E+00	0.00E+00	0.00E+00	3.23E-04	0.00E+00	3.23E-04	0.00E+00	0.00E+00	0.00E+00	3.23E-04	3.23E-04	0.00E+00	0.00E+00	3.23E-04
0018	0.00E+00	2.70E-05	0.00E+00	2.70E-05	0.00E+00	2.70E-05	0.00E+00	0.00E+00	0.00E+00	2.70E-05	2.70E-05	0.00E+00	0.00E+00	2.70E-05
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-05	0.00E+00	0.00E+00	4.55E-05
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0022	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
SUM	0.00E+00	2.70E-05	0.00E+00	1.12E-03	0.00E+00	5.27E+00	0.00E+00	1.14E-02	0.00E+00	1.12E-03	5.27E+00	0.00E+00	7.69E-04	5.27E+00

SITE PARAMETERS

DEPOSITION

Deposition rate (m/s) 0.02

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

This file: C:\HARP\projects\demo\PointEstimateRisk.txt

Created by HARP Risk Module Version: 21.7.30
Creation date: 6/25/2004 11:17:45 AM

EXCEPTION REPORT
(there have been no changes or exceptions)

Point Estimate
GLC source: values edited by user
Exposure Duration: 70 year (adult resident)
Analysis Method: Average Point Estimate

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME
0001	75070	Acetaldehyde	Acetaldehyde
0002	107028	Acrolein	Acrolein
0003	7664417	Ammonia	Ammonia
0004	71432	Benzene	Benzene
0005	106990	1,3-Butadiene	1,3-Butadiene
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter
0007	50000	Formaldehyde	Formaldehyde
0008	110543	Hexane	Hexane
0009	56553	B[a]anthracene	Benz[a]anthracene
0010	50328	B[a]P	Benzo[a]pyrene
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene
0013	218019	Chrysene	Chrysene
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene
0015	91203	Naphthalene	Naphthalene
0016	115071	Propylene	Propylene
0017	75569	Propylene Oxide	Propylene oxide
0018	108883	Toluene	Toluene
0019	1210	Xylenes	Xylenes (mixed)
0020	100414	Ethyl Benzene	Ethyl benzene
0021	120127	Anthracene	Anthracene
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3)

CHEM	CAS	ABBREVIATION	AVERAGE	HOURLY MAX	WATER	PASTURE	FISH
0001	75070	Acetaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0002	107028	Acrolein	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0003	7664417	Ammonia	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0004	71432	Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0005	106990	1,3-Butadiene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0006	9901	DieselExhPM	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0007	50000	Formaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0008	110543	Hexane	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0009	56553	B[a]anthracene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0010	50328	B[a]P	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0011	205992	B[b]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0012	207089	B[k]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0013	218019	Chrysene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0014	193395	In[1,2,3-cd]pyr	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0015	91203	Naphthalene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0016	115071	Propylene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0017	75569	Propylene Oxide	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0018	108883	Toluene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0019	1210	Xylenes	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0020	100414	Ethyl Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0021	120127	Anthracene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0022	53703	D[a,h]anthracen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

AVERAGE DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	TOTAL
0001	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-04
0002	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.20E-04
0003	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.80E-04
0004	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-03
0005	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-03
0006	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-03
0007	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.82E-03
0008	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-03
0009	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E-03
0010	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.07E-03
0011	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.56E-03
0012	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.06E-03
0013	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-03
0014	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.05E-03
0015	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.31E-03
0016	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.57E-03
0017	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.83E-03
0018	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-03
0019	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.34E-03
0020	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.60E-03
0021	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E-03
0022	2.60E-04	6.64E-05	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.36E-03

AVERAGE CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	2.60E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-06
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	2.60E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-05
0005	1.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-04
0006	2.86E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E-04
0007	5.46E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-06
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.01E-04	7.96E-05	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-04	3.83E-04
0010	1.01E-03	7.96E-04	2.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-03	3.83E-03
0011	1.01E-04	7.96E-05	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-04	3.83E-04
0012	1.01E-04	7.96E-05	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-04	3.83E-04
0013	1.01E-05	7.96E-06	2.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-05	3.83E-05
0014	1.01E-04	7.96E-05	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E-04	3.83E-04
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	3.38E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E-06
0018	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.07E-03	2.72E-04	6.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.62E-04	2.03E-03
SUM	2.97E-03	1.39E-03	3.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E-03	7.90E-03

SITE PARAMETERS

DEPOSITION

Deposition rate (m/s) 0.02

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

This file: C:\HARP\projects\demo\PointEstimateRisk.txt

Created by HARP Risk Module Version: 21.7.30
Creation date: 6/25/2004 11:17:11 AM

EXCEPTION REPORT
(there have been no changes or exceptions)

Point Estimate
GLC source: values edited by user
Exposure Duration: 70 year (adult resident)
Analysis Method: High-end Point Estimate

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME
0001	75070	Acetaldehyde	Acetaldehyde
0002	107028	Acrolein	Acrolein
0003	7664417	Ammonia	Ammonia
0004	71432	Benzene	Benzene
0005	106990	1,3-Butadiene	1,3-Butadiene
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter
0007	50000	Formaldehyde	Formaldehyde
0008	110543	Hexane	Hexane
0009	56553	B[a]anthracene	Benz[a]anthracene
0010	50328	B[a]P	Benzo[a]pyrene
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene
0013	218019	Chrysene	Chrysene
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene
0015	91203	Naphthalene	Naphthalene
0016	115071	Propylene	Propylene
0017	75569	Propylene Oxide	Propylene oxide
0018	108883	Toluene	Toluene
0019	1210	Xylenes	Xylenes (mixed)
0020	100414	Ethyl Benzene	Ethyl benzene
0021	120127	Anthracene	Anthracene
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3)

CHEM	CAS	ABBREVIATION	AVERAGE	HOURLY MAX	WATER	PASTURE	FISH
0001	75070	Acetaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0002	107028	Acrolein	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0003	7664417	Ammonia	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0004	71432	Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0005	106990	1,3-Butadiene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0006	9901	DieselExhPM	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0007	50000	Formaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0008	110543	Hexane	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0009	56553	B[a]anthracene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0010	50328	B[a]P	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0011	205992	B[b]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0012	207089	B[k]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0013	218019	Chrysene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0014	193395	In[1,2,3-cd]pyr	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0015	91203	Naphthalene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0016	115071	Propylene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0017	75569	Propylene Oxide	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0018	108883	Toluene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0019	1210	Xylenes	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0020	100414	Ethyl Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0021	120127	Anthracene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0022	53703	D[a,h]anthracen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

HIGH-END DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	TOTAL
0001	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-04
0002	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.54E-04
0003	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E-03
0004	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-03
0005	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-03
0006	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-03
0007	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-03
0008	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.01E-03
0009	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.68E-03
0010	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.35E-03
0011	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.02E-03
0012	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-03
0013	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-02
0014	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-02
0015	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-02
0016	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E-02
0017	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-02
0018	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-02
0019	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.49E-02
0020	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-02
0021	3.77E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-02
0022	3.77E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-02

HIGH-END CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	3.77E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-06
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	3.77E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-05
0005	2.26E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-04
0006	4.15E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.15E-04
0007	7.91E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E-06
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.47E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.70E-03
0010	1.47E-03	1.35E-02	2.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-02	1.70E-02
0011	1.47E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.70E-03
0012	1.47E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.70E-03
0013	1.47E-05	1.35E-04	2.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-04	1.70E-04
0014	1.47E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.70E-03
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	4.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-06
0018	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.55E-03	4.60E-03	6.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	6.84E-03
SUM	4.31E-03	2.36E-02	3.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-02	3.15E-02

SITE PARAMETERS

DEPOSITION

Deposition rate (m/s) 0.02

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

This file: C:\HARP\projects\demo\PointEstimateRisk.txt

Created by HARP Risk Module Version: 21.7.30
Creation date: 6/25/2004 11:22:44 AM

EXCEPTION REPORT
(there have been no changes or exceptions)

Point Estimate
GLC source: values edited by user
Exposure Duration: 70 year (adult resident)
Analysis Method: Derived (Adjusted) Method

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME
0001	75070	Acetaldehyde	Acetaldehyde
0002	107028	Acrolein	Acrolein
0003	7664417	Ammonia	Ammonia
0004	71432	Benzene	Benzene
0005	106990	1,3-Butadiene	1,3-Butadiene
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter
0007	50000	Formaldehyde	Formaldehyde
0008	110543	Hexane	Hexane
0009	56553	B[a]anthracene	Benz[a]anthracene
0010	50328	B[a]P	Benzo[a]pyrene
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene
0013	218019	Chrysene	Chrysene
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene
0015	91203	Naphthalene	Naphthalene
0016	115071	Propylene	Propylene
0017	75569	Propylene Oxide	Propylene oxide
0018	108883	Toluene	Toluene
0019	1210	Xylenes	Xylenes (mixed)
0020	100414	Ethyl Benzene	Ethyl benzene
0021	120127	Anthracene	Anthracene
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3)

CHEM	CAS	ABBREVIATION	AVERAGE	HOURLY MAX	WATER	PASTURE	FISH
0001	75070	Acetaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0002	107028	Acrolein	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0003	7664417	Ammonia	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0004	71432	Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0005	106990	1,3-Butadiene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0006	9901	DieselExhPM	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0007	50000	Formaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0008	110543	Hexane	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0009	56553	B[a]anthracene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0010	50328	B[a]P	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0011	205992	B[b]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0012	207089	B[k]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0013	218019	Chrysene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0014	193395	In[1,2,3-cd]pyr	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0015	91203	Naphthalene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0016	115071	Propylene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0017	75569	Propylene Oxide	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0018	108883	Toluene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0019	1210	Xylenes	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0020	100414	Ethyl Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0021	120127	Anthracene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0022	53703	D[a,h]anthracen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

DOMINANT PATHWAYS FOR CANCER

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	A	-	-	-	-	-	-	-	-	-	-	-
0002	-	-	-	-	-	-	-	-	-	-	-	-
0003	-	-	-	-	-	-	-	-	-	-	-	-
0004	A	-	-	-	-	-	-	-	-	-	-	-
0005	A	-	-	-	-	-	-	-	-	-	-	-
0006	A	-	-	-	-	-	-	-	-	-	-	-
0007	A	-	-	-	-	-	-	-	-	-	-	-
0008	-	-	-	-	-	-	-	-	-	-	-	-
0009	-	YES	YES	-	-	-	-	-	-	-	-	-
0010	-	YES	YES	-	-	-	-	-	-	-	-	-
0011	-	YES	YES	-	-	-	-	-	-	-	-	-
0012	-	YES	YES	-	-	-	-	-	-	-	-	-
0013	-	YES	YES	-	-	-	-	-	-	-	-	-
0014	-	YES	YES	-	-	-	-	-	-	-	-	-
0015	-	-	-	-	-	-	-	-	-	-	-	-
0016	-	-	-	-	-	-	-	-	-	-	-	-
0017	A	-	-	-	-	-	-	-	-	-	-	-
0018	-	-	-	-	-	-	-	-	-	-	-	-
0019	-	-	-	-	-	-	-	-	-	-	-	-
0020	-	-	-	-	-	-	-	-	-	-	-	-
0021	-	-	-	-	-	-	-	-	-	-	-	-
0022	A	YES	-	-	-	-	-	-	-	-	-	-

DERIVED DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	TOTAL
0001	2.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-04
0002	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.49E-04
0003	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.09E-04
0004	2.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-03
0005	2.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-03
0006	2.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-03
0007	2.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-03
0008	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-03
0009	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E-03
0010	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-03
0011	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.88E-03
0012	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E-03
0013	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.98E-03
0014	2.60E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-02
0015	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-02
0016	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-02
0017	2.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-02
0018	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-02
0019	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-02
0020	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.31E-02
0021	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-02
0022	2.90E-04	1.12E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E-02

DERIVED CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	2.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-06
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	2.90E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-05
0005	1.74E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E-04
0006	3.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.19E-04
0007	6.08E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-06
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0010	1.01E-03	1.35E-02	2.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-02	1.65E-02
0011	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0012	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0013	1.01E-05	1.35E-04	2.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-04	1.65E-04
0014	1.01E-04	1.35E-03	2.02E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.65E-03
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	3.76E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.76E-06
0018	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.19E-03	4.60E-03	6.90E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	6.48E-03
SUM	3.15E-03	2.36E-02	3.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-02	3.03E-02

SITE PARAMETERS

DEPOSITION

Deposition rate (m/s) 0.02

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

This file: C:\HARP\projects\demo\PointEstimateRisk.txt

Created by HARP Risk Module Version: 21.7.30
Creation date: 6/21/2004 12:21:13 PM

EXCEPTION REPORT
(there have been no changes or exceptions)

Point Estimate
GLC source: values edited by user
Exposure Duration: Standard work schedule (49 wks/yr, 5 days/wk, 8 hrs/day, 40 yrs)
Analysis Method: Point estimate

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME
0001	75070	Acetaldehyde	Acetaldehyde
0002	107028	Acrolein	Acrolein
0003	7664417	Ammonia	Ammonia
0004	71432	Benzene	Benzene
0005	106990	1,3-Butadiene	1,3-Butadiene
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter
0007	50000	Formaldehyde	Formaldehyde
0008	110543	Hexane	Hexane
0009	56553	B[a]anthracene	Benz[a]anthracene
0010	50328	B[a]P	Benzo[a]pyrene
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene
0013	218019	Chrysene	Chrysene
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene
0015	91203	Naphthalene	Naphthalene
0016	115071	Propylene	Propylene
0017	75569	Propylene Oxide	Propylene oxide
0018	108883	Toluene	Toluene
0019	1210	Xylenes	Xylenes (mixed)
0020	100414	Ethyl Benzene	Ethyl benzene
0021	120127	Anthracene	Anthracene
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3)

CHEM	CAS	ABBREVIATION	AVERAGE	HOURLY MAX	WATER	PASTURE	FISH
0001	75070	Acetaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0002	107028	Acrolein	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0003	7664417	Ammonia	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0004	71432	Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0005	106990	1,3-Butadiene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0006	9901	DieselExhPM	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0007	50000	Formaldehyde	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0008	110543	Hexane	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0009	56553	B[a]anthracene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0010	50328	B[a]P	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0011	205992	B[b]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0012	207089	B[k]fluoranthen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0013	218019	Chrysene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0014	193395	In[1,2,3-cd]pyr	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0015	91203	Naphthalene	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
0016	115071	Propylene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0017	75569	Propylene Oxide	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0018	108883	Toluene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0019	1210	Xylenes	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0020	100414	Ethyl Benzene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0021	120127	Anthracene	1.000E+00	1.000E+00	0.000E+00	0.000E+00	0.000E+00
0022	53703	D[a,h]anthracen	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

AVERAGE DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	TOTAL
0001	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.72E-05
0002	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-04
0003	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E-04
0004	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-04
0005	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E-04
0006	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E-04
0007	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04
0008	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.57E-04
0009	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.96E-04
0010	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-03
0011	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E-03
0012	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-03
0013	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E-03
0014	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.69E-03
0015	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.75E-03
0016	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.80E-03
0017	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.86E-03
0018	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.92E-03
0019	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-03
0020	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.03E-03
0021	5.72E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.09E-03
0022	5.72E-05	4.26E-04	5.54E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.63E-03

AVERAGE CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	5.72E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.72E-07
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	5.72E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.72E-06
0005	3.43E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E-05
0006	6.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-05
0007	1.20E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-06
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	2.23E-05	5.12E-04	6.65E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-04	6.00E-04
0010	2.23E-04	5.12E-03	6.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-03	6.00E-03
0011	2.23E-05	5.12E-04	6.65E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-04	6.00E-04
0012	2.23E-05	5.12E-04	6.65E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-04	6.00E-04
0013	2.23E-06	5.12E-05	6.65E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-05	6.00E-05
0014	2.23E-05	5.12E-04	6.65E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.78E-04	6.00E-04
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	7.43E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.43E-07
0018	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	2.34E-04	1.75E-03	2.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-03	2.21E-03
SUM	6.54E-04	8.96E-03	1.16E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-02	1.08E-02

INHALATION CONCENTRATION (ug/m^3) AND AVERAGE DOSE BY PATHWAY (mg/(kg-d)) FOR CHRONIC CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0002	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0005	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0006	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0007	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0008	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0010	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0011	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0012	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0013	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0014	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0015	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0016	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0018	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.00E+00	1.11E-03	1.44E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

AVERAGE CHRONIC HI

CHEM	CV	CNS	BONE	DEVEL	ENDO	EYE	GILV	IMMUN	KIDN	REPRO	RESP	SKIN	BLOOD	MAX
0001	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-01	0.00E+00	0.00E+00	1.11E-01
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	0.00E+00	1.67E+01
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-03	0.00E+00	0.00E+00	5.00E-03
0004	0.00E+00	1.67E-02	0.00E+00	1.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-02	1.67E-02
0005	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-02	0.00E+00	0.00E+00	0.00E+00	5.00E-02
0006	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-01	0.00E+00	0.00E+00	2.00E-01
0007	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	3.33E-01
0008	0.00E+00	1.43E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-04
0009	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0010	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0011	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0012	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0013	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0014	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-01	0.00E+00	0.00E+00	1.11E-01
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-04	0.00E+00	0.00E+00	3.33E-04
0017	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-02	0.00E+00	0.00E+00	3.33E-02
0018	0.00E+00	3.33E-03	0.00E+00	3.33E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-03	0.00E+00	0.00E+00	3.33E-03
0019	0.00E+00	1.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03	0.00E+00	0.00E+00	1.43E-03
0020	0.00E+00	0.00E+00	0.00E+00	5.00E-04	5.00E-04	0.00E+00	5.00E-04	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-04
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0022	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
SUM	0.00E+00	2.16E-02	0.00E+00	2.05E-02	5.00E-04	1.70E+01	5.00E-04	0.00E+00	5.00E-04	5.00E-02	1.75E+01	0.00E+00	1.67E-02	1.75E+01

ACUTE HI

CHEM	CV	CNS	BONE	DEVEL	ENDO	EYE	GILV	IMMUN	KIDN	REPRO	RESP	SKIN	BLOOD	MAX
0001	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E+00	0.00E+00	0.00E+00	5.26E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	3.13E-04
0004	0.00E+00	0.00E+00	0.00E+00	7.69E-04	0.00E+00	0.00E+00	0.00E+00	7.69E-04	0.00E+00	7.69E-04	0.00E+00	0.00E+00	7.69E-04	7.69E-04
0005	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0006	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0007	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-02	0.00E+00	1.06E-02	0.00E+00	0.00E+00	1.06E-02	0.00E+00	0.00E+00	1.06E-02
0008	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0009	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0010	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0011	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0012	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0013	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0014	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0015	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0016	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0017	0.00E+00	0.00E+00	0.00E+00	3.23E-04	0.00E+00	3.23E-04	0.00E+00	0.00E+00	0.00E+00	3.23E-04	3.23E-04	0.00E+00	0.00E+00	3.23E-04
0018	0.00E+00	2.70E-05	0.00E+00	2.70E-05	0.00E+00	2.70E-05	0.00E+00	0.00E+00	0.00E+00	2.70E-05	2.70E-05	0.00E+00	0.00E+00	2.70E-05
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-05	0.00E+00	0.00E+00	4.55E-05
0020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0021	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
0022	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-30
SUM	0.00E+00	2.70E-05	0.00E+00	1.12E-03	0.00E+00	5.27E+00	0.00E+00	1.14E-02	0.00E+00	1.12E-03	5.27E+00	0.00E+00	7.69E-04	5.27E+00

SITE PARAMETERS

DEPOSITION

Deposition rate (m/s) 0.02

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

Attachment 8.1C-2

Calculation of Weighted Risk Rates for Modeling

Table 8.1C-2
San Francisco Electric Reliability Project
Calculation of Cancer Risk Assessment Modeling Inputs for Combustion Turbines

		Residential (70-yr) Exposure			Residential (70-yr) Exposure			Residential (70-yr) Exposure			Residential (70-yr) Exposure			Worker Exposure		
Compound	Annual Average Emissions Per Turbine, g/s	Derived (OEHHA) Method Unit Risk (per ug/m3)	Derived (OEHHA) Method Cancer Risk Model Input (each turbine, per ug/m3 per g/s)	Modeled Contribution to Cancer Risk (2)	Average Point Est Unit Risk (per ug/m3)	Average Point Est Cancer Risk Model Input (each turbine, per ug/m3 per g/s)	Modeled Contribution to Cancer Risk (3)	High-End Point Est Unit Risk (per ug/m3)	High-End Point Est Cancer Risk Model Input (each turbine, per ug/m3 per g/s)	Modeled Contribution to Cancer Risk (4)	Derived (Adjusted) Method Unit Risk (per ug/m3)	Derived (Adjusted) Method Cancer Risk Model Input (each turbine, per ug/m3 per g/s)	Modeled Contribution to Cancer Risk (5)	Derived (OEHHA) Method Unit Risk (per ug/m3)	Derived (OEHHA) Method Cancer Risk Model Input (each turbine, per ug/m3 per g/s)	Modeled Contribution to Cancer Risk (6)
Ammonia	3.76E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Propylene	2.13E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetaldehyde	1.12E-03	3.77E-06	4.24E-03	1.09E-03	2.60E-06	2.92E-03	7.52E-04	3.77E-06	4.24E-03	1.09E-03	2.90E-06	3.26E-03	8.38E-04	5.72E-07	6.43E-04	1.65E-04
Acrolein	1.02E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	9.18E-05	3.77E-05	3.46E-03	8.89E-04	2.60E-05	2.39E-03	6.13E-04	3.77E-05	3.46E-03	8.89E-04	2.90E-05	2.66E-03	6.84E-04	5.72E-06	5.25E-04	1.35E-04
1,3-Butadiene	1.21E-05	2.26E-04	2.74E-03	7.03E-04	1.56E-04	1.89E-03	4.85E-04	2.26E-04	2.74E-03	7.03E-04	1.74E-04	2.11E-03	5.41E-04	3.43E-05	4.15E-04	1.07E-04
Ethylbenzene	8.99E-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Formaldehyde	1.01E-02	7.91E-06	8.00E-02	2.06E-02	5.46E-06	5.52E-02	1.42E-02	7.91E-06	8.00E-02	2.06E-02	6.08E-06	6.15E-02	1.58E-02	1.20E-06	1.21E-02	3.12E-03
Hexane	7.14E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	4.58E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PAHs (listed individually below) (Note 1)	4.93E-06	1.65E-02	8.14E-02	2.09E-02	3.83E-03	1.89E-02	4.86E-03	1.70E-02	8.39E-02	2.16E-02	1.65E-02	8.14E-02	2.09E-02	6.00E-03	2.96E-02	7.61E-03
Benzo(a)anthracene		*1.65E-03*			*3.83E-04*			*1.70E-03*			*1.65E-02*			*6.00E-04*		
Benzo(a)pyrene		*1.65E-02*			*3.83E-03*			*1.70E-02*			*1.65E-03*			*6.00E-03*		
Benzo(b)fluoranthrene		*1.65E-03*			*3.83E-04*			*1.70E-03*			*1.65E-03*			*6.00E-04*		
Benzo(k)fluoranthrene		*1.65E-03*			*3.83E-04*			*1.70E-03*			*1.65E-03*			*6.00E-04*		
Chrysene		*1.65E-04*			*3.83E-05*			*1.70E-04*			*1.65E-04*			*6.00E-05*		
Dibenz(a,h)anthracene		*6.84E-03*			*2.03E-03*			*6.84E-03*			*6.48E-03*			*2.21E-03*		
Indeno(1,2,3-cd)pyrene		*1.65E-03*			*3.83E-04*			*1.70E-03*			*1.65E-03*			*6.00E-04*		
Propylene oxide	8.16E-04	4.90E-06	4.00E-03	1.03E-03	3.38E-06	2.76E-03	7.09E-04	4.90E-06	4.00E-03	1.03E-03	3.76E-06	3.07E-03	7.89E-04	7.43E-07	6.06E-04	1.56E-04
Toluene	3.67E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylene	1.80E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			1.76E-01 in one million per ug/m3 per g/s	4.52E-02 in one million		8.41E-02 in one million per ug/m3 per g/s	2.16E-02 in one million		1.78E-01 in one million per ug/m3 per g/s	4.58E-02 in one million		1.54E-01 in one million per ug/m3 per g/s	3.96E-02 in one million		4.39E-02 in one million per ug/m3 per g/s	1.13E-02 in one million

Notes:
(1) Maximum unit risk value applied to all PAHs for purposes of this analysis.
(2) Based on modeled cancer risk from the turbines of 0.045 in one million.
(3) Based on modeled cancer risk from the turbines of 0.022 in one million.
(4) Based on modeled cancer risk from the turbines of 0.046 in one million.
(5) Based on modeled cancer risk from the turbines of 0.040 in one million.
(6) Based on modeled cancer risk from the turbines of 0.011 in one million.

Table 8.1C-3
San Francisco Electric Reliability Project
Calculation of Risk Assessment Modeling Inputs for Combustion Turbines

Compound	Max Hourly Emissions Per Turbine g/s	HARP Acute HI (per ug/m3 per g/s)	Acute HHI Model Input (per ug/m3)	Modeled Contribution to Acute HHI	Annual Average Emissions, g/s	HARP Chronic HI (per ug/m3 per g/s)	Chronic HHI Model Input (per ug/m3)	Modeled Contribution to Chronic HHI
Ammonia	0.8240	3.13E-04	2.58E-04	3.87E-03	3.76E-01	5.00E-03	1.88E-03	4.84E-04
Propylene	0.0465	--	--	--	2.13E-02	3.33E-04	7.08E-06	1.82E-06
Acetaldehyde	2.463E-03	--	--	--	1.12E-03	1.11E-01	1.25E-04	3.21E-05
Acrolein	2.228E-04	5.26E+00	1.17E-03	1.76E-02	1.02E-04	1.67E+01	1.70E-03	4.37E-04
Benzene	2.010E-04	7.69E-04	1.55E-07	2.32E-06	9.18E-05	1.67E-02	1.53E-06	3.94E-07
1,3-Butadiene	2.650E-05	--	--	--	1.21E-05	5.00E-02	6.05E-07	1.56E-07
Ethylbenzene	1.968E-03	--	--	--	8.99E-04	5.00E-04	4.49E-07	1.15E-07
Formaldehyde	2.216E-02	1.06E-02	2.35E-04	3.52E-03	1.01E-02	3.33E-01	3.37E-03	8.66E-04
Hexane	1.564E-02	--	--	--	7.14E-03	1.43E-04	1.02E-06	2.62E-07
Naphthalene	1.002E-04	--	--	--	4.58E-05	1.11E-01	5.08E-06	1.31E-06
PAHs (listed individually below)	1.081E-05	--	--	--	4.93E-06	--	--	--
Benzo(a)anthracene								
Benzo(a)pyrene								
Benzo(b)fluoranthrene								
Benzo(k)fluoranthrene								
Chrysene								
Dibenz(a,h)anthracene								
Indeno(1,2,3-cd)pyrene								
Propylene oxide	1.787E-03	3.23E-04	5.77E-07	8.66E-06	8.16E-04	3.33E-02	2.72E-05	6.98E-06
Toluene	8.030E-03	2.70E-05	2.17E-07	3.25E-06	3.67E-03	3.33E-03	1.22E-05	3.14E-06
Xylene	3.942E-03	4.55E-05	1.79E-07	2.69E-06	1.80E-03	1.43E-03	2.57E-06	6.62E-07
		Total =	1.67E-03	2.50E-02		Total =	7.13E-03	1.83E-03

Notes:
(1) Maximum unit risk value applied to all PAHs for purposes of this analysis.
(2) Based on modeled acute health hazard index from the turbines of 0.025.
(3) Based on modeled chronic health hazard index from the turbines of 0.002.

APPENDIX 8.1D

Construction Emissions and Impact Analysis

APPENDIX 8.1D

CONSTRUCTION EMISSIONS AND IMPACT ANALYSIS

8.1D-1 Onsite Construction

Construction of the project is expected to last approximately 12 months. Construction activities will occur in the following four main phases:

- Site preparation;
- Foundation work;
- Installation of major equipment; and
- Construction/installation of major structures.

Site preparation includes grading, excavation of footings and foundations, and backfilling operations. After site preparation is finished, the construction of the foundations and structures is expected to begin. Once the foundations and structures are finished, installation and assembly of the mechanical and electrical equipment are scheduled to commence. Construction of the process water line, underground transmission line and natural gas pipeline will occur simultaneously with onsite construction.

Fugitive dust emissions from the construction of the project will result from:

- Dust entrained during site preparation and grading/excavation at the construction site;
- Dust entrained during trenching and repaving activities along the process water line and underground transmission line routes;
- Dust entrained during onsite travel on paved and unpaved surfaces;
- Dust entrained during aggregate and soil loading and unloading operations; and
- Wind erosion of areas disturbed during construction activities.

Combustion emissions during construction will result from:

- Exhaust from the Diesel construction equipment used for site preparation, grading, excavation, trenching and construction of onsite structures;
- Exhaust from the Diesel excavator, paver, and trucks associated with process water line and underground transmission line construction;
- Exhaust from water trucks used to control construction dust emissions;
- Exhaust from Diesel-powered welding machines, electric generators, air compressors, and water pumps;
- Exhaust from pickup trucks and Diesel trucks used to transport workers and materials around the construction site;
- Exhaust from Diesel trucks used to deliver concrete, fuel, and construction supplies to the construction site; and
- Exhaust from automobiles used by workers to commute to the construction site.

To determine the potential worst-case daily construction impacts, exhaust and dust emission rates have been evaluated for each source of emissions. Because of the staggered construction schedule, site preparation and equipment installation may be occurring simultaneously. Therefore, maximum short-term impacts are calculated assuming that all equipment is operating simultaneously with the peak workforce (264

persons) on-site.[1] Annual emissions are based on the average equipment mix during the 12-month construction period.

8.1D-2 Linear Facilities

Offsite construction will include an underground transmission line and a process water line. Emissions from these construction activities are included in this analysis.

8.1D-3 Available Mitigation Measures

The following typical mitigation measures are proposed to control exhaust emissions from the Diesel heavy equipment and potential emissions of fugitive dust during construction of the project:

- All unpaved roads and disturbed areas in the project and linear construction sites shall be watered as frequently as necessary to prevent fugitive dust plumes. The frequency of watering can be reduced or eliminated during periods of precipitation.
- No vehicle shall exceed 10 miles per hour within the construction site.
- The construction site entrances shall be posted with visible speed limit signs.
- All construction equipment vehicle tires shall be inspected and washed as necessary to be cleaned free of dirt prior to entering paved roadways.
- Gravel ramps of at least 20 feet in length must be provided at the tire washing/cleaning station.
- All unpaved exits from the construction site shall be graveled or treated to prevent track-out to public roadways.
- All construction vehicles shall enter the construction site through the treated entrance roadways, unless an alternative route has been submitted to and approved by the Compliance Project Manager.
- Construction areas adjacent to any paved roadway shall be provided with sandbags or other measures as specified in the Storm Water Pollution Prevention Plan (SWPPP) to prevent run-off to roadways.
- All paved roads within the construction site shall be swept at least twice daily (or less during periods of precipitation) on days when construction activity occurs to prevent the accumulation of dirt and debris.
- At least the first 500 feet of any public roadway exiting from the construction site shall be swept at least twice daily (or less during periods of precipitation) on days when construction activity occurs or on any other day when dirt or runoff from the construction site is visible on the public roadways.
- All soil storage piles and disturbed areas that remain inactive for longer than 10 days shall be covered, or shall be treated with appropriate dust suppressant compounds.
- All vehicles that are used to transport solid bulk material on public roadways and that have potential to cause visible emissions shall be provided with a

[1] Workforce includes construction personnel for plant, gas line and potable water line (onsite) and underground transmission line and process water line (offsite).

cover, or the materials shall be sufficiently wetted and loaded onto the trucks in a manner to provide at least one foot of freeboard.

- Wind erosion control techniques (such as windbreaks, water, chemical dust suppressants, and/or vegetation) shall be used on all construction areas that may be disturbed. Any windbreaks installed to comply with this condition shall remain in place until the soil is stabilized or permanently covered with vegetation.

An on-site Air Quality Construction Mitigation Manager will be responsible for directing and documenting compliance construction-related mitigation conditions.

8.1D-4 Estimates of Emissions with Mitigation Measures

8.1D-4.1 Onsite Construction

Tables 8.1D-1 and 8.1D-2 show the estimated maximum daily and annual heavy equipment exhaust and fugitive dust emissions with recommended mitigation measures for onsite construction activities. Detailed emission calculations are included as Attachment 8.1D-1.

Table 8.1D-1
Maximum Daily Emissions During Onsite Construction, Pounds Per Day

	NOx	CO	POC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	67.4	39.6	7.3	0.07	4.0	4.0
Fugitive Dust	--	--	--	--	17.0	5.2
Offsite						
Worker Travel, Truck Deliveries	55.5	247.6	25.2	0.5	1.8	1.8
Total Emissions						
Total	122.9	287.2	32.5	0.6	22.8	10.9

Table 8.1D-2
Annual Emissions During Construction, Tons Per Year

	NOx	CO	POC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	5.2	3.2	0.6	0.01	0.3	0.3
Fugitive Dust	--	--	--	--	1.5	0.5
Offsite						
Worker Travel, Truck Deliveries	5.6	19.0	2.0	0.05	0.2	0.2
Total Emissions						
Total	10.8	22.2	2.6	0.06	2.0	1.0

8.1D-4.2 Linear Facilities Construction

The estimated maximum daily heavy equipment exhaust and fugitive dust emissions with recommended mitigation measures for the natural gas and potable water pipeline construction activities are included in the onsite construction analysis. Table 8.1D-3 shows the estimated maximum daily equipment exhaust and fugitive dust emissions

with mitigation during process water line and underground transmission line construction. Detailed emissions calculations are shown in Attachment 8.1D-1. Note that the construction of the process water and transmission lines are expected to occur concurrently only for approximately two months.

Table 8.1D-3
Maximum Daily Emissions During Water and Transmission Line Construction, Pounds Per Day

	NOx	CO	POC	SOx	PM_{10}	$PM_{2.5}$
Process Water Line						
Construction Equipment	17.3	7.6	1.3	0.06	0.7	0.7
Fugitive Dust	--	--	--	--	0.4	0.08
Worker Travel, Truck Deliveries	18.7	23.0	2.6	0.2	0.4	0.4
Underground Transmission Line						
Construction Equipment	17.3	7.6	1.3	0.06	0.7	0.7
Fugitive Dust	--	--	--	--	0.4	0.08
Worker Travel, Truck Deliveries	18.7	23.0	2.6	0.2	0.4	0.4
Total Emissions						
Total	72.0	60.2	7.8	0.5	3.0	2.5

8.1D-5 Analysis of Ambient Impacts from Onsite Construction

Ambient air quality impacts from emissions during construction of the project were estimated using an air quality dispersion modeling analysis. The modeling analysis considers the construction site location, the surrounding topography, and the sources of emissions during construction, including vehicle and equipment exhaust emissions and fugitive dust.

8.1D-5.1 Existing Ambient Levels

As with the modeling analysis of project operating impacts (Section 8.1.2), the Arkansas Street (San Francisco) monitoring station was used to establish the ambient background levels for the construction impact modeling analysis. Table 8.1-4.3 shows the maximum concentrations of NOx, SO_2, CO, and PM_{10} recorded for 2001 through 2003 at that monitoring station.[2]

[2] Ambient background data from Arkansas Street for the 2004 calendar year is not yet available.

8.1D-5.2 Dispersion Model

As in the analysis of project operating impacts, the EPA-approved Industrial Source Complex Short Term (ISCST3) model was used to estimate ambient impacts from construction activities. A detailed discussion of the ISCST3 dispersion model is included in Section 8.1.5.3.1.

The emission sources for the construction site were grouped into three categories: exhaust emissions, construction dust emissions and windblown dust emissions. The exhaust and construction dust emissions were modeled as volume sources. The windblown dust emissions were modeled as area sources. For the volume sources, the vertical dimension was set to 6 meters. For combustion sources in the project site area, the horizontal dimension was set to 125.19 meters, with sigma-y = 33.38 meters (based on the width of the construction area). For combustion sources in the construction laydown area, the horizontal dimension was set to 209.78 meters, with sigma-y = 48.79 meters.

For the windblown dust sources, the area covers the entire site plan. An effective plume height of 0.5 meters was used in the modeling analysis. The exhaust and dust emissions were modeled as a single area source that covered the total area of the construction site, with half of the emissions allocated to the project site and half to the laydown area. The construction impacts modeling analysis used the same receptor locations as used for the project operating impact analysis. A detailed discussion of the receptor locations is included in Section 8.1.5.3.1.

To determine the construction impacts on short-term ambient standards (24 hours and less), the worst-case daily onsite construction emission levels shown in Table 8.1D-1 were used. For pollutants with annual average ambient standards, the annual onsite emission levels shown in Table 8.1D-2 were used. As with the project operating impact analysis, the meteorological data set used for the construction emission impacts analysis is the ambient data collected at the nearby Arkansas Street monitoring station between 2001 and 2003.

8.1D-4.5.3 Modeling Results

Based on the emission rates of NOx, SO_2, CO, and PM_{10} and the meteorological data, the ISCST3 model calculates hourly and annual ambient impacts for each pollutant. As mentioned above, the modeled 1-hour, 3-hour, 8-hour, and 24-hour ambient impacts are based on the worst-case daily emission rates of NOx, SO_2, CO, and PM_{10}. The annual impacts are based on the annual emission rates of these pollutants.

The one-hour and annual average concentrations of NO_2 were computed following the revised EPA guidance for computing these concentrations (August 9, 1995 *Federal Register,* 60 FR 40465). The ISC_OLM model was used for the one-hour average NO_2 impacts; uncorrected one-hour impacts are also reported for comparison. The annual average was calculated using the ambient ratio method (ARM) with the national default value of 0.75 for the annual average NO_2/NOx ratio.

The modeling analysis results are shown in Table 8.1D-4. Also included in the table are the maximum background levels that have occurred in the last 3 years and the resulting total ambient impacts. Construction impacts alone for all modeled pollutants are expected to be below the most stringent state and national standards. With the exception of the 24-hour and annual average PM_{10}, construction activities are not expected to cause the violation of any state or federal ambient air quality standard.

However, the state 24-hour and annual average PM_{10} standards are exceeded in the absence of the construction emissions for the project.

The dust mitigation measures already proposed by the applicant are expected to be very effective in minimizing fugitive dust emissions. The attached isopleth diagrams show the extent of the modeled impacts from construction PM_{10} and $PM_{2.5}$ for the 24-hour and annual averaging periods.

Table 8.1D-4

Modeled Maximum Onsite Construction Impacts

Pollutant	Averaging Time	Maximum Construction Impacts (µg/m³)	Background (µg/m³)	Total Impact (µg/m³)	Standard (µg/m³)	Federal Standard (µg/m³)
NO_2[a]	1-hour	97.1	141	238	470	--
	Annual	2.1	36	38	--	100
SO_2	1-hour	0.4	138	138	650	--
	24-hour	0.05	29	29	109	365
	Annual	0.005	5.3	5.3	--	80
CO	1-hour	205.4	5,000	5,205	23,000	40,000
	8-hour	73.8	3,644	3,718	10,000	10,000
PM_{10}[b]	24-hour	14.2	74	88	50	150
	Annual	1.1	26.3	27	20	50
$PM_{2.5}$[b]	24-hour	6.2	58	64	--	65
	Annual	0.6	13.1	14	12	15

Notes:

a. Ozone limiting method applied for 1-hour average, using concurrent O_3 data (1992). ARM applied for annual average, using national default 0.75 ratio. Uncorrected 1-hour NOx concentration is 350 µg/m³.

b. PM_{10} and $PM_{2.5}$ impacts shown are from fugitive dust as well as combustion sources. 24-hour average $PM_{2.5}/PM_{10}$ impact from combustion sources only is 2.7 µg/m³.

As shown on these isopleths, while maximum impacts occur next to the project site fenceline, concentrations decrease rapidly at locations only a couple of hundred meters away from the project site. For example, maximum modeled PM_{10} impacts along the fenceline are approximately 14 µg/m³. However, as shown on the isopleths for 24-hour average PM_{10} impacts, within 500 meters of the fenceline, 24-hour average PM_{10} impacts are below the 5 µg/m³ PM_{10} significance threshold.

It is also important to note that emissions in an exhaust plume are dispersed through the entrainment of ambient air, which dilutes the concentration of the emissions as they are carried away from the source by winds. The process of mixing the pollutants with greater and greater volumes of cleaner air is controlled primarily by the turbulence in the atmosphere. This dispersion occurs both horizontally, as the exhaust plume rises above the emission point, and vertically, as winds carry the plume horizontally away from its source.

The rise of a plume above its initial point of release is a significant contributing factor to the reductions in ground-level concentrations, both because a rising plume entrains more ambient air as it travels downwind, and because it travels farther downwind (and thus also undergoes more horizontal dispersion) before it impacts the ground. Vertical plume rise occurs as a result of buoyancy (plume is hotter than ambient air, and hot air, being less dense, tends to rise) and/or momentum (plume has an initial vertical velocity).

In ISCST3, area sources are not considered to have either buoyant or momentum plume rise, and therefore the model assumes that there is no vertical dispersion taking place. Thus a significant source of plume dilution is ignored when sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards. The input and output modeling files are being provided electronically.

8.1D-5.4 Health Risk of Diesel Exhaust

The combustion portion of annual PM_{10} emissions from Table 8.1D-3 above was modeled separately to determine the annual average Diesel PM_{10} exhaust concentration. This was used with HARP-derived risk values for Diesel exhaust particulate[3] for a 70-year lifetime to determine the potential carcinogenic risk from Diesel exhaust during construction. The exposure was also adjusted by a factor of 12/840, or 0.0143, to correct for the 12-month exposure.

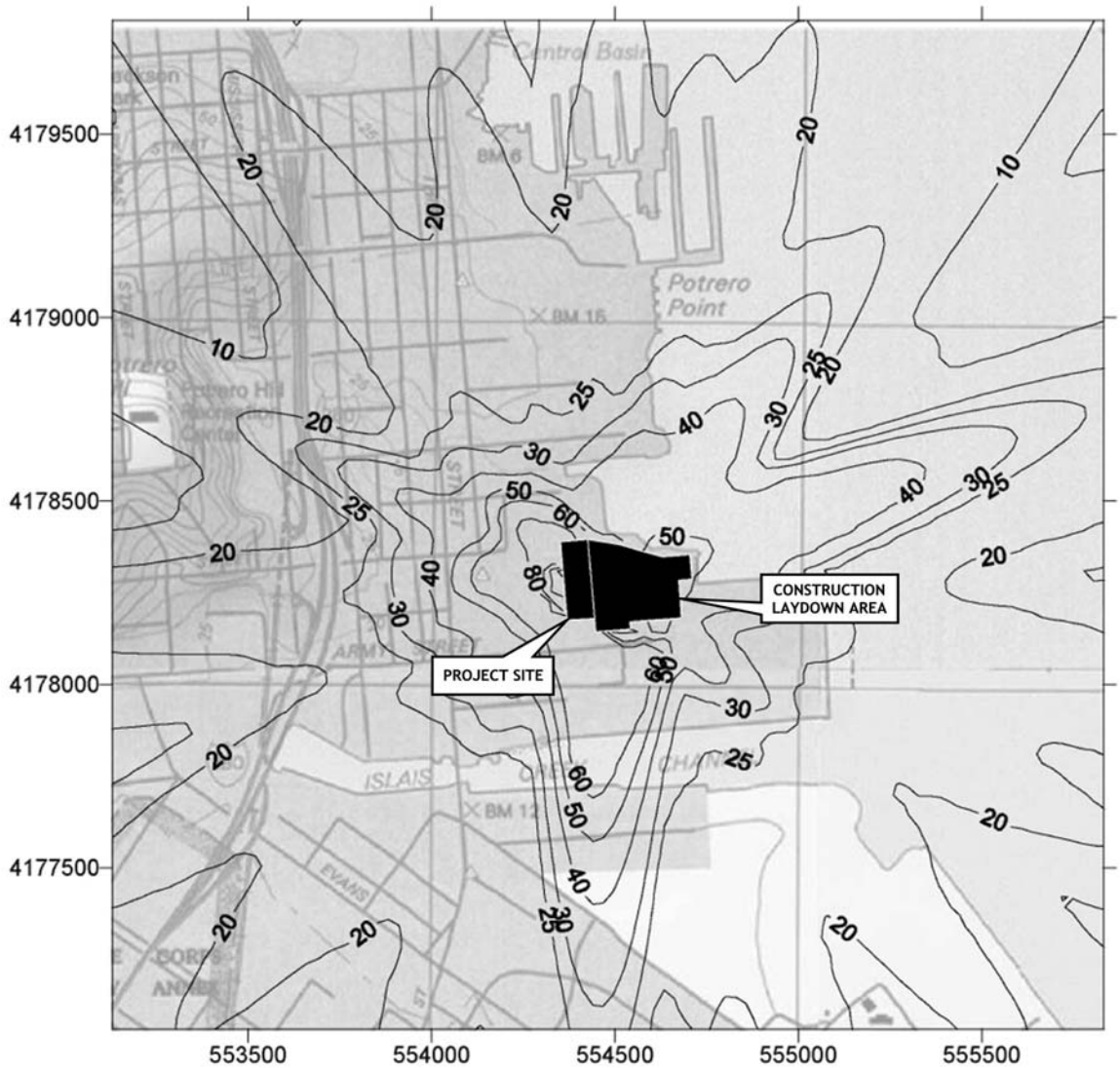
The maximum modeled annual average concentration of Diesel exhaust PM_{10} at any location is 0.1825 µg/m^3. The risk values obtained from HARP range from 2.86×10^{-4} (average point estimate value) to 4.15×10^{-4} (derived OEHHA and high end risk estimates). Using the range of risk values and adjustment factors described above, the carcinogenic risk due to exposure to Diesel exhaust during construction activities is expected to be between approximately 0.75 and 1.1 in one million. This is well below the 10 in one million level considered by the CEC and BAAQMD staffs to be significant.

It is also important to note that these impacts are highly localized near the project site. As shown in the attached annual average Diesel combustion PM_{10} isopleth diagram (Figure 8.1D-3), the area in which the risk may exceed 1 in one million (Diesel PM_{10} impact greater than or equal to 0.168 µg/m^3) extends less than 100 meters from the facility fenceline. This analysis remains conservative because, as discussed above, the modeled PM_{10} concentrations from construction operations are overpredicted by the ISCST3 model.

[3] See Appendix 8.1C for a discussion of the use of the HARP model to derive cancer risk values.

Figure 8.1D-1

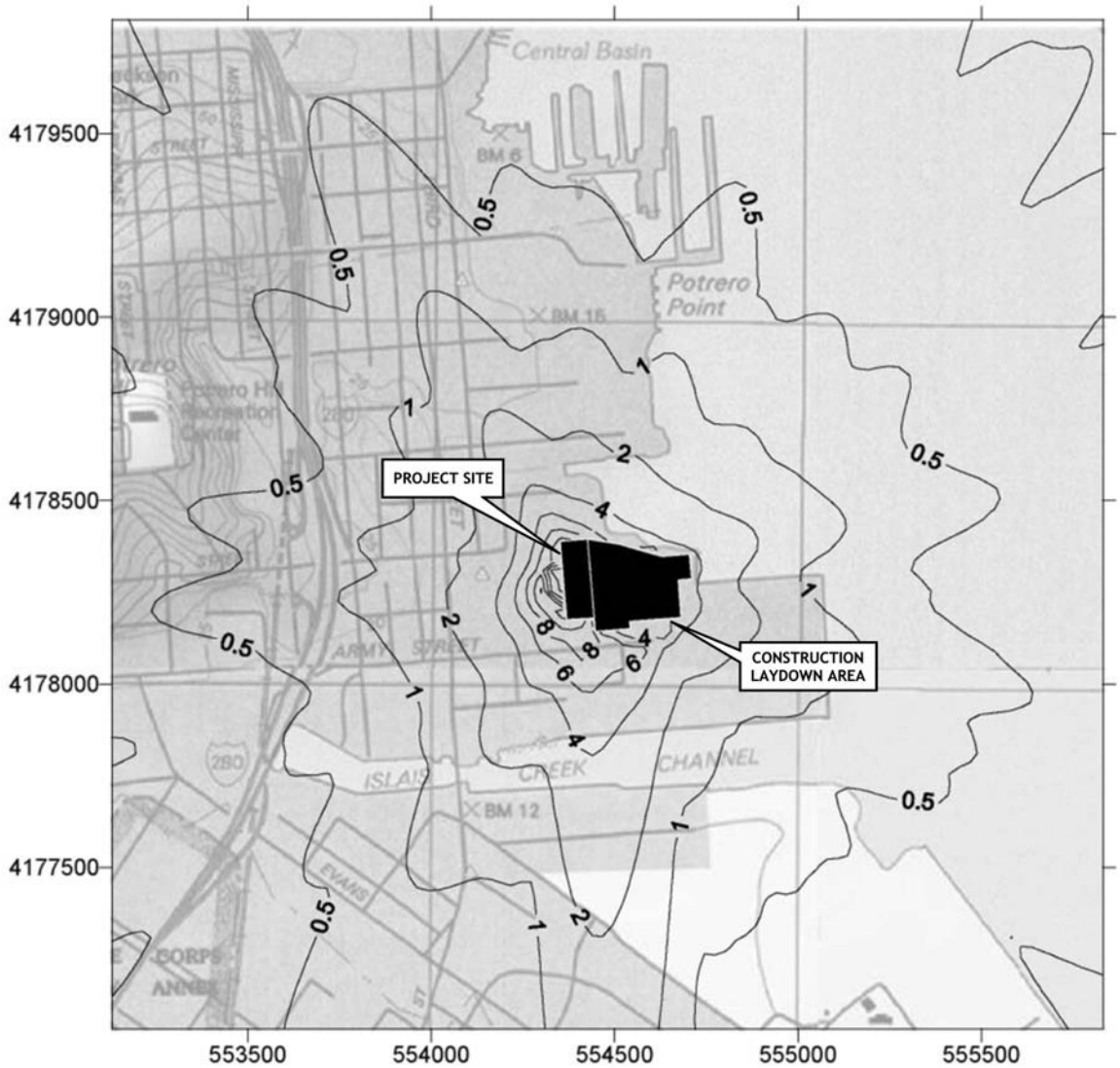
Maximum One-Hour Average NO_2 Impacts During Construction Activities
(Ozone-Limited)
Concentrations in $\mu g/m^3$



Modeled construction impacts are conservatively high because assumptions are made for both emissions calculations and modeling techniques that tend to overpredict results. Maximum short-term impacts are calculated assuming that all equipment is operating simultaneously with the peak workforce. A significant source of plume dilution is being ignored, since the construction emissions sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Figure 8.1D-2

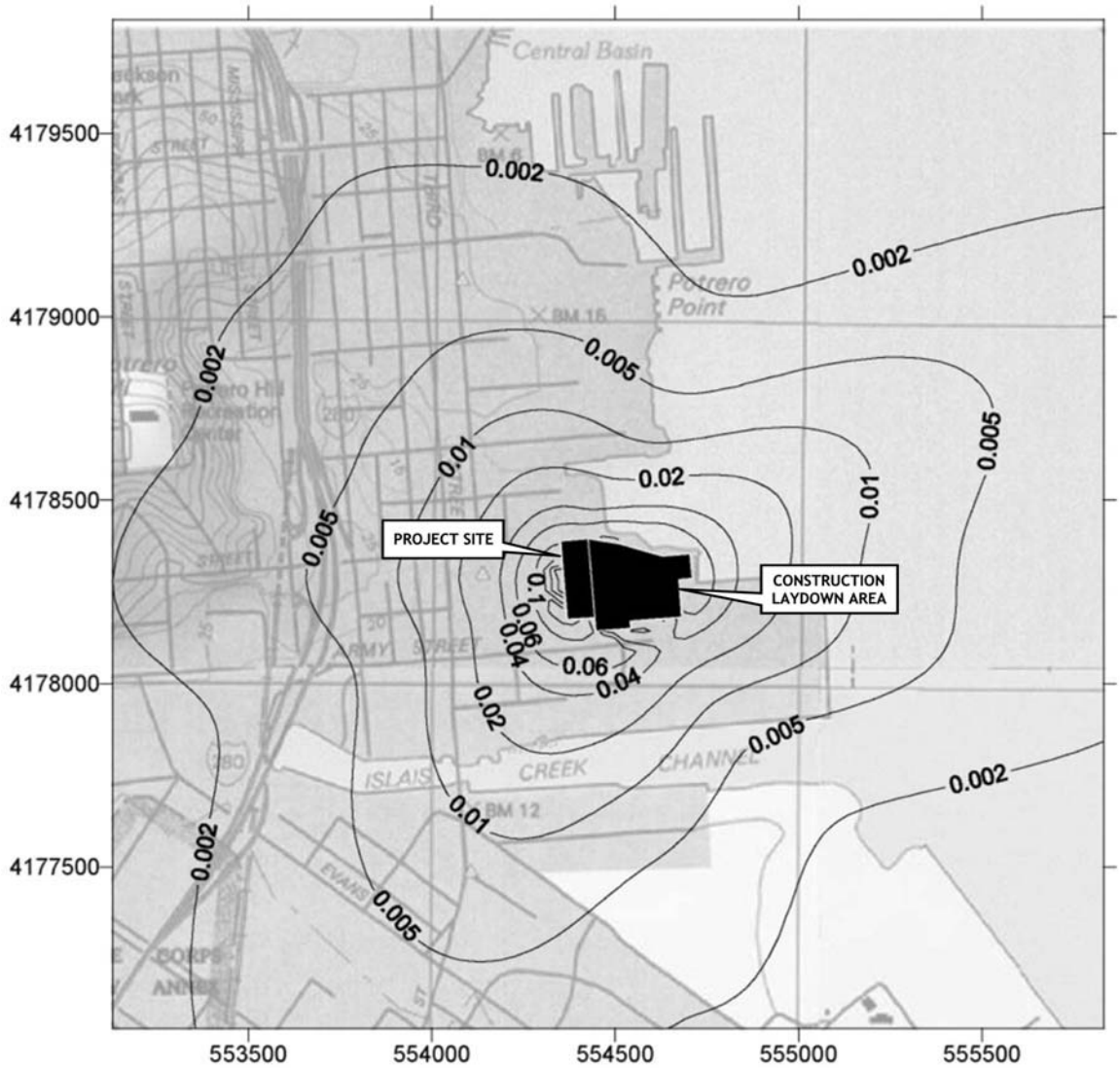
Maximum 24-Hour Average PM_{10} Impacts During Construction Activities,
All Sources
Concentrations in $\mu g/m^3$



Modeled construction impacts are conservatively high because assumptions are made for both emissions calculations and modeling techniques that tend to overpredict results. Maximum short-term impacts are calculated assuming that all equipment is operating simultaneously with the peak workforce. A significant source of plume dilution is being ignored, since the construction emissions sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Figure 8.1D-3a

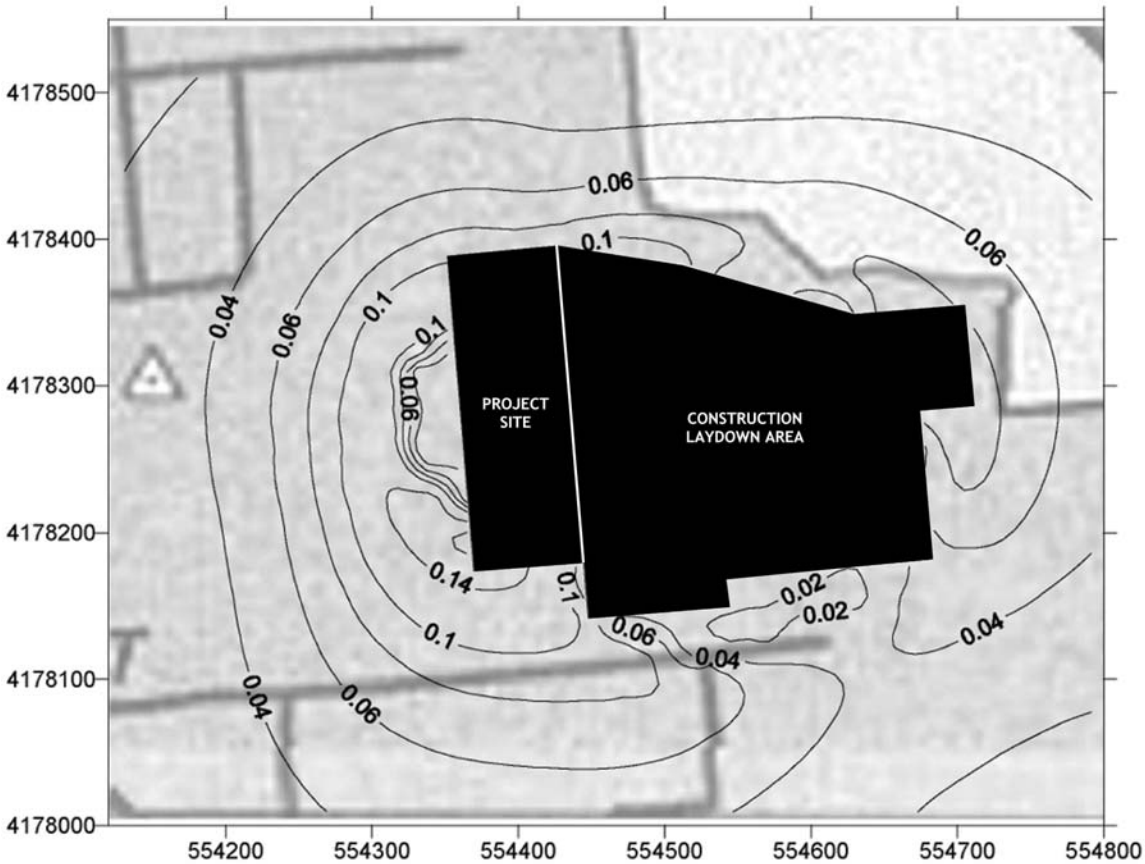
Maximum Annual Average PM_{10} Impacts During Construction Activities, Combustion Sources
Concentrations in $\mu g/m^3$



Modeled construction impacts are conservatively high because assumptions are made for both emissions calculations and modeling techniques that tend to overpredict results. Maximum impacts are calculated assuming that all equipment is operating simultaneously. A significant source of plume dilution is being ignored, since the construction emissions sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Figure 8.1D-3b

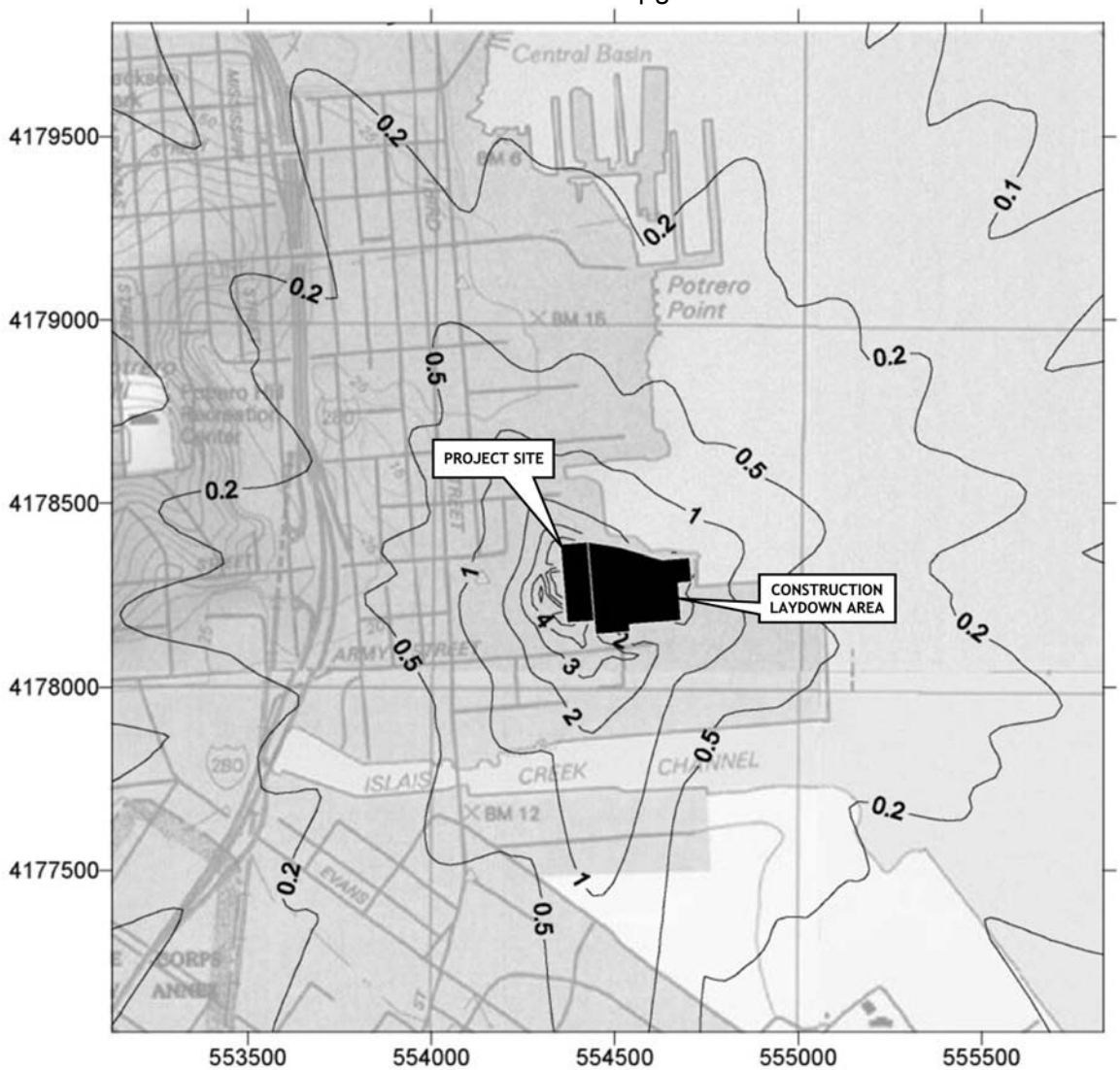
Maximum Annual Average PM_{10} Impacts During Construction Activities,
Combustion Sources (detail)
Concentrations in $\mu g/m^3$



Modeled construction impacts are conservatively high because assumptions are made for both emissions calculations and modeling techniques that tend to overpredict results. Maximum are calculated assuming that all equipment is operating simultaneously. A significant source of plume dilution is being ignored, since the construction emissions sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Figure 8.1D-4

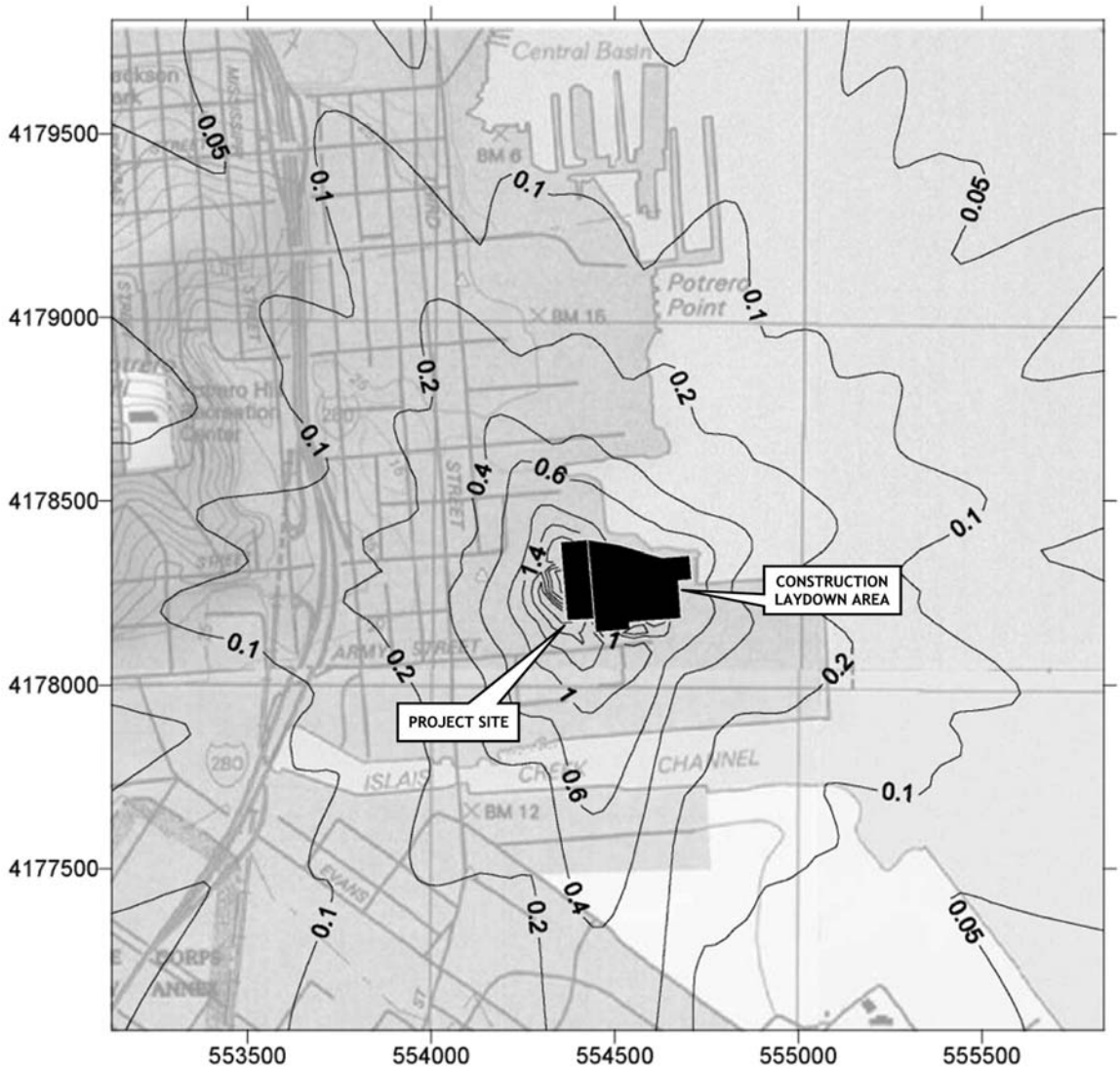
Maximum 24-Hour Average $PM_{2.5}$ Impacts During Construction Activities,
All Sources
Concentrations in $\mu g/m^3$



Modeled construction impacts are conservatively high because assumptions are made for both emissions calculations and modeling techniques that tend to overpredict results. Maximum short-term impacts are calculated assuming that all equipment is operating simultaneously with the peak workforce. A significant source of plume dilution is being ignored, since the construction emissions sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Figure 8.1D-5

Maximum 24-Hour Average $PM_{10}/PM_{2.5}$ Impacts During Construction Activities, Combustion Sources
Concentrations in $\mu g/m^3$



Modeled construction impacts are conservatively high because assumptions are made for both emissions calculations and modeling techniques that tend to overpredict results. Maximum short-term impacts are calculated assuming that all equipment is operating simultaneously with the peak workforce. A significant source of plume dilution is being ignored, since the construction emissions sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Attachment 8.1D-1

Detailed Construction Emissions Calculations

Daily Construction Emissions (peak months)						
(lbs/day)						
	NOx	CO	VOC	SOx	PM2.5	PM10
Onsite						
Construction Equipment	67.43	39.61	7.33	0.07	3.98	3.98
Fugitive Dust					5.16	17.03
Subtotal =	67.43	39.61	7.33	0.07	9.15	21.01
Offsite						
Worker Travel	23.22	229.10	22.76	0.13	1.09	1.09
Truck Deliveries	32.25	18.46	2.41	0.37	0.70	0.70
Subtotal =	55.47	247.56	25.17	0.50	1.78	1.78
Total =	122.89	287.17	32.50	0.58	10.93	22.79

Annual Construction Emissions (peak 12-month period) (tons/yr)						
	NOx	CO	VOC	SOx	PM2.5	PM10
Onsite						
Construction Equipment	5.21	3.22	0.60	0.01	0.34	0.34
Fugitive Dust					0.46	1.50
Subtotal =	5.21	3.22	0.60	0.01	0.79	1.84
Offsite						
Worker Travel	1.70	16.76	1.66	0.01	0.08	0.08
Truck Deliveries	3.87	2.22	0.29	0.04	0.08	0.08
Subtotal =	5.57	18.97	1.95	0.05	0.16	0.16
Total =	10.77	22.19	2.56	0.06	0.96	2.00

Dust Emission Ranking

Equipment	Hrs/Day Per Unit (1)	PM10 lbs/hr Per Unit	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Grader	7	0.06	0.45	0.45	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dozer	7	0.42	2.94	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scraper	7	0.83	5.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vibrator	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	7	0.18	0.00	0.00	1.27	3.81	3.81	3.81	3.81	3.81	3.81	3.81	2.54	0.00
Backhoe	7	0.19	0.00	0.00	3.99	3.99	3.99	3.99	3.99	3.99	3.99	2.66	0.00	0.00
Crane	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loader	7	0.04	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Field truck (3/4T)	7	0.13	0.88	0.88	0.88	0.88	0.88	1.76	1.76	1.76	1.76	0.88	0.88	0.88
Dump truck	7	0.19	1.36	1.36	1.36	2.71	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water truck	7	0.30	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	0.00	0.00
Service truck	7	0.09	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.00	0.00	0.00
Fuel Truck	7	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00
Boom truck	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Concrete pump	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Port air compressor	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Port. Light plant	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Total =	**10.3**	4	7	9	9	9.6	10	10	10	7	3	1
			100%	41%	64%	84%	84%	93%	93%	93%	93%	71%	33%	9%
		12-month Total =												88

Note: (1) 7 hours of equipment operation during 10 hrs/day of construction activity.

Daily Fugitive Dust Emissions (peak month)									
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Backhoe	0	882.0	0.0	tons	5.305E-05	0.0015	0%	0.00	0.00
Grader	1	21.0	21.0	vmt	0.0193297	0.2754	92%	0.03	0.45
Dozer	1	7.0	7.0	hr	0.23	0.4194	0%	1.62	2.94
Scraper - Excavation	1	7.0	7.0	hr	0.23	0.4194	0%	1.62	2.94
Scraper - Unpaved Road Travel	1	10.6	10.6	vmt	0.53	3.4638	92%	0.44	2.86
Loader - Excavation	1	735.0	735.0	tons	2.827E-05	0.0001	0%	0.02	0.07
Loader - Unpaved Road Travel	1	1.3	1.3	vmt	0.29	1.9201	92%	0.03	0.20
Water Truck Unpaved Road Travel	1	9.5	9.5	vmt	0.44	2.8400	92%	0.32	2.11
Forklift Unpaved Road Travel	0	9.5	0.0	vmt	0.26	1.7100	92%	0.00	0.00
Dump Truck Unpaved Road Travel	1	5.6	5.6	vmt	0.46	2.9806	92%	0.20	1.29
Dump Truck Unloading	1	735.0	735.0	tons	2.827E-05	0.0001	0%	0.02	0.07
3/4 ton Truck Unpaved Road Travel	1	11.4	11.4	vmt	0.15	0.9947	92%	0.13	0.88
3 ton Truck Unpaved Road Travel	1	5.7	5.7	vmt	0.22	1.4328	92%	0.10	0.63
Fuel Truck Unpaved Road Travel	1	0.1	0.1	vmt	0.33	2.1349	92%	0.00	0.02
Windblown Dust (active construction area)	N/A	728,462.8	728,462.8	sq.ft.	6.728E-06	1.682E-05	92%	0.38	0.95
Worker Gravel Road Travel	203	0.1	23.1	vmt	0.12	0.7705	92%	0.21	1.38
Delivery Truck Gravel Road Travel	6.5	0.1	0.7	vmt	0.35	2.3088	92%	0.02	0.13
Delivery Truck Unpaved Road Travel	6.5	0.1	0.5	vmt	0.46	2.9806	92%	0.02	0.11
Total =								5.16	17.03

Notes:
(1) See notes for fugitive dust emission calculations.

Annual Fugitive Dust Emissions					
Activity	Average Daily PM2.5 Emissions(1) (lbs/day)	Average Daily PM10 Emissions(1) (lbs/day)	Days per Year	Annual PM2.5 Emissions (tons/yr)	Annual PM10 Emissions (tons/yr)
Construction Activities	3.41	11.47	240	0.41	1.38
Windblown Dust	0.27	0.68	365	0.05	0.12
Total =				0.46	1.50

Notes:
(1) Based on average of daily emissions during 12-month construction period.

Notes - Fugitive Dust Emission Calculations

Wind erosion of active construction area - 'Source: "Improvement of Specific Emission Factors (BACM Project No. 1), Final Report", prepared for South Coast AQMD by Midwest Research Institute, March 1996

Level 2 Emission Factor =	0.011	ton/acre-month
Construction Schedule =	30	days/month
=	0.7	lbs/acre-day
=	1.682E-05	PM10 lbs/scf-day
	6.728E-06	PM2.5 lbs/scf-day

Material Unloading - Source: AP-42, p. 13.2.4-3, 1/95

E = (k)(0.0032)[(U/5)^1.3]/[(M/2)^1.4]

k = particle size constant =	0.35	for PM10
k = particle size constant =	0.11	for PM2.5
U = average wind speed =	2.81	m/sec (based on project area wind data)
=	6.29	mph
M = moisture content =	15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1, moist soil)
E = PM10 emission factor =	0.0001	lb/ton
E = PM2.5 emission factor =	0.00003	lb/ton

Loader Unpaved Road Travel - Source: AP-42, Section 13.2.2, 12/03

E = (k)[(s/12)^0.9][(W/3)^0.45]

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = surface silt content =	8.50	(AP-42, Table 13.2.2-1, 12/03, construction haul route)
W = avg. vehicle weight =	10.35	tons (avg. of loaded and unloaded weights, 966F loader, Caterpillar Performance Handbook, 10/97)
E = PM10 emission factor =	1.92	lb PM10/VMT
E = PM2.5 emission factor =	0.29	lb PM2.5/VMT
Soil Density =	1.05	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Loader Bucket Capacity =	5	yd3 (966F loader, Caterpillar Performance Handbook, 10/97)
=	5.25	ton/load
Daily Soil Transfer Rate =	735	ton/day (operating 7 hrs/day)
Daily Loader Trips =	140	loading trips/day
Loading Travel Distance =	50	ft/load (estimated)
Daily Loader Travel Distance =	7,000	ft/day
=	1.3	mi/day

Notes - Fugitive Dust Emission Calculations

Backhoe Trenching - Source: AP-42, Table 11.9-1 (dragline operations), 7/98

E = (0.75)(0.0021)(d^0.7)/(M^0.3)

d = drop height =	3	ft (estimated)
M = moisture content =	15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1, moist soil)
E = PM10 emission factor =	0.0015	PM10 lb/ton
E = PM2.5 emission factor =	0.0001	PM2.5 lb/ton
Backhoe Excavating Rate =	120.0	yd3/hr (based on 1 yd3 bucket on a 416C backhoe and a 30 sec. Cycle time)
=	840	yd3/day for 1 backhoe @ 7 hrs/day of operation
Soil Density =	1.0500	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Daily Soil Transfer Rate =	882.0000	ton/day (estimated)

Unpaved Road Travel - Source: AP-42, Section 13.2.2, 12/03.

E = (k)[(s/12)^0.9*(W/3)^0.45

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = silt fraction =	8.50	(AP-42, Table 13.2.2-1, 12/03, constructic
W = water truck avg. veh. weight =	10.0	tons empty (estimated)
=	39.4	tons loaded (estimated with 8,000 gallon water capacity)
=	24.7	tons average
W = dump truck avg. veh. weight =	15.0	tons (for heavy duty Diesel trucks)
=	40.0	tons (for heavy duty Diesel trucks)
=	27.5	tons (for heavy duty Diesel trucks)
W = forklift avg. veh. weight =	8.0	tons empty (estimated)
W = auto/pickup avg. vehicle weight =	2.4	tons (CARB Area Source Manual, 9/97)
W = delivery truck avg. veh. wt. =	27.5	tons (for heavy duty Diesel trucks)
W = 3 ton truck avg. veh. Wt =	5.4	tons (estimate)
W = scraper avg. veh. wt. =	28.2	tons empty (615 scraper, Caterpillar Performance Handbook, 10/89)
	48.6	tons loaded (615 scraper, Caterpillar Performance Handbook, 10/89)
	38.4	tons mean weight
W = fuel truck avg. veh. weight =	8.0	tons empty (estimated)
=	18.2	tons loaded (estimated with 3,000 gallons Diesel fuel capacity)
=	13.1	tons average

Gravel Road Travel - Source: AP-42, Section 13.2.2, 12/03.

E = (k)[(s/12)^0.9*(W/3)^0.45

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = silt fraction =	6.40	(AP-42, Table 13.2.2-1, 12/03, gravel road)
W = water truck avg. veh. weight =	10.0	tons empty (estimated)
=	39.4	tons loaded (estimated with 8,000 gallon water capacity)
=	24.7	tons average
W = dump truck avg. veh. weight =	15.0	tons (for heavy duty Diesel trucks)
=	40.0	tons (for heavy duty Diesel trucks)
=	27.5	tons (for heavy duty Diesel trucks)
W = forklift avg. veh. weight =	8.0	tons empty (estimated)
W = auto/pickup avg. vehicle weight =	2.4	tons (CARB Area Source Manual, 9/97)
W = delivery truck avg. veh. wt. =	27.5	tons (for heavy duty Diesel trucks)

Notes - Fugitive Dust Emission Calculations

E = water truck emission factor =	2.84	lb PM10/VMT
E = dump truck emission factor =	2.98	lb PM10/VMT
E = forklift emiss. factor =	1.71	lb PM10/VMT
E = auto/pickup emiss. factor =	0.99	lb PM10/VMT
E = delivery truck emiss. factor =	2.98	lb PM10/VMT
E = 3-ton truck emiss. factor =	1.43	lb PM10/VMT
E = scaper emiss. factor =	3.46	lb PM10/VMT
E = fuel truck emiss. factor =	2.13	lb PM10/VMT
E = auto/pickup emiss. factor =	0.77	lb PM10/VMT
E = delivery truck emiss. factor =	2.31	lb PM10/VMT
E = water truck emission factor =	0.44	lb PM2.5/VMT
E = dump truck emission factor =	0.46	lb PM2.5/VMT
E = forklift emiss. factor =	0.26	lb PM2.5/VMT
E = auto/pickup emiss. factor =	0.15	lb PM2.5/VMT
E = delivery truck emiss. factor =	0.46	lb PM2.5/VMT
E = 3-ton truck emiss. factor =	0.22	lb PM2.5/VMT
E = scaper emiss. factor =	0.53	lb PM2.5/VMT
E = fuel truck emiss. factor =	0.33	lb PM2.5/VMT
E = auto/pickup emiss. factor =	0.12	lb PM2.5/VMT
E = delivery truck emiss. factor =	0.35	lb PM2.5/VMT

Unpaved Road Travel and Active Excavation Area Control - Source: Control of Open Fugitive Dust Sources, U.S EPA, 9/88

C = 100 - (0.8)(p)(d)(t)/(i)

p = potential average hourly daytime evaporation rate =	0.3575	mm/hr (EPA document, Figure 3-2, summer)
evaporation rate =	0.2695	mm/hr (EPA document, Figure 3-2, annual)
d = average hourly daytime traffic rate =	37.0	vehicles/hr (estimated)
t = time between watering applications =	1.00	hr/application (estimated)
i = application intensity =	1.4	L/m2 (typical level in EPA document, page 3-23)
C = average summer watering control efficien	92.2%	
C = average annual watering control efficiency	94.1%	

Finish Grading - Source: AP-42, Table 11.9-1, 7/98

E = (0.60)(0.051)(S^2.0)

S = mean vehicle speed =	3.0	mph (estimate)
E = emission factor =	0.2754	PM10 lb/VMT
E = emission factor =	0.0193	PM2.5 lb/VMT

Notes - Fugitive Dust Emission Calculations

Bulldozer Operation and Scraper Excavation - Source: AP-42, Table 11.9.1, 7/98

E = (0.75)(s^1.5)/(M^1.4)

s = silt content =	8.5%	(AP-42, Table 13.2.2-1, 9/98, construction haul route)
M = moisture content =	15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1)
E = emission factor =	0.42	PM10 lb/hr
E = emission factor =	0.23	PM2.5 lb/hr

Scraper Travel

W = mean vehicle weight =	28.2	tons empty (615E scraper, Caterpillar Performance Handbook, 10/89)
=	48.6	tons loaded (615E scraper, Caterpillar Performance Handbook, 10/89)
=	38.4	tons mean weight
Daily Scraper Haul Tonnage =	1,428	ton/day (estimated)
Scraper Load =	20.4	ton (615E scraper, Caterpillar Performance Handbook, 10/89)
Daily Scraper Loads =	70.00	loads/day
Daily Scraper Hauling Distance =	0.08	miles/load (estimated)
Daily Scraper Travel =	10.61	miles/day

Notes - Fugitive Dust Emission Calculations

(1) Wind erosion emission factor for active construction area is based on "Improvement of Specific Emission Factors (BACM Project No. 1), Final Report", prepared for South Coast AQMD by Midwest Research Institute, March 1996.
(2) Material unloading emission factors are based on AP-42, p. 13.2.4-3, 1/95.
(Based on average annual wind speed recorded onsite and default soil moisture contents.)
(3) Trenching emission factor is based on AP-42, Table 11.9-2 (dragline operations), 1/95.
(Based on default soil moisture content.)
(4) Unpaved surface travel emission factors for water trucks, loaders, dump trucks, forklifts, delivery trucks, are based on AP-42, Section 13.2.2, 12/2003.
(Based on default soil silt content.)
(5) Dust control efficiency for unpaved road travel and active excavation area is based on "Control of Open Fugitive Dust Sources", U.S. EPA, 9/88.
(Based on default evaporation rate shown in EPA document, Figure 3-2, 9/88, and typical water application rate shown in EPA document, page 3-23, 9/88.)

Combustion Emission Ranking

Equipment	Hrs/Day Per Unit (1)	Gals/Hr Per Unit	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Grader	7	5.00	35	35	35	0	0	0	0	0	0	0	0	0
Dozer	7	5.50	39	39	0	0	0	0	0	0	0	0	0	0
Scraper	7	9.00	63	0	0	0	0	0	0	0	0	0	0	0
Vibrator	7	0.25	2	2	0	0	0	0	0	0	0	0	0	0
Forklift	7	2.50	0	0	18	53	53	53	53	53	53	53	35	0
Backhoe	7	2.50	0	0	53	53	53	53	53	53	53	35	0	0
Crane	7	5.00	0	0	35	35	70	70	70	70	35	0	0	0
Loader	7	2.50	18	0	0	0	0	0	0	0	0	0	0	0
Field truck (3/4T)	7	0.78	5	5	5	5	5	11	11	11	11	5	5	5
Dump truck	7	3.13	22	22	22	44	44	0	0	0	0	0	0	0
Water truck	7	3.13	22	22	22	22	22	22	22	22	22	22	0	0
Service truck	7	1.56	11	11	11	11	11	11	11	11	11	0	0	0
Fuel Truck	7	3.13	22	22	22	22	22	22	22	22	22	22	0	0
Boom truck	7	1.56	0	0	0	11	11	11	11	11	11	11	0	0
Concrete pump	7	3.13	0	22	44	44	44	22	22	0	0	0	0	0
Port air compressor	7	1.27	9	9	9	9	9	9	9	9	9	9	0	0
Port. Light plant	7	1.27	9	9	9	9	9	9	9	9	9	9	0	0
		Total =	256	197	284	317	**352**	291	291	269	234	165	40	5
		12-month Total =												2702

Note: (1) 7 hours of equipment operation during 10 hrs/day of construction activity.

Notes - Combustion Emissions

(1) For Construction Equipment
For Diesel construction equipment, emission factors based on equipment meeting EPA Tier I off-road Diesel standards and use of CARB ultra low-sulfur fuel.
For trucks, depending on size of truck, emissions factors based on EMFAC 2002 v.2.2 for heavy-heavy duty or medium duty Diesel trucks, fleet average for calendar year 2005.

(2) For Delivery Trucks
From EMFAC 2002 V.2.2, heavy-heavy duty Diesel trucks, fleet average for calendar year 2005, San Francisco Air Basin.

(3) For Worker Travel
From EMFAC 2002 v.2.2, average of light duty automobiles and light duty trucks, fleet average for calendar year 2005.

	Emission Factors (1)				
	NOx	CO	VOC	SOx	PM10
Truck Hauling (lbs/vmt)	0.03543	0.02029	0.00264	0.00041	0.00077
Truck Hauling (lbs/1000 gals)	167.27418	95.77071	12.48315	1.93738	3.61512

Notes:
(1) From EMFAC 2002 V.2.2, heavy-heavy duty Diesel trucks, fleet average for calendar year 2005, San Francisco Air Basin.

	Emission Factors				
	NOx	CO	POC	SOx	PM10
Light Duty Trucks/Cars (lbs/vmt)(1)	0.00163	0.01612	0.00160	0.00001	0.00008
Light Duty Trucks (lbs/1000 gals)(2)	41.87820	369.45051	33.92633	0.19942	1.62860
Medium Duty Trucks (lbs/1000 gals)(3)	40.59	262.67	25.01	0.21	1.32

Notes:
(1) From EMFAC 2002 v.2.2, average of light duty automobiles and light duty trucks, fleet average for calendar year 2005, San Franciso Air Basin.
(2) From EMFAC 2002 v2.2, light duty trucks (gasoline and Diesel), fleet average for calendar year 2005, San Francisco Air Basin.
(3) From EMFAC 2002 v2.2, medium duty trucks (gasoline and Diesel), fleet average for calendar year 2005, San Franciso Air Basin.

Gasoline Equipment Factors - Small Engines

			(gm/bhp-hr)		
	NOx	CO	POC	SO2	PM10
Small Equipment(1) (g/bhp-hr)	2.03	353.00	19.13	0.00	0.06
Small Equipment(1) (lb/1000 gal)	79.44	13813.38	748.58	0.00	2.35

Notes:

(1) From EPA's "Non-road Engine and Vehicle Emission Study Report", 11/91, Table 2-07, for generator sets, welders, pumps, and air compressors less than 50 hp.

Worker Travel Daily Emissions (Maximum Monthly)														
Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
264	1.3	203	70	14215	0.0016	0.0161	0.0016	0.0000	0.0001	23.22	229.10	22.76	0.13	1.09

Notes:
(1) See notes for combustion emissions.

Worker Travel Annual Emissions															
Average Number of Workers Per Day	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Days per Year	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
						NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
161	1.3	124	70	240	2,079,538	0.0016	0.0161	0.0016	0.0000	0.0001	1.70	16.76	1.66	0.01	0.08

Notes:
(1) See notes for combustion emissions.

Delivery Truck Daily Emissions (Maximum Monthly)												
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
13	70	910	0.0354	0.0203	0.0026	0.0004	0.0008	32.25	18.46	2.41	0.37	0.70
Idle exhaust (2)												0.0546

Notes:
(1) See notes for combustion emissions.
(2) 13 trucks per day times 1 hr idle time per visit times 0.0042 lb/hr.

Delivery Truck Annual Emissions												
Average Number of Deliveries Per Year	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
3120	70	218400.00	0.0354	0.0203	0.0026	0.0004	0.0008	3.87	2.22	0.29	0.04	0.08
Idle exhaust (2,3)												0.00655

Notes:
(1) See notes for combustion emissions.
(2) Annual average of 10 trucks per day, 240 days per year times 1 hr idle time per visit times 0.0042 lb/hr
(3) Based on 1.91 g/hr idle emission rate for the composite HDD truck fleet in 2001 from EPA's PART5 model.

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Season : Annual
Area : San Francisco Air Basin Average
I/M Stat : I and M program in effect
Emissions: Tons Per Day

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	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCAT	LDT1-CAT	LDT1-DSL	LDT1-TOT	LDT2-NCA1	LDT2-CAT	LDT2-DSL
Vehicles	67414	2972660	15394	3055470	23488	580582	14396	618465	12480	711733	8207
VMT/1000	790	100533	324	101647	410	19137	402	19949	224	24540	284
Trips	287679	18757200	88176	19133100	101829	3639110	88494	3829430	55412	4517670	51784
Reactive Organic Gas Emissions											
Run Exh	4.9	16.99	0.09	21.99	2.52	4.44	0.07	7.03	1.33	4.66	0.03
Idle Exh	0	0	0	0	0	0	0	0	0	0	0
Start Ex	1.72	21.34	0	23.06	0.59	4.53	0	5.12	0.3	5.43	0
Total Ex	6.62	38.33	0.09	45.05	3.11	8.97	0.07	12.15	1.63	10.09	0.03
Diurnal	0.39	3.12	0	3.51	0.13	0.72	0	0.85	0.07	0.63	0
Hot Soak	0.9	2.72	0	3.61	0.32	0.66	0	0.98	0.17	0.57	0
Running	5.65	17.42	0	23.06	1.25	5.85	0	7.11	0.55	5.37	0
Resting	0.19	1.16	0	1.35	0.07	0.29	0	0.35	0.03	0.23	0
Total	13.74	62.75	0.09	76.58	4.87	16.5	0.07	21.44	2.46	16.9	0.03
Carbon Monoxide Emissions											
Run Exh	63.55	439.06	0.28	502.89	33.49	134.92	0.3	168.71	17.89	132.33	0.17
Idle Exh	0	0	0	0	0	0	0	0	0	0	0
Start Ex	9.55	224.61	0	234.16	3.44	58.78	0	62.21	1.84	61.47	0
Total Ex	73.1	663.67	0.28	737.05	36.93	193.7	0.3	230.93	19.73	193.79	0.17
Oxides of Nitrogen Emissions											
Run Exh	4	51.66	0.49	56.15	2.04	15.7	0.56	18.31	1.09	22.43	0.42
Idle Exh	0	0	0	0	0	0	0	0	0	0	0
Start Ex	0.46	12.77	0	13.23	0.16	2.74	0	2.9	0.09	5.16	0
Total Ex	4.46	64.43	0.49	69.37	2.2	18.45	0.56	21.21	1.18	27.59	0.42
Carbon Dioxide Emissions (000)											
Run Exh	0.43	40.37	0.13	40.93	0.22	9.32	0.15	9.7	0.12	11.99	0.11
Idle Exh	0	0	0	0	0	0	0	0	0	0	0
Start Ex	0.06	1.55	0	1.61	0.02	0.36	0	0.39	0.01	0.45	0
Total Ex	0.49	41.92	0.13	42.54	0.24	9.68	0.15	10.08	0.13	12.44	0.11
PM10 Emissions											
Run Exh	0.03	1.12	0.05	1.2	0.01	0.23	0.03	0.28	0.01	0.55	0.02
Idle Exh	0	0	0	0	0	0	0	0	0	0	0
Start Ex	0	0.13	0	0.14	0	0.03	0	0.03	0	0.06	0
Total Ex	0.03	1.25	0.05	1.34	0.02	0.26	0.03	0.31	0.01	0.61	0.02
TireWear	0.01	0.89	0	0.9	0	0.17	0	0.18	0	0.22	0
BrakeWr	0.01	1.39	0	1.41	0.01	0.26	0.01	0.28	0	0.34	0
Total	0.05	3.53	0.06	3.64	0.02	0.69	0.04	0.76	0.01	1.16	0.02
Lead	0	0	0	0	0	0	0	0	0	0	0
SOx	0.01	0.41	0.01	0.43	0	0.1	0.01	0.11	0	0.12	0.01
Fuel Consumption (000 gallons)											
Gasoline	63.96	4411.67	0	4475.63	31.81	1025.72	0	1057.53	17.29	1308.48	0
Diesel	0	0	11.73	11.73	0	0	13.89	13.89	0	0	9.79

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I/M Stat : I and M program in effect
Emissions: Tons Per Day
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	LDT2-TOT	MDV-NCAT	MDV-CAT	MDV-DSL	MDV-TOT	LHDT1-NC/	LHDT1-CA1	LHDT1-DSL	LHDT1-TO1	LHDT2-NC/	LHDT2-CA1	LHDT2-DSL	LHDT2-TO1	MHDT-NCA	MHDT-CAT	MHDT-DSL	MHDT-TOT	HHDT-NCA	HHDT-CAT	HHDT-DSL
Vehicles	732420	5615	363369	11141	380125	1438	34381	6749	42569	7	8851	6875	15733	2194	10708	36009	48912	438	3084	28936
VMT/1000	25048	103	12439	409	12952	12	1977	457	2446	0	437	361	798	19	483	2180	2681	6	260	4462
Trips	4624860	25852	2304600	71509	2401960	47566	1136880	84893	1269340	227	292681	86478	379386	100213	489018	1009700	1598930	20018	140854	146430
Reactive Or																				
Run Exh	6.02	0.71	3.18	0.04	3.93	0.1	0.46	0.18	0.74	0	0.26	0.19	0.45	0.14	0.4	0.82	1.36	0.1	0.91	3.31
Idle Exh	0	0	0	0	0	0	0.05	0	0.05	0	0.01	0	0.01	0	0.02	0.02	0.05	0	0	0.24
Start Ex	5.73	0.17	3.67	0	3.84	0.4	0.69	0	1.08	0	0.29	0	0.29	1.24	0.93	0	2.17	0.42	0.72	0
Total Ex	11.76	0.88	6.84	0.04	7.76	0.5	1.2	0.18	1.88	0	0.56	0.19	0.75	1.38	1.36	0.83	3.58	0.51	1.63	3.55
Diurnal	0.7	0.02	0.34	0	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0.75	0.05	0.33	0	0.39	0.04	0.05	0	0.09	0	0.03	0	0.03	0.05	0.04	0	0.09	0.01	0.02	0
Running	5.92	0.17	2.89	0	3.07	0.33	0.8	0	1.13	0	0.49	0	0.49	0.46	0.94	0	1.4	0.11	0.42	0
Resting	0.27	0.01	0.13	0	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	19.39	1.14	10.55	0.04	11.72	0.87	2.04	0.18	3.1	0	1.07	0.19	1.27	1.89	2.35	0.83	5.07	0.64	2.07	3.55
Carbon Mon																				
Run Exh	150.39	12.71	71.01	0.23	83.95	2.01	5.26	0.58	7.85	0.01	3.4	0.56	3.97	3.32	7.03	5.27	15.61	3.35	12.88	13.28
Idle Exh	0	0	0	0	0	0.01	0.3	0.01	0.32	0	0.08	0.01	0.08	0.03	0.15	0.1	0.28	0	0	1.42
Start Ex	63.31	1.32	37.82	0	39.14	2.24	8.86	0	11.1	0.01	3.9	0	3.91	7.08	16.68	0	23.76	5.79	11.23	0
Total Ex	213.7	14.04	108.83	0.23	123.09	4.27	14.42	0.58	19.27	0.02	7.38	0.57	7.96	10.43	23.85	5.37	39.65	9.13	24.12	14.7
Oxides of Ni																				
Run Exh	23.94	0.71	14.69	0.62	16.02	0.03	0.92	2.92	3.87	0	0.52	2.45	2.97	0.08	1.86	26.82	28.76	0.15	4.09	73.67
Idle Exh	0	0	0	0	0	0	0	0.02	0.02	0	0	0.02	0.02	0	0	0.31	0.31	0	0	4.34
Start Ex	5.25	0.06	2.95	0	3	0.04	1.65	0	1.69	0	0.6	0	0.6	0.12	1.67	0	1.79	0.1	1.41	0
Total Ex	29.19	0.76	17.64	0.62	19.02	0.07	2.58	2.94	5.59	0	1.12	2.47	3.59	0.2	3.53	27.13	30.86	0.24	5.5	78.01
Carbon Diox																				
Run Exh	12.22	0.06	8.41	0.16	8.63	0.01	2.11	0.26	2.39	0	0.47	0.22	0.68	0.01	0.36	3.62	4	0	0.17	10.63
Idle Exh	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0.02	0.02	0	0	0.22
Start Ex	0.46	0.01	0.32	0	0.32	0.01	0.05	0	0.06	0	0.01	0	0.01	0.02	0.02	0	0.04	0	0.01	0
Total Ex	12.68	0.07	8.73	0.16	8.95	0.02	2.17	0.26	2.46	0	0.48	0.22	0.7	0.04	0.39	3.63	4.06	0.01	0.17	10.85
PM10 Emiss																				
Run Exh	0.57	0	0.27	0.02	0.3	0	0.02	0.04	0.06	0	0.01	0.04	0.05	0	0.01	0.78	0.79	0	0	1.46
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0.1
Start Ex	0.06	0	0.03	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Ex	0.63	0	0.3	0.02	0.33	0	0.03	0.04	0.06	0	0.01	0.04	0.05	0	0.01	0.79	0.8	0	0.01	1.56
TireWear	0.22	0	0.11	0	0.11	0	0.03	0.01	0.03	0	0.01	0	0.01	0	0.01	0.03	0.04	0	0	0.18
BrakeWr	0.35	0	0.17	0.01	0.18	0	0.03	0.01	0.03	0	0.01	0	0.01	0	0.01	0.03	0.04	0	0	0.06
Total	1.2	0.01	0.59	0.03	0.62	0	0.08	0.05	0.13	0	0.02	0.05	0.07	0	0.02	0.85	0.87	0	0.01	1.8
Lead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOx	0.13	0	0.09	0.01	0.1	0	0.02	0.02	0.04	0	0	0.02	0.02	0	0	0.32	0.33	0	0	0.97
Fuel Consur																				
Gasoline	1325.77	9.72	913.43	0	923.15	3.28	224.71	0	227.99	0.02	50.63	0	50.65	5.95	44.13	0	50.08	2.46	22.01	0
Diesel	9.79	0	0	14.07	14.07	0	0	23.79	23.79	0	0	19.53	19.53	0	0	326.88	326.88	0	0	976.88

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	HHDT-TOT	LHV-NCAT	LHV-CAT	LHV-DSL	LHV-TOT	SBUS-NCA	SBUS-CAT	SBUS-DSL	SBUS-TOT	UB-NCAT	UB-CAT	UB-DSL	UB-TOT	MH-NCAT	MH-CAT	MH-DSL	MH-TOT	MCY-NCAT	MCY-CAT	MCY-DSL	MCY-TOT	ALL-TOT
Vehicles	32458	0	0	0	0	141	671	4354	5167	233	2412	5089	7734	4722	37360	2432	44513	64415	11530	0	75945	5059510
VMT/1000	4727	0	0	0	0	6	28	177	210	28	296	621	945	58	515	35	607	467	103	0	570	172581
Trips	307302	0	0	0	0	565	2685	17416	20666	931	9648	20357	30936	472	3737	243	4453	128818	23057	0	151875	33752200
Reactive Org																						
Run Exh	4.32	0	0	0	0	0.05	0.05	0.08	0.19	0.29	0.74	0.74	1.77	0.41	0.4	0.01	0.82	2.02	0.21	0	2.23	50.84
Idle Exh	0.24	0	0	0	0	0	0.01	0.01	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0.37
Start Ex	1.14	0	0	0	0	0.01	0.01	0	0.02	0.02	0.05	0	0.06	0.01	0.01	0	0.01	0.4	0.07	0	0.47	42.99
Total Ex	5.69	0	0	0	0	0.06	0.07	0.09	0.23	0.31	0.79	0.74	1.84	0.42	0.41	0.01	0.83	2.43	0.27	0	2.7	94.2
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0.09	0.07	0	0.16	5.61
Hot Soak	0.03	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0.1	0.02	0	0.11	6.09
Running	0.53	0	0	0	0	0.01	0.01	0	0.02	0.02	0.02	0	0.04	0	0.01	0	0.01	0.64	0.14	0	0.78	43.56
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.02	0	0.06	2.17
Total	6.25	0	0	0	0	0.07	0.09	0.09	0.25	0.33	0.82	0.74	1.88	0.42	0.43	0.01	0.85	3.3	0.52	0	3.82	151.63
Carbon Mon																						
Run Exh	29.51	0	0	0	0	1.14	0.81	0.52	2.47	5.9	5.59	3	14.49	10.06	12.29	0.05	22.4	26.58	2.83	0	29.41	1031.65
Idle Exh	1.42	0	0	0	0	0.01	0.06	0.07	0.13	0	0	0	0	0	0	0	0	0	0	0	0	2.23
Start Ex	17.02	0	0	0	0	0.06	0.19	0	0.25	0.09	0.79	0	0.88	0.03	0.13	0	0.16	1.18	0.47	0	1.65	457.55
Total Ex	47.95	0	0	0	0	1.21	1.05	0.59	2.85	5.99	6.37	3	15.36	10.09	12.42	0.05	22.56	27.76	3.3	0	31.07	1491.43
Oxides of Ni																						
Run Exh	77.9	0	0	0	0	0.02	0.12	2.33	2.47	0.12	1.38	15.73	17.24	0.23	1.46	0.43	2.12	0.69	0.16	0	0.85	250.59
Idle Exh	4.34	0	0	0	0	0	0	0.21	0.21	0	0	0	0	0	0	0	0	0	0	0	0	4.91
Start Ex	1.51	0	0	0	0	0	0.01	0	0.01	0	0.07	0	0.08	0	0.01	0	0.01	0.05	0	0	0.05	30.12
Total Ex	83.75	0	0	0	0	0.02	0.13	2.54	2.69	0.12	1.46	15.73	17.31	0.24	1.46	0.43	2.13	0.74	0.16	0	0.9	285.62
Carbon Diox																						
Run Exh	10.8	0	0	0	0	0	0.02	0.29	0.32	0.02	0.24	1.91	2.17	0.04	0.39	0.06	0.49	0.06	0.01	0	0.07	92.4
Idle Exh	0.22	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.27
Start Ex	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	2.91
Total Ex	11.03	0	0	0	0	0.01	0.02	0.3	0.33	0.02	0.24	1.91	2.18	0.04	0.39	0.06	0.49	0.06	0.02	0	0.08	95.58
PM10 Emiss																						
Run Exh	1.46	0	0	0	0	0	0	0.09	0.09	0	0.01	0.29	0.3	0	0	0.01	0.01	0.03	0	0	0.03	5.14
Idle Exh	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.27
Total Ex	1.56	0	0	0	0	0	0	0.09	0.09	0	0.01	0.29	0.3	0	0	0.01	0.01	0.03	0	0	0.03	5.52
TireWear	0.18	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.01	0	0.01	0	0	0	0	1.69
BrakeWr	0.07	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.01	0	0.01	0.01	0	0	0.01	2.39
Total	1.81	0	0	0	0	0	0	0.1	0.1	0	0.01	0.31	0.32	0	0.02	0.01	0.03	0.04	0	0	0.04	9.6
Lead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOx	0.97	0	0	0	0	0	0	0.03	0.03	0	0	0.17	0.17	0	0	0.01	0.01	0	0	0	0	2.36
Fuel Consur																						
Gasoline	24.47	0	0	0	0	0.75	2.75	0	3.5	3.47	26.3	0	29.78	6.23	41.94	0	48.18	11.92	2.2	0	14.11	8230.84
Diesel	976.88	0	0	0	0	0	0	27.3	27.3	0	0	171.69	171.69	0	0	5.18	5.18	0	0	0	0	1600.74

Onsite Combustion Emissions

			Base Factors g/bhp, if Tier 1 >50 hp (1)						Appendix A Table A3 Adjustment (2)						Adjustment (3)	Adjusted Factors					
Equipment	HP Cat.	Tier	BSFC lb/h	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fuel S	BSFC	NOx	CO	VOC	SOx	PM10
Crane	175-300	1	0.367	5.5772	0.7475	0.3085	0.00499	0.2521	None	1	1	1	1	1	-0.086	0.367	5.58	0.75	0.31	0.0049	0.17
Wrecking Ball	175-300	1	0.367	5.5772	0.7475	0.3085	0.00499	0.2521	None	1	1	1	1	1	-0.086	0.367	5.58	0.75	0.31	0.0049	0.17
Dozer	100-175	1	0.367	5.6523	0.8667	0.3384	0.00499	0.2799	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.37	1.33	0.36	0.0049	0.26
Scraper	175-300	1	0.367	5.5772	0.7475	0.3085	0.00499	0.2521	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.30	1.14	0.32	0.0049	0.22
Grader	100-175	1	0.367	5.6523	0.8667	0.3384	0.00499	0.2799	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.37	1.33	0.36	0.0049	0.26
Backhoe	50-100	1	0.408	5.5988	2.3655	0.5213	0.00555	0.473	Lo LF	1.1	2.57	2.29	1.18	1.97	-0.113	0.481	6.16	6.08	1.19	0.0064	0.82
Loader	50-100	1	0.408	5.5988	2.3655	0.5213	0.00555	0.473	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	5.32	3.62	0.55	0.0055	0.49
Truck- Water	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Forklift	50-100	1	0.408	5.5988	2.3655	0.5213	0.00555	0.473	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	5.32	3.62	0.55	0.0055	0.49
Dump Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Service Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Boom Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Truck- Fuel/Lube	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Concrete Pumper Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Trucks- Pickup 3/4 ton	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Vibrator	25-50	0	0.408	6.9	5	1.8	0.00555	0.8	None	1	1	1	1	1	-0.094	0.40	6.90	5.00	1.80	0.0053	0.71
Light Plants	25-50	0	0.408	6.9	5	1.8	0.00555	0.8	None	1	1	1	1	1	-0.094	0.40	6.90	5.00	1.80	0.0053	0.71
Air Compressor	25-50	0	0.408	6.9	5	1.8	0.00555	0.8	None	1	1	1	1	1	-0.094	0.40	6.90	5.00	1.80	0.0053	0.71

	Adjusted factors lbs/1000 gallon (4)						Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day					Total Annual Fuel Use(6) (Gals/yr)	Annual Emissions Lbs/yr				
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Crane	1	237.87	31.88	13.16	0.21	7.09	70.00	16.65	2.23	0.92	0.01	0.50	7,700	1831.58	245.48	101.31	1.60	54.60
Dozer	1	226.75	56.00	15.00	0.21	10.88	0.00	0.00	0.00	0.00	0.00	0.00	1,540	349.19	86.23	23.11	0.32	16.75
Scraper	1	223.74	48.29	13.68	0.21	9.43	0.00	0.00	0.00	0.00	0.00	0.00	1,260	281.91	60.85	17.24	0.26	11.88
Grader	1	226.75	56.00	15.00	0.21	10.88	0.00	0.00	0.00	0.00	0.00	0.00	2,100	476.17	117.59	31.51	0.44	22.84
Backhoe	1	200.23	197.65	38.81	0.21	26.63	52.50	10.51	10.38	2.04	0.01	1.40	8,050	1611.86	1591.09	312.44	1.67	214.40
Loader	1	202.03	137.47	20.79	0.21	18.44	0.00	0.00	0.00	0.00	0.00	0.00	350	70.71	48.12	7.28	0.07	6.45
Truck- Water	na	167.27	95.77	12.48	0.21	3.62	21.91	3.66	2.10	0.27	0.00	0.08	4,382	733.00	419.67	54.70	0.92	15.84
Forklift	1	202.03	137.47	20.79	0.21	18.44	52.50	10.61	7.22	1.09	0.01	0.97	8,400	1697.08	1154.78	174.65	1.74	154.87
Dump Truck	na	167.27	95.77	12.48	0.21	3.62	43.82	7.33	4.20	0.55	0.01	0.16	3,067	513.10	293.77	38.29	0.64	11.09
Service Truck	na	74.40	59.47	5.57	0.21	4.83	10.92	0.81	0.65	0.06	0.00	0.05	1,966	146.25	116.89	10.94	0.41	9.50
Boom Truck	na	167.27	95.77	12.48	0.21	3.62	10.92	1.83	1.05	0.14	0.00	0.04	1,529	255.73	146.41	19.08	0.32	5.53
Truck- Fuel/Lube	na	167.27	95.77	12.48	0.21	3.62	21.91	3.66	2.10	0.27	0.00	0.08	4,382	733.00	419.67	54.70	0.92	15.84
Concrete Pumper Truck	na	167.27	95.77	12.48	0.21	3.62	43.82	7.33	4.20	0.55	0.01	0.16	3,944	659.70	377.70	49.23	0.83	14.26
Trucks- Pickup 3/4 ton	na	41.88	369.45	33.93	0.20	1.63	5.46	0.23	2.02	0.19	0.00	0.01	1,747	73.17	645.50	59.28	0.35	2.85
Vibrator	0	270.01	195.66	70.44	0.21	27.64	0.00	0.00	0.00	0.00	0.00	0.00	70	18.90	13.70	4.93	0.01	1.94
Light Plants	0	270.01	195.66	70.44	0.21	27.64	8.89	2.40	1.74	0.63	0.00	0.25	1,778	480.07	347.88	125.24	0.37	49.15
Air Compressor	0	270.01	195.66	70.44	0.21	27.64	8.89	2.40	1.74	0.63	0.00	0.25	1,778	480.07	347.88	125.24	0.37	49.15
Total =							351.54	67.43	39.61	7.33	0.07	3.93	54,042.80	10,411.48	6,433.20	1,209.15	11.24	656.93
														5.21	3.22	0.60	0.01	0.33 tons/yr

(1) - Steady State Emission Factors from Table A2 of EPA November 2002 NR-009b Publication.
(2) - In use adjustment factors per Table A3 EPA November 2002 NR-009b Publication.
(3) - PM10 and SO2 adjustments due to Equation 5 and Equation 7 on pages 18 and 19, Respectively of EPA Report No. NR-009b
(4) - Calculation uses adjusted BSFC and assumed 7.1 lbs/gallon. The onroad emission factors are not adjusted.
(5) - Daily fuel use based on peak combustion month equipment schedule.
(6) - Annual fuel use based on average level during peak 12-month period.

Construction Equipment Daily Fuel Use (peak period)

Equipment	Gasoline/ Diesel	Number of Units	Hrs/Day Per Unit	Gals/Hr Per Unit	Total Fuel Use (Gals/day)
Grader	D	0	7	5.00	0.00
Dozer	D	0	7	5.50	0.00
Scraper	D	0	7	9.00	0.00
Vibrator	D	0	7	0.25	0.00
Forklift	D	3	7	2.50	52.50
Backhoe	D	3	7	2.50	52.50
Crane	D	2	7	5.00	70.00
Loader	D	0	7	2.50	0.00
Field truck (3/4T)	D	1	7	0.78	5.46
Dump truck	D	2	7	3.13	43.82
Water truck	D	1	7	3.13	21.91
Service truck	D	1	7	1.56	10.92
Fuel Truck	D	1	7	3.13	21.91
Boom truck	D	1	7	1.56	10.92
Concrete pump	D	2	7	3.13	43.82
Port air compressor	D	1	7	1.27	8.89
Port. Light plant	D	1	7	1.27	8.89

Total = 351.54

Construction Equipment Annual Fuel Use (12-month construction period)

Equipment	Gasoline/ Diesel	12-Month Average Number of Units Per Year(1)	Peak 12-Month Average Number of Units Per Year(1)	Average Operating Hrs/Day Per Unit	Gals/Hr Per Unit	Average Operating Days per Year	12-Month Average Total Fuel Use (Gals/yr)	Peak 12-Month Average Total Fuel Use (Gals/yr)
Grader	D	0.25	0.25	7	5.00	240	2,100	2,100
Dozer	D	0.17	0.17	7	5.50	240	1,540	1,540
Scraper	D	0.08	0.08	7	9.00	240	1,260	1,260
Vibrator	D	0.17	0.17	7	0.25	240	70	70
Forklift	D	2.00	2.00	7	2.50	240	8,400	8,400
Backhoe	D	1.92	1.92	7	2.50	240	8,050	8,050
Crane	D	0.92	0.92	7	5.00	240	7,700	7,700
Loader	D	0.08	0.08	7	2.50	240	350	350
Field truck (3/4T)	D	1.33	1.33	7	0.78	240	1,747	1,747
Dump truck	D	0.58	0.58	7	3.13	240	3,067	3,067
Water truck	D	0.83	0.83	7	3.13	240	4,382	4,382
Service truck	D	0.75	0.75	7	1.56	240	1,966	1,966
Fuel Truck	D	0.83	0.83	7	3.13	240	4,382	4,382
Boom truck	D	0.58	0.58	7	1.56	240	1,529	1,529
Concrete pump	D	0.75	0.75	7	3.13	240	3,944	3,944
Port air compressor	D	0.83	0.83	7	1.27	240	1,778	1,778
Port. Light plant	D	0.83	0.83	7	1.27	240	1,778	1,778

Total = 54,043 54,043

SFPUC - Construction Modeling
MUNI Site

Short Term Impacts (24 hours and less)					
	NOx	CO	SOx	PM2.5	PM10
Combustion (lbs/day)	67.4	39.6	0.07	3.98	3.98
Construction Dust (lbs/day)				4.78	16.07
Windblown Dust (lbs/day)				0.38	0.95

Long Term Impacts (annual)					
	NOx	CO	SOx	PM2.5	PM10
Combustion (tons/yr)	5.21	3.22	0.01	0.34	0.34
Construction Dust (tons/yr)				0.41	1.38
Windblown Dust (tons/yr)				0.05	0.12

Daily Transmission Line Construction Emissions						
(lbs/day)						
	NOx	CO	VOC	SOx	PM2.5	PM10
Onsite						
Construction Equipment	17.29	7.60	1.31	0.06	0.69	0.69
Fugitive Dust					0.08	0.45
Subtotal =	17.29	7.60	1.31	0.06	0.78	1.15
Offsite						
Worker Travel	1.32	13.02	1.29	0.01	0.06	0.06
Truck Deliveries	17.36	9.94	1.30	0.20	0.38	0.38
Subtotal =	18.68	22.96	2.59	0.21	0.44	0.44
Total =	35.97	30.56	3.90	0.27	1.21	1.59

Underground Transmission Line Construction - Delivery Truck Daily Emissions												
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
7	70	490	0.0354	0.0203	0.0026	0.0004	0.0008	17.36	9.94	1.30	0.20	0.38
Idle exhaust (2)												0.0294

Notes:
(1) See notes for combustion emissions.
(2) 7 trucks per day times 1 hr idle time per visit times 0.0042 lb/hr.

Underground Transmission Line Construction - Worker Travel Daily Emissions														
Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
15	1.3	12	70	808	0.0016	0.0161	0.0016	0.0000	0.0001	1.32	13.02	1.29	0.01	0.06

Notes:
(1) See notes for combustion emissions.

Underground Transmission Line Construction - Combustion Emissions

			Base Factors g/bhp, if Tier 1 >50 hp (1)						Appendix A Table A3 Adjustment (2)						Adjustment (3)	Adjusted Factors					
Equipment	HP Cat.	Tier	BSFC lb/hp-hr	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fue	BSFC	NOx	CO	VOC	SOx	PM10
Excavator	175-300	1	0.367	5.5772	0.7475	0.3085	0.00499	0.2521	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.30	1.14	0.32	0.0049	0.22
Roller	100-175	1	0.367	5.6523	0.8667	0.3384	0.00499	0.2799	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.37	1.33	0.36	0.0049	0.26
Water Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Service Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Trucks- Pickup	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad

		Adjusted factors lbs/1000 gallon (4)					Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day				
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Excavator	1	223.74	48.29	13.68	0.21	9.43	38.50	8.61	1.86	0.53	0.01	0.36
Roller	1	226.75	56.00	15.00	0.21	10.88	17.50	3.97	0.98	0.26	0.00	0.19
Water Truck	na	167.27	95.77	12.48	1.94	3.62	21.91	3.66	2.10	0.27	0.04	0.08
Service Truck	na	74.40	59.47	5.57	0.21	4.83	10.92	0.81	0.65	0.06	0.00	0.05
Trucks- Pickup	na	41.88	369.45	33.93	0.20	1.63	5.46	0.23	2.02	0.19	0.00	0.01
Total =							94.29	17.29	7.60	1.31	0.06	0.69

(1) - Steady State Emission Factors from Table A2 of EPA November 2002 NR-009b Publication.
(2) - In use adjustment factors per Table A3 EPA November 2002 NR-009b Publication.
(3) - PM10 and SO2 adjustments due to Equation 5 and Equation 7 on pages 18 and 19, Respectively of EPA Report No. NR-009b
(4) - Calculation uses adjusted BSFC and assumed 7.1 lbs/gallon. The onroad emission factors are not adjusted.
(5) - Based on 7 hrs/day of equipment operation.

Process Water Line Construction - Daily Fugitive Dust Emissions									
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Excavator	1	662	662	tons	2.82661E-05	8.99E-05	0%	0.02	0.06
Pickup Truck Unpaved Road Travel	1	0.9	0.9	vmt	0.15	0.99	92%	0.01	0.07
Service Truck Unpaved Road Travel	1	0.9	0.9	vmt	0.22	1.43	92%	0.02	0.11
Water Truck Unpaved Road Travel	1	0.9	0.9	vmt	0.44	2.84	92%	0.03	0.21
Windblown Dust (active construction area)	N/A	5,000	5,000	sq.ft.	6.72783E-06	1.68E-05	92%	0.00	0.01
Total =								0.08	0.45

Notes:
(1) See notes for fugitive dust emission calculations.

Daily Process Water Line Construction Emissions						
(lbs/day)						
	NOx	CO	VOC	SOx	PM2.5	PM10
Onsite						
Construction Equipment	17.29	7.60	1.31	0.06	0.69	0.69
Fugitive Dust					0.08	0.45
Subtotal =	17.29	7.60	1.31	0.06	0.78	1.15
Offsite						
Worker Travel	1.32	13.02	1.29	0.01	0.06	0.06
Truck Deliveries	17.36	9.94	1.30	0.20	0.38	0.38
Subtotal =	18.68	22.96	2.59	0.21	0.44	0.44
Total =	35.97	30.56	3.90	0.27	1.21	1.59

Process Water Line Construction - Delivery Truck Daily Emissions												
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
7	70	490	0.0354	0.0203	0.0026	0.0004	0.0008	17.36	9.94	1.30	0.20	0.38
Idle exhaust (2)												0.0294

Notes:
(1) See notes for combustion emissions.
(2) 7 trucks per day times 1 hr idle time per visit times 0.0042 lb/hr.

Process Water Line Construction - Worker Travel Daily Emissions														
Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
15	1.3	12	70	808	0.0016	0.0161	0.0016	0.0000	0.0001	1.32	13.02	1.29	0.01	0.06

Notes:
(1) See notes for combustion emissions.

Process Water Line Construction - Combustion Emissions

			Base Factors g/bhp, if Tier 1 >50 hp (1)						Appendix A Table A3 Adjustment (2)						Adjustment (3)	Adjusted Factors					
Equipment	HP Cat.	Tier	BSFC lb/hp-hr	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fue	BSFC	NOx	CO	VOC	SOx	PM10
Excavator	175-300	1	0.367	5.5772	0.7475	0.3085	0.00499	0.2521	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.30	1.14	0.32	0.0049	0.22
Roller	100-175	1	0.367	5.6523	0.8667	0.3384	0.00499	0.2799	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.37	1.33	0.36	0.0049	0.26
Water Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Service Truck	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Trucks- Pickup	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad

		Adjusted factors lbs/1000 gallon (4)					Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day				
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Excavator	1	223.74	48.29	13.68	0.21	9.43	38.50	8.61	1.86	0.53	0.01	0.36
Roller	1	226.75	56.00	15.00	0.21	10.88	17.50	3.97	0.98	0.26	0.00	0.19
Water Truck	na	167.27	95.77	12.48	1.94	3.62	21.91	3.66	2.10	0.27	0.04	0.08
Service Truck	na	74.40	59.47	5.57	0.21	4.83	10.92	0.81	0.65	0.06	0.00	0.05
Trucks- Pickup	na	41.88	369.45	33.93	0.20	1.63	5.46	0.23	2.02	0.19	0.00	0.01
Total =							94.29	17.29	7.60	1.31	0.06	0.69

(1) - Steady State Emission Factors from Table A2 of EPA November 2002 NR-009b Publication.
(2) - In use adjustment factors per Table A3 EPA November 2002 NR-009b Publication.
(3) - PM10 and SO2 adjustments due to Equation 5 and Equation 7 on pages 18 and 19, Respectively of EPA Report No. NR-009b
(4) - Calculation uses adjusted BSFC and assumed 7.1 lbs/gallon. The onroad emission factors are not adjusted.
(5) - Based on 7 hrs/day of equipment operation.

Process Water Line Construction - Daily Fugitive Dust Emissions									
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Excavator	1	662	662	tons	2.82661E-05	8.99E-05	0%	0.02	0.06
Pickup Truck Unpaved Road Travel	1	0.9	0.9	vmt	0.15	0.99	92%	0.01	0.07
Service Truck Unpaved Road Travel	1	0.9	0.9	vmt	0.22	1.43	92%	0.02	0.11
Water Truck Unpaved Road Travel	1	0.9	0.9	vmt	0.44	2.84	92%	0.03	0.21
Windblown Dust (active construction area)	N/A	5,000	5,000	sq.ft.	6.72783E-06	1.68E-05	92%	0.00	0.01
Total =								0.08	0.45

Notes:
(1) See notes for fugitive dust emission calculations.

APPENDIX 8.1E

Evaluation of Best Available Control Technology

APPENDIX 8.1E

EVALUATION OF BEST AVAILABLE CONTROL TECHNOLOGY

Rule 2-2-301 requires the application of BACT to any new or modified emissions unit if the new unit or modification results in an increase in permitted daily emissions greater than 10 pounds per day. BACT is defined in Rule 2-2-206 as the most stringent emission limitation or control technique of the following:

206.1 The most effective emission control device or technique which has been successfully utilized for the type of equipment comprising such a source; or

206.2 The most stringent emission limitation achieved by an emission control device or technique for the type of equipment comprising such a source; or

206.3 Any emission control device or technique determined to be technologically feasible and cost-effective by the APCO; or

206.4 The most effective emission control limitation for the type of equipment comprising such a source which the EPA states, prior to or during the public comment period, is contained in an approved implementation plan of any state, unless the applicant demonstrates to the satisfaction of the APCO that such limitations are not achievable. Under no circumstances shall the emission control required be less stringent than the emission control required by any applicable provision of federal, state or District laws, rules or regulations.

The SFERP will have emissions in excess of 10 lb/day for NOx, POC, CO, PM_{10}, and SOx. Therefore, BACT will be required for these pollutants. The emission rates determined to be BACT for this project are summarized below. The information considered in making these determinations is discussed in detail in the following sections.

- NOx emission limit of 2.5 ppmv @ 15% O_2 constitutes BACT for natural gas-fired LM6000 combustion turbines in simple cycle. At a design exhaust NOx concentration of 2.5 ppmv at 15% O_2, the proposed project will comply with the BACT NOx emission limit.
- POC emission limit of 2 ppmv @ 15% O_2 constitutes BACT for natural gas-fired simple cycle combustion turbines. At a design exhaust POC concentration of 2 ppmv at 15% O_2, the proposed modification will comply with the BACT VOC emission limit.
- CO emission limit of 4 ppmv @ 15% O_2 constitutes BACT for natural gas-fired simple cycle combustion turbines. At a design exhaust CO concentration of 4 ppmv at 15% O_2, the proposed project will comply with the BACT CO emission limit.
- The use of natural gas with an annual average sulfur content of 0.33 grains per 100 scf constitutes BACT for this project. District BACT Guideline 89.1.3 specifies BACT 2 (achieved in practice) for SO_2 for simple cycle gas turbines with an output rating of > 50 MW as the exclusive use of clean-burning natural gas.
- BACT for PM_{10} is the use of natural gas as the fuel source.

8.1E.1 Top-Down BACT Analysis for Control of Nitrogen Oxides

The following "top-down" BACT analysis for NO_x has been prepared in accordance with EPA's 1990 Draft New Source Review Workshop Manual. A "top-down" BACT analysis takes into account energy, environmental, economic, and other costs associated with each alternative technology.

8.1E.1.1 Identify All Control Technologies

The baseline NOx emission rate for this analysis is considered to be 75 ppmvd @ 15% O_2, based on the governing new source performance standard (40 CFR 60 Subpart GG). This emission rate provides the frame of reference for the evaluation of control effectiveness and feasibility. The maximum degree of control, resulting in the minimum emission rate, is a combination of water injection and either selective catalytic reduction or SCONOx to achieve a long-term NOx limit of approximately 2.0 ppmvd. Several intermediate levels of control are also evaluated.

There are three basic means of controlling NOx emissions from combustion turbines: wet combustion controls, dry combustion controls, and post-combustion controls. Wet and dry combustion controls act to reduce the formation of NOx during the combustion process, while post-combustion controls remove NOx from the exhaust stream. Potential NOx control technologies for combustion gas turbines include the following:

Wet combustion controls

- Water injection
- Steam injection

Dry combustion controls

- Dry low-NOx combustor design
- Catalytic combustors (e.g., XONON)
- Other combustion modifications

Post-combustion controls

- Selective non-catalytic reduction (SNCR)

Non-selective catalytic reduction (NSCR)

- Selective catalytic reduction (SCR)
- SCONOx

8.1E.1.2 Eliminate Technically Infeasible Options

The performance and technical feasibility of available NOx control technologies are discussed in more detail below.

Combustion Modifications

Wet Combustion Controls

Steam or water injection directly into the turbine combustor is one of the most common NOx control techniques for combustion turbines. These wet injection techniques lower the flame temperature in the combustor and thereby reduce thermal NOx formation. The water or steam-to-fuel injection ratio is the most significant factor affecting the performance of wet controls. Steam injection techniques can reduce NOx emissions in gas-fired turbines to between 15 and 25 ppmv at 15% O_2; the practical limit of water injection has been demonstrated at approximately 25-42 ppmv @ 15% O_2 before combustor damage becomes significant. Higher diluent:fuel ratios (especially with steam) not only result in greater NOx reductions, but also increase emissions of CO and hydrocarbons, reduce turbine efficiency, and may increase turbine maintenance requirements. The principal NOx control mechanisms are identical for water and steam injection. Water or steam is injected into the primary combustion chamber to act as a heat sink, lowering the peak flame temperature of combustion and thus lowering the quantity of thermal NOx formed. The injected water or steam exits the turbine as part of the exhaust.

Because water has a higher heat absorbing capacity than steam (due to the temperature and to the latent heat of vaporization associated with water), it takes more steam than water to achieve an equivalent level of NOx control. Typical steam injection ratios are 0.5 to 2.0 pounds steam per pound fuel; water injection ratios are generally below 1.0 pound water per pound fuel.

Although the lower peak flame temperature has a beneficial effect on NOx emissions, it can also reduce combustion efficiency and prevent complete combustion. As a result, CO and VOC emissions increase as water/steam-to-fuel ratios increase. Thus, the higher steam-to-fuel ratio required for NOx control will tend to cause higher CO and VOC emissions from steam-injected turbines than from water-injected turbines, due to the kinetic effect of the water molecules interfering with the combustion process. However, steam injection can reduce the heat rate of the turbine so that equivalent power output can be achieved with reduced fuel consumption and reduced SO_2 emission rates.

Water and steam injection have been in use on both oil- and gas-fired combustion turbines in all size ranges for many years, so these NOx control technologies are clearly technologically feasible and widely available.

Dry Combustion Controls

Combustion modifications that lower NOx emissions without wet injection include lean combustion, reduced combustor residence time, lean premixed combustion, and two-stage rich/lean combustion. Lean combustion uses excess air (greater than stoichiometric air-to-fuel ratio) in the combustor primary combustion zone to cool the flame, thereby reducing the rate of thermal NOx formation. Reduced combustor residence times are achieved by introducing dilution air between the combustor and the turbine sooner than with standard combustors. The combustion gases are at high temperatures for a shorter time, which also has the effect of reducing the rate of thermal NOx formation.

The most advanced combination of combustion controls for NOx is referred to as dry low-NOx (DLN) combustors. DLN technology uses lean, premixed combustion to keep peak combustion temperatures low, thus reducing the formation of thermal NOx. This technology is effective in achieving NOx emission levels comparable to levels achieved using wet injection without the need for large volumes of purified water and without the increases in CO and VOC emissions that result from wet injection. However, this control technology does not result in lower NOx emissions than can be achieved using water injection on the LM6000 combustion turbine.

Catalytic combustors use a catalytic reactor bed mounted within the combustor to burn a very lean fuel-air mixture. This technology has been commercially demonstrated under the trade name XONON in a 1.5 MW natural gas-fired combustion turbine in Santa Clara, California. The technology has also been announced as commercially available for some models of small combustion turbines, generally 10 MW in size and less. The technology has not been announced commercially for the engines used at the SFPERP. No turbine vendor, other than General Electric, has indicated the commercial availability of catalytic combustion systems at the present time; therefore, catalytic combustion controls are not available for this specific application and are not discussed further.

Post-Combustion Controls

SCR is a post-combustion technique that controls both thermal and fuel NOx emissions by reducing NOx with a reagent (generally ammonia or urea) in the presence of a catalyst to form water and nitrogen. NOx conversion is sensitive to exhaust gas temperature, and performance can be limited by contaminants in the exhaust gas that may mask the catalyst (sulfur compounds, particulates, heavy metals, and silica). SCR is used in numerous gas turbine installations throughout the United States, almost exclusively in conjunction with other wet or dry NOx combustion controls. SCR requires the consumption of a reagent (ammonia or urea) and requires periodic catalyst replacement. Estimated levels of NOx control are in excess of 90%.

Selective non-catalytic reduction (SNCR) involves injection of ammonia or urea with proprietary conditioners into the exhaust gas stream without a catalyst. SNCR technology requires gas temperatures in the range of 1200° to 2000° F and is most commonly used in boilers. The exhaust temperatures for the SFERP gas turbines are in the 800° F range, which is well below the minimum SNCR operating temperature. Some method of exhaust gas reheat, such as additional fuel combustion, would be required to achieve exhaust temperatures compatible with SNCR operations, and this requirement makes SNCR technologically infeasible for this application. Even when technically feasible, SNCR is unlikely to achieve NOx reductions in excess of 80%-85%.

Nonselective catalytic reduction (NSCR) uses a catalyst without injected reagents to reduce NOx emissions in an exhaust gas stream. NSCR is typically used in automobile exhaust and rich-burn stationary IC engines, and employs a platinum/rhodium catalyst. NSCR is effective only in a stoichiometric or fuel-rich environment where the combustion gas is nearly depleted of oxygen, and this condition does not occur in turbine exhaust where the oxygen concentrations are typically between 14 and 16%. For this reason, NSCR is not technologically feasible for this application.

SCONOx is a proprietary catalytic oxidation and adsorption technology that uses a single catalyst for the control of NOx, CO, and VOC emissions. The catalyst is a monolithic design, made from a ceramic substrate with both a proprietary platinum-based oxidation

catalyst and a potassium carbonate adsorption coating. The catalyst simultaneously oxidizes NO to NO_2, CO to CO_2, and VOCs to CO_2 and water, while NO_2 is adsorbed onto the catalyst surface where it is chemically converted to and stored as potassium nitrates and nitrites. The SCONOx potassium carbonate layer has a limited adsorption capability and requires regeneration approximately every 12-15 minutes in normal service.[2] Each regeneration cycle requires approximately 3-5 minutes. At any point in time, approximately 20% of the compartments in a SCONOx system would be in regeneration mode, and the remaining 80% of the compartments would be in oxidation/absorption mode.[3]

Regeneration of the adsorption layer requires exposure of the catalyst to hydrogen gas. In practice, this is accomplished by reforming natural gas with high-pressure steam to produce a gas mixture consisting of methane, carbon dioxide, and hydrogen that is passed over the catalyst beds.[4] Initial attempts by the developer of the process to create regeneration gases from natural gas and steam within the SCONOx catalyst bed (internal autothermal regeneration) failed to produce consistent results; this approach was abandoned in favor of the current offering, which uses an external steam-heated reformer that partially reforms the natural gas to produce the gas mixture that is introduced into the catalyst bed.[5] The reformation reaction continues to some extent within the catalyst bed due to the presence of steam and the temperature of the catalyst surface, but some methane and VOCs from the natural gas remain.

Because the active regenerant gas is hydrogen, the regeneration process must be performed in an atmosphere of low oxygen to prevent dilution of the hydrogen. In practice, the oxygen present in the exhaust gas of combustion turbines is excluded from the catalyst bed by dividing the catalyst bed into a number of individual cells or compartments that are equipped with front and rear dampers that are closed at the beginning of each regeneration cycle. Proper regeneration of the SCONOx catalyst system depends upon the proper functioning and sealing of these sets of dampers approximately 4 times per hour so that an adequate concentration of hydrogen can be maintained in each module to accomplish complete regeneration of the catalyst before the dampers are opened and the compartment is placed back in service.

Because the SCONOx catalyst can be "poisoned" or rendered inactive by even the very small amounts of sulfur compounds present in natural gas, a SCOSOx catalyst bed (or "guard bed") that is intended to remove trace quantities of sulfur-bearing compounds from the exhaust gas stream is installed upstream of the SCONOx catalyst bed. Like the SCONOx catalyst, the SCOSOx catalyst must be regenerated. Regeneration of the two catalyst types occurs at the same time, with the same regeneration gas supply provided to both; however, the sulfur-bearing regeneration gases for the SCOSOx catalyst exit the SCONOx modules separately from the SCONOx regeneration gases to avoid contaminating the SCONOx catalyst beds. Both regeneration gas streams are returned to the gas turbine exhaust stream downstream of the SCONOx module.[6]

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[2] Personal communication, ABB Environmental, 1/18/00.

[3] Stone & Webster, "Independent Technical Review – SCONOx Technology and Design Review", February 2000.

[4] Stone & Webster, op cit

[5] ABB Environmental, op cit

[6] ABB Environmental, op cit

The external reformer used to create the regeneration gases is supplied with steam and natural gas. For one F-class turbine, an estimated 15,000 to 20,000 lbs/hr of 600°F steam is required, along with approximately 100 pounds per hour (2.2 MMbtu/hr) of natural gas.[7] These quantities would be expected to be lower for the smaller LM6000 combustion turbines used in this project. To avoid poisoning the reformer catalyst, the natural gas supplied to the reformer passes through an activated carbon filter to remove some of the sulfur-bearing compounds that are added to natural gas to facilitate leak detection.[8]

The regeneration cycle time is expected to be controlled using a feedback system based on NOx emission rates.[9] That is, the higher the NOx emissions are relative to the design level, the shorter the absorption cycle, and regeneration cycles will occur more frequently. This is analogous to the use of feedback systems for controlling reagent (ammonia or urea) flow rates in an SCR system.

Maintenance requirements for SCONOx systems are expected to include periodic replacement of the reformer fuel sulfur carbon unit, periodic replacement of the reformer catalyst, periodic washings of the SCOSOx and SCONOx catalyst beds, and periodic replacement of the SCOSOx and SCONOx catalyst beds. The replacement frequency for the reformer sulfur carbon unit and reformer catalyst is unknown to the applicant at present. The SCOSOx catalyst is expected to require washing several times per year. The lead (upstream) SCONOx catalyst bed is also expected to require washing several times per year, while the trailing (downstream) SCONOx catalyst bed(s) are expected to require washing less frequently. The annual catalyst washing process is expected to take approximately three days for an F-class machine, at an estimated annual cost of $200,000.[10] For the smaller LM6000 CTG, the time requirement and cost can be estimated to be approximately one-third of this, or one day and $65,000. The estimated catalyst life is reported to be 7 washings;[11] the guaranteed catalyst life is 3 years.[12]

The adsorption temperature operating range for the SCONOx system is 300°F to 700°F, with an optimal temperature of approximately 600°F.[13] However, regeneration cycles are not initiated unless the catalyst bed temperature is above 450°F to avoid the creation of hydrogen sulfide during the regeneration of the SCOSOx catalyst.[14]

Estimates of control system efficiency vary. ABB Environmental has indicated that the SCONOx system is capable of achieving a 90% reduction in NOx; a 90% reduction in CO, to a level of 2 ppm; and an 80%-85% reduction in VOC emissions.[15] (This VOC reduction is not likely to be achieved with low VOC inlet concentrations, in the 1–2 ppm range.[16]) Commercially quoted NOx emission rates for the SCONOx system range from 2.0 ppm on a 3-hour average basis, representing a 78% reduction,[17] to 1.0 ppm with no averaging

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[7] Ibid
[8] Stone & Webster, op cit
[9] Ibid
[10] Ibid
[11] Ibid
[12] Letter from ABB Alstom Power to Bibb & Associates dated May 5, 2000. (ABB Three Mountain Power or ABB TMP)
[13] Ibid
[14] ABB Environmental, op cit. Stone & Webster, op cit
[15] ABB Environmental, op cit
[16] Ibid
[17] ABB TMP, op cit

period specified (96% reduction).[18] The SCONOx system does not control or reduce emissions of sulfur oxides or particulate matter from the combustion device.[19]

The SCONOx system has been applied at the Sunlaw Federal Cogeneration Plant in Vernon California since December 1996, and at the Genetics Institute Facility in Massachusetts. The Sunlaw facility uses an LM-2500 gas turbine, rated at a nominal 23 MW, and the Genetics Institute facility has a 5 MW Solar gas turbine.

The SCONOx system was proposed for use by PG&E Generating Company at its La Paloma facility; however, PG&E Generating no longer plans to use the SCONOx system at that site.[20] The SCONOx system was also proposed for demonstration by PG&E Generating Company at the Otay Mesa Generating Project; however, PG&E Generating Company sold the project to Calpine and Calpine has indicated that it no longer plans to use SCONOx. Although the technology's co-developer, Sunlaw, proposed to use the technology in conjunction with ABB gas turbines at the Nueva Azalea site in Southern California, the Nueva Azalea project has been withdrawn from the CEC licensing process.

The University of California, San Diego, operates two SoLoNox Titan 130S combustion turbines that are equipped with SCONOx. Each CTG is rated at approximately 13 MW and has NOx and CO emissions limits of 2.5 and 5.0 ppmvd @ 15% O_2, 3-hour average, respectively. Quarterly emission reports for the first 3 quarters of 2002 showed that Unit 1 had 5219 hours of operation with 9 3-hour periods of excess emissions, while Unit 2 had 5294 hours of operation with no exceedances of the 2.5 ppm NOx limit. In 2002, the SCONOx catalyst had to be washed three times, with the units taken off-line each time.

Redding Electric Utility operates a 43 MW Alstom Power Model GTX 100 CTG that is equipped with SCONOx at its Redding power plant. The unit has NOx and CO limits of 2.5 and 6.0 ppmvd @ 15% O_2, one-hour average basis, respectively, with a "demonstration" NOx limit of 2.0 ppm. Despite initial compliance problems, the turbine is currently operating in compliance with the 2.5 ppm NOx limit, but the operator is having to wash the catalyst more often than expected. The unit has not been able to consistently meet the 2.0 ppm "demonstration" limit.

The following information is taken from the ARB's draft report to the legislature, titled "Gas-Fired Power Plant NOx Emission Controls and Related Environmental Impacts," May 2004.

University of California San Diego

The system at the University of California San Diego has been in operation since July 2001. This installation operates at 420 F to treat the exhaust gases from two Solar SoLoNOx Titan 130S gas turbines (26 MW) at a cogeneration plant. Initially, the facility was under a variance with the San Diego County Air Pollution Control District—the turbines passed the start-up source test, but failed their Relative Accuracy Test Audit (RATA).[21] The facility installed a multi-point probe and

[18] Letter from ABB Alstom Power to Sunlaw Energy Corporation dated February 11, 2000. (ABB Sunlaw)
[19] ABB Environmental, op cit
[20] Ibid

[21] The RATA is essentially an on-site analyzer comparison test between the CEMS analyzers and those used by a RATA testing company. Both systems sample the same source and the results are subjected to

subsequently passed the test. The plant operator reports that the permit limits are being met, but that maintenance is more extensive than originally estimated. Quarterly CEMS reports from October 2002 through September 2003 indicate no excess NOx emissions. The plant operator reports NOx measurements meet the 2.5 ppmvd at 15% O_2 permit limit between catalyst washings, which are currently conducted about every four months. During the wash process, the plant is down for about three days. The facility has determined that emission levels are best met when all three layers of catalyst are washed, not just the leading layer. Overall, the facility is pleased with the emissions performance, and they attribute the more frequent washing to the engineering design of the regeneration system (e.g., gas leaks and inefficiencies in regenerating sulfur from the SCOSOx guard bed). Based on experience from this site, EmeraChem has improved the regeneration system design.

City of Redding

The system at the City of Redding Power Plant in Redding, California, has been in operation since June 2002 and has accumulated approximately 8,300 hours of run time. This installation operates at 600 F to treat the exhaust gases from an Alstom Power GTX 100 gas turbine (43 MW) at a combined-cycle plant. Redding Power owns the dampers but has a 15-year lease agreement on the catalyst from Alstom. As such, Alstom is in charge of ongoing catalyst maintenance. The Shasta County Air Quality Management District reports that there have been no major compliance issues in meeting the 2.5 ppmvd at 15% O_2 NOx permit limit. To date, the SCONOx catalyst has required washing about three times per year, and the SCOSOx catalyst has not yet required washing. The wash process is generally completed over a weekend. The SCONOx reactor contains three layers of SCONOx catalyst. Since installation, the leading layer of SCONOx catalyst has been replaced—the second and third layers are the originals.

As discussed further below, there are serious questions about the probability of a successful commercial demonstration and the commercial availability of the technology for application to the SFERP, as well as the levels of emission control that can be consistently achieved. However, based on the preceding discussion, the SCONOx system will be considered as technologically feasible for the purposes of this analysis.

Based on the discussions above, the following NOx control technologies are available and potentially technologically feasible for the proposed project:

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statistical analysis and compared. The average accuracy of the CEMS analyzer relative to the RATA analyzer must be within a specific percentage.

- Water injection
- Selective Catalytic Reduction
- SCONOx

8.1E.1.3 Rank Remaining Control Technologies by Control Effectiveness

The remaining technically feasible control technologies are ranked by NOx control effectiveness in Table 8.1-E-1.

TABLE 8.1E-1
NOx Control Alternatives

NOx Control Alternative	Available?	Technically Feasible?	NOx Emissions (@ 15% O_2)	Environmental Impact	Energy Impacts
Water Injection	Yes	Yes	25 ppm	Increased CO/VOC	Decreased Efficiency
Steam Injection	No	No	15 – 25 ppm	Increased CO/VOC	Increased Efficiency
Dry Low-NOx Combustors	No	No	9-25 ppm	Reduced CO/VOC	Increased Efficiency
Selective Catalytic Reduction	Yes	Yes	>90% reduction 1 – 2.5 ppm	Ammonia slip	Decreased Efficiency
SCONOx	Yes[a]	Yes	>90% reduction 1 – 2.5 ppm	Reduced CO; potential reduction in VOC	Decreased Efficiency

a. There are no standard, commercial guarantees for LM6000 projects for this technology available in the public domain.

8.1E.1.4 Available Control Options and Technical Feasibility

In a March 24, 2000 letter sent to local air pollution control districts, EPA Region 9 stated that the SCONOx Catalytic Adsorption System should be included in any BACT/LAER analysis for combined cycle combustion turbine power plant projects since it can achieve the BACT/LAER emission specification for NO_x of 2.5 ppmvd @ 15% O_2, averaged over one hour or 2.0 ppmvd @ 15% O_2, averaged over three hours. In this letter, EPA stated that ABB Alstom Power, the exclusive licensee for SCONOx applications, has conducted "full-scale damper testing" that demonstrates that SCONOx is technically feasible for utility-scale combustion turbines. Stone & Webster Management Consultants, Inc. of Denver, Colorado was subsequently hired by ABB to conduct an independent technical review of the SCONOx technology as well as the full-scale damper testing program. According to the report by Stone & Webster, modifications to the actuators, fiberglass seals, and louver shaft-seal interface are being incorporated to resolve unacceptable reliability and leakage problems. However, no subsequent testing of the redesigned components has occurred to determine if the problems have been solved. Because the feasibility of the "scale-up" of the SCONOx system for large turbines has not been demonstrated, SCONOx is not considered to be a demonstrated NO_x control technology

for projects of the size of the SFERP. Further, the SFERP consists of simple-cycle and not combined-cycle combustion turbines.

Although SCONOx is not considered to be a demonstrated control alternative for this project, it may be considered a technically feasible technology, and thus we have analyzed the collateral impacts of both SCR and SCONOx. Because SCONOx does not offer any emission control benefits over SCR control technology, the following analysis compares the cost-effectiveness and collateral impacts of the two technologies. The analysis shown in Table 8.1E-2 applies to three GE LM6000 combustion turbines equipped with water injection and an uncontrolled NO_x emission rate of 25 ppmvd @ 15% O_2. Details of the calculations are shown in Figures 8.1E-1 and 8.1E-2.

TABLE 8.1E-2
Top-Down BACT Analysis Summary for NOx

Control Technology	Controlled Emissions, tpy[a]	Emissions Controlled, tpy[b]	Average Cost-Effectiveness, $/ton[c]	Electricity Cost Impact, $/kwh[d]	Collateral Toxic Impacts?	Incremental Energy Impact, MMBtu/yr[e]
SCONOx	39.8	224.7	$18,671	0.981	No	109,818
SCR	39.8	224.7	$7,253	0.381	No	61,119

a. From Table 8.1A-5, based on 2.5 ppmvd controlled emission rate. Total, three turbines.
b. Based on 25 ppmvd uncontrolled emission rate from turbines, 90% control. Total, three turbines.
c. Total annual costs from ONSITE SYCOM Energy Corporation report for US DOE: "Cost Analysis of NOx Control Alternatives for Stationary Gas Turbines, Contract No. DE-FC02-97CHIO877," October 15, 1999. Scaled for 47.5 MW LM6000 turbine from data in Tables A-5 and A-7.
d. Electricity cost from Ref c.
e. "Towantic Energy Project Revised BACT Analysis", RW Beck, February 18, 2000; based upon increased fuel use required to overcome catalyst bed back pressure. Scaled by ratio of Frame 7FA unit to LM6000 unit, or 161 MW/47.5 MW.

Energy Impacts

As shown in Table 8.1E-2, the use of SCR does not result in any significant or unusual energy penalties or benefits when compared to SCONOx. Although the operation and maintenance of SCONOx does result in a greater energy penalty when compared to that of SCR, this is not considered significant enough to eliminate SCONOx as a control alternative.

Economic Impacts

According to EPA's 1990 Draft New Source Review Workshop Manual, "Average and incremental cost effectiveness are the two economic criteria that are considered in the BACT analysis."

As shown in Table 8.1E-2, the average cost-effectiveness of both SCR and SCONOx meet the current District cost-effectiveness guideline of $17,500 per ton of NO_x abated. However, the average cost-effectiveness of SCR is approximately 40% of the average cost-effectiveness of SCONOx. These figures are based on total annualized cost figures from a cost analysis conducted by ONSITE SYCOM Energy Corporation.[22] Although SCONOx

[22] ONSITE SYCOM Energy Corporation for US DOE: "Cost Analysis of NOx Control Alternatives for Stationary Gas Turbines," Contract No. DE-FC02-97CHIO877, October 15, 1999.

will result in greater economic impact as quantified by average cost effectiveness, this impact is not considered adverse enough to eliminate SCONOx as a control alternative. Incremental cost-effectiveness does not apply since SCR and SCONOx both achieve the BACT standard for NO_x of 2.5 ppmvd @ 15% O_2, averaged over three hours, and therefore achieve the same NO_x emission reduction in tons per year.

Environmental Impacts

The use of SCR will result in ammonia emissions due to an allowable ammonia slip limit of 10 ppmvd @ 15% O_2. A health risk screening analysis of the proposed project using air dispersion modeling showed an acute hazard index and a chronic hazard index to be each much less than 1, resulting from an ammonia slip limit of 10 ppmv @ 15% O_2. In accordance with the District Toxic Risk Management Policy and currently accepted practice, a hazard index of less than 1.0 or above is considered not significant. Therefore, the toxic impact of the ammonia slip resulting from the use of SCR is deemed to be not significant and is not a sufficient reason to eliminate SCR as a control alternative.

The ammonia emissions resulting from the use of SCR may have another environmental impact through their potential to form secondary particulate matter such as ammonium nitrate. Because of the complex nature of the chemical reactions and dynamics involved in the formation of secondary particulates, it is difficult to estimate the amount of secondary particulate matter that will be formed from the emission of a given amount of ammonia. However, the Research and Modeling section of the BAAQMD Planning Division has stated in previous CEC proceedings that the formation of ammonium nitrate in the Bay Area air basin is limited by the formation of nitric acid and not driven by the amount of ammonia in the atmosphere. Therefore, ammonia emissions from the proposed SCR system are not expected to contribute significantly to the formation of secondary particulate matter within the BAAQMD.

A second potential environmental impact that may result from the use of SCR involves the storage and transport of aqueous ammonia. Although ammonia is toxic if swallowed or inhaled and can irritate or burn the skin, eyes, nose, or throat, it is a commonly used material that is typically handled safely and without incident. The SFERP will be required to maintain a Risk Management Plan (RMP) and implement a Risk Management Program to prevent accidental releases (see Section 8.5 of the AFC). The RMP will provide information on the hazards of the substance handled at the facility and the programs in place to prevent and respond to accidental releases. The accident prevention and emergency response requirements reflect existing safety regulations and sound industry safety codes and standards. In addition, the modeling analysis of the health impacts arising from a catastrophic release of ammonia due to spontaneous storage tank failure at the SFERP shows that the impact would not be significant. Thus the potential environmental impact due to aqueous ammonia storage at the SFERP does not justify the elimination of SCR as a control alternative.

Conclusion

Because both SCR and SCONOx can achieve the proposed BACT NO_x emission limit of 2.5 ppmvd @ 15% O_2 averaged over three hours and neither will cause significant energy, economic, or environmental impacts, neither can be eliminated as viable control alternatives. The concern remains regarding the long-term effectiveness of SCONOx as a control technology as the technology has not been demonstrated on the turbines used in this project. For this reason, SCR has been selected as the NOx control technology to be used for the the SFERP.

8.1E.2 Determination of BACT Emission Rates

The BACT analysis performed for NOx control includes the following:

- Review of published BACT guidelines for natural gas-fired simple cycle gas turbines;
- Review of recent BACT decisions for natural gas-fired simple-cycle gas turbines;
- Review of continuous NOx emissions monitoring data for natural gas-fired simple-cycle gas turbines obtained from EPA's acid rain website;
- Review of federal NSPS for natural gas-fired simple cycle gas turbines; and
- Review of published prohibitory rules for natural gas-fired simple cycle gas turbines.

Published BACT Guidelines

Published BACT determinations from the following agencies were reviewed to identify relevant previously established BACT guidelines:

- California Air Resources Board (ARB);
- Bay Area Air Quality Management District (BAAQMD);
- San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD); and
- South Coast Air Quality Management District (SCAQMD).

ARB's BACT Clearinghouse contained determinations by the Sacramento Metropolitan Air Quality Management District (SMAQMD) that specified water injection and SCR achieving an emission limit of 5 ppmv @ 15% O_2 as BACT for the following facilities:

- Carson Energy Group cogeneration plant in Sacramento, California; and
- Sacramento Cogeneration Authority cogeneration plant in Sacramento, California.

This clearinghouse has not been updated since 2000. ARB is also in the process of developing a new guideline document for power plant permitting. The most recent available ARB document on this subject[23] indicated that BACT for NOx from gas turbines

[23] ARB Guidance for the Permitting of Electrical Generation Technologies, July 2002.

without heat recovery systems rated at < 50 MW was still 5 ppmv @ 15% O_2 on a 3-hour average basis.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple cycle combustion gas turbines, a NOx limit of 5 ppmv @ 15% O_2 has been "achieved in practice." This BACT guideline was established in CARB's Guidance for Power Plant Sitting and Best Available Control Technology (June 1999).

The SJVUAPCD's BACT guidelines contained a determination for gas turbines rated at less than 50 MW with uniform load and without heat recovery. The SJVUAPCD concluded that a NOx exhaust concentration of 5 ppmv @ 15% O_2 constituted BACT that had been achieved in practice and 3 ppmv @ 15% O_2 constituted BACT that is technologically feasible.

Recent BACT Decisions

The ARB staff has prepared a draft table summarizing NOx emission control requirements and permitted emission levels for simple-cycle power plant gas turbines. This table showed that most of the recently permitted simple-cycle gas turbine projects in California have been required to meet NOx BACT limits of 2.5 to 3 ppmvd @ 15% O_2 on a 3-hour average basis. The most recent of these BACT determinations was made by the SJVUAPCD for the Modesto Irrigation District MEGS project, which also consists of GE LM6000 Sprint gas turbines equipped with water injection and SCR for NOx control. For this project, which has been approved by the District and was licensed by the CEC on February 4, 2004, NOx BACT was determined to be 2.5 ppmvd @ 15% O_2 on a 3-hour average basis.

This table also shows that in 2001, the Massachusetts Department of Environmental Protection issued two permits for GE LM6000 simple-cycle gas turbines with NOx emissions limitations of 2.0 ppmvd @ 15% O_2 on a 1-hour average basis. Only one of these facilities is currently in operation and reporting emissions data to EPA, and as discussed below, the operating facility has not been able to meet this limit in operation. The NOx limit has been changed to 3.5 ppmvd @ 15% O_2, which is higher than the level considered to be BACT in California.

The SCAQMD database included a December 2001 determination for the Wildflower Energy Indigo power plant that BACT for NOx for a simple-cycle LM5000 Sprint gas turbine was 5 ppm on a 1-hour average basis.

Review of NOx CEMS Data

Real-time hourly NOx CEMS data are available on EPA's Acid Rain website for generating units that are subject to acid rain reporting requirements. The reported NOx data for the West Springfield Redevelopment Project simple-cycle gas turbines were analyzed for compliance with the original permit limit of 2.0 ppmvd @ 15% O_2, 1-hour average basis. Five quarters of monitoring data were available for each of the two West Springfield Redevelopment Project units. Analysis of these data showed that when low-load, startup/shutdown and commissioning periods were excluded, the turbines operated in compliance with the 2.0 ppm, 1-hour average permit limit only between 10 and 20% of the time (see Table 8.1E-3). Even a 3.0 ppm, 3-hour average limit would have been exceeded almost 10% of the time. The NOx limit for these turbines was recently revised to 3.5 ppmvd @ 15% O_2.

Federal NSPS

The NSPS applicable to new natural gas-fired combustion gas turbines are found in Title 40 CFR Part 60 Subpart GG. As discussed in Section 8.1.4.2.2 of the application, the NOx emission limit applicable to the proposed combustion gas turbines will be 109 ppmv @ 15% O_2.

Table 8.1E-3
Summary of NOx Emissions Performance: West Springfield Redevelopment Project LM6000 Simple Cycle Gas Turbines

Unit/Period	Averaging Prd	Exceedance Frequency Based on NOx Limit, ppmvd @ 15% O_2		
		3.0	2.5	2.0
Unit 1				
5/1 to 12/31/2002	1 hour	14%	43%	84%
	3 hours	11%	37%	82%
1/1 to 6/30/2003	1 hour	20%	34%	98%
	3 hours	13%	27%	99%
Unit 2				
5/1 to 12/31/2002	1 hour	11%	53%	79%
	3 hours	9%	56%	77%
1/1 to 6/30/2003	1 hour	7%	16%	90%
	3 hours	5%	18%	91%

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SMAQMD, San Diego County Air Pollution Control District (SDCAPCD), SJVUAPCD, and SCAQMD were reviewed to identify the NOx standards that govern existing natural gas-fired simple cycle combustion gas turbines.

- BAAQMD adopted Rule 9-9 (Nitrogen Oxides from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 9-9 specifies an efficiency-adjusted NOx emission limit of 13.0 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW, rated at 9,353 Btu/kW-hr (HHV), and equipped with SCR.
- The SMAQMD adopted Rule 413 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 413 specifies a NOx emission limit of 9 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW and equipped with SCR.
- The SJVUAPCD adopted Rule 4703 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 4703 specifies an enhanced Tier II NOx emission limit of 3 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated at no less than 10 MW and equipped with SCR (April 30, 2008 deadline).

- The SCAQMD adopted Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 1134 specifies an efficiency-adjusted NOx emission limit of 13 ppmv @ 15% O_2 for natural gas-fired combustion gas turbines rated no less than 10 MW, rated at 9,353 Btu/kW-hr, and equipped with SCR.

Conclusions

BACT must be at least as stringent as the most stringent level achieved in practice, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the NOx BACT determination of 2.5 ppm @ 15% O_2 on a 3-hour average basis made for recently permitted simple cycle turbine projects in the Bay Area and the SJVUAPCD reflects the most stringent achievable NOx emission limit. Therefore, BACT for NOx emissions for natural gas-fired simple cycle combustion gas turbines is 2.5 ppmv @ 15% O_2. The SFERP facility will be designed to meet a NOx level of 2.5 ppmv @ 15% O_2 on a 3-hour average basis.

Carbon Monoxide

The BACT analysis performed for CO control includes the following:

- Review of published BACT guidelines for natural gas-fired simple cycle combustion gas turbines;
- Review of recent BACT decisions for natural gas-fired simple-cycle gas turbines;
- Review of federal NSPS for natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for natural gas-fired simple cycle combustion gas turbines.

Published BACT Guidelines

As discussed in the previous section, published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- ARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The ARB's BACT guidance document for electric generating units rated at less than 50 MW[24] indicates that BACT for the control of CO emissions from stationary gas turbines rated at less than 50 MW used in electrical generation is 6 ppmvd @ 15% O_2.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple cycle combustion gas turbines, a CO limit of 6 ppmv @ 15% O_2 has been "achieved in practice." A BACT guideline of 6 ppmv @ 15% O_2 was established in CARB's Guidance for Power Plant Sitting and Best Available Control Technology (June 1999).

[24] Ibid, Table I-1.

The SJVUAPCD's BACT guidelines contained a determination for gas turbines rated at less than 50 MW with uniform load and without heat recovery. The SJVUAPCD concluded that a CO exhaust concentration of 6 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

The SCAQMD database did not contain BACT guidelines for VOC emissions from natural gas-fired simple cycle combustion gas turbines.

Recent BACT Decisions

The ARB staff has prepared a draft table of NOx emission control requirements and permitted emission levels for simple-cycle power plant gas turbines. This table, which includes information regarding limits for VOC, CO, PM_{10}, SO_2 and ammonia, shows that most of the recently permitted simple-cycle gas turbine projects in California have been required to meet CO BACT limits of 6 ppmvd @ 15% O_2 on a 1-hour average basis. The most recent of these BACT determinations was made by the SJVUAPCD for the Modesto Irrigation District Ripon project, which also consists of GE LM6000 Sprint gas turbines equipped with water injection and SCR for NOx control. For this project, which has been approved by the District and is expected to be licensed by the CEC before the end of 2003, CO BACT was determined to be 6 ppmvd @ 15% O_2 on a 3-hour average basis.

The SCAQMD database included a December 2001 determination for the Wildflower Energy Indigo power plant that BACT for CO for a simple-cycle LM5000 Sprint gas turbine was 6 ppm on a 1-hour average basis.

Federal NSPS

The NSPS applicable to new natural gas-fired combustion gas turbines are found in Title 40 CFR Part 60 Subpart GG. This NSPS does not specify an emission limit for CO.

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SMAQMD, SDCAPCD, SJVUAPCD, and SCAQMD were reviewed to identify the CO standards that govern existing natural gas-fired simple cycle combustion gas turbines. Of the five prohibitory rules reviewed, the SJVUAPCD prohibitory rule for combustion gas turbines is the only one that includes an emission limit for CO (200 ppmv @ 15% O_2). Generic prohibitory rules (i.e., not device specific) from each of these districts were also reviewed; emission limits are 2000 ppmv at actual operating conditions.

Conclusions

BACT must be at least as stringent as the most stringent level required in a permit, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the BAAQMD BACT determination for natural gas-fired simple cycle combustion gas turbines, obtained from CARB's Guidance for Power Plant Sitting and Best Available Control Technology, reflects the most stringent CO emission limit. Therefore, BACT for CO emissions from natural gas-fired simple cycle combustion gas turbines is 6 ppmv @ 15% O_2. The proposed CO emission limit of 4 ppmvd @ 15% O_2 on a 3-hour average

basis is more stringent than the level currently considered BACT, but is expected to be achievable in practice.

Volatile Organic Compounds

The BACT analysis performed for VOC control includes the following:

- Review of published BACT guidelines for natural gas-fired simple cycle combustion gas turbines;
- Review of recent BACT decisions for natural gas-fired simple-cycle gas turbines;
- Review of federal NSPS for natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for natural gas-fired simple cycle combustion gas turbines.

Published BACT Guidelines

As discussed previously, published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- ARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The ARB's BACT guidance document for electric generating units rated at less than 50 MW[25] indicates that BACT for the control of POC emissions from stationary gas turbines rated at less than 50 MW used in electrical generation is 2 ppmvd @ 15% O_2.

ARB's BACT Clearinghouse contained SMAQMD determinations that specified an oxidation catalyst achieving an emission limit of 2.1 ppmv @ 15% O_2 as BACT for the following facilities:

- Carson Energy Group cogeneration plant in Sacramento, California; and
- Sacramento Cogeneration Authority cogeneration plant in Sacramento, California.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple cycle combustion gas turbines, a VOC limit of 2 ppmv @ 15% O_2 has been "achieved in practice." This BACT guideline was established in CARB's Guidance for Power Plant Sitting and Best Available Control Technology (June 1999).

The SJVUAPCD's BACT guidelines contained a determination for gas turbines rated at less than 50 MW with uniform load and without heat recovery. The SJVUAPCD concluded that a VOC exhaust concentration of 2.0 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

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[25] Ibid, Table I-1.

The SCAQMD database did not contain BACT guidelines for VOC emissions from natural gas-fired simple cycle combustion gas turbines.

Recent BACT Decisions

The ARB staff has prepared a draft table summarizing NOx emission control requirements and permitted emission levels for simple-cycle power plant gas turbines. This table, which includes information regarding limits for VOC, CO, PM_{10}, SO_2 and ammonia, shows that most of the recently permitted simple-cycle gas turbine projects in California have been required to meet VOC BACT limits of 2 ppmvd @ 15% O_2 on a 1- or a 3-hour average basis. The most recent of these BACT determinations was made by the SJVUAPCD for the Modesto Irrigation District Ripon project, which also consists of GE LM6000 Sprint gas turbines equipped with water injection and SCR for NOx control. For this project, which has been approved by the District and is expected to be licensed by the CEC before the end of 2003, VOC BACT was determined to be 2 ppmvd @ 15% O_2 on a 3-hour average basis.

The SCAQMD database included a December 2001 determination for the Wildflower Energy Indigo power plant that BACT for VOC for a simple-cycle LM5000 Sprint gas turbine was 2 ppm on a 1-hour average basis.

Federal NSPS

The NSPS applicable to new natural gas-fired combustion gas turbines are found in Title 40 CFR Part 60 Subpart GG. This NSPS does not specify an emission limit for VOC.

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SMAQMD, SDCAPCD, SJVUAPCD, and SCAQMD were reviewed to identify the VOC standards that govern existing natural gas-fired simple cycle combustion gas turbines. None of the prohibitory rules for combustion gas turbines, discussed previously in Section IV.A.3, specify an emission limit for VOC. Generic prohibitory rules (i.e., not device specific) from each of these districts were also reviewed; none contain an emission limit for VOC.

Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the BAAQMD BACT determination for natural gas-fired simple cycle combustion gas turbines, obtained from CARB's Guidance for Power Plant Siting and Best Available Control Technology, reflects the most stringent VOC emission limit. The BAAQMD established VOC emission limits of 2 ppmv @ 15% O_2 for natural gas-fired simple cycle combustion gas turbines. Therefore, BACT for VOC emissions from natural gas-fired simple cycle combustion gas turbines is 2 ppmv @ 15% O_2.

Particulate Matter Less Than 10 Microns in Diameter (PM_{10})

The BACT analysis performed for PM_{10} includes the following:

- Review of published BACT guidelines for comparable natural gas-fired simple cycle combustion turbines;
- Review of recent BACT decisions for natural gas-fired simple-cycle gas turbines;
- Review of federal NSPS for small natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for comparable natural gas-fired simple cycle combustion gas turbines.

Published BACT Guidelines

Published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- ARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The ARB BACT Clearinghouse, as well as the BAAQMD and SJVUAPCD BACT guidelines, identify the use of natural gas as the primary fuel as "achieved in practice" for the control of PM_{10} for small simple cycle combustion gas turbines.

The ARB's BACT guidance document for electric generating units rated at less than 50 MW[26] indicates that BACT for the control of PM emissions from stationary gas turbines rated at less than 50 MW used in electrical generation is an emission limit corresponding to natural gas with fuel sulfur content of no more than 1 grain/100 standard cubic foot.

The SCAQMD database contained BACT determinations for the Los Angeles Department of Power and Water plant in Sun Valley, CA, and the Indigo Energy Facility in North Palm Springs, CA. The SCAQMD concluded that an exhaust PM_{10} concentration of 0.01 gr/dscf (equivalent to 11 lb/hr) constituted BACT.

Recent BACT Decisions

The ARB staff has prepared a draft table summarizing NOx emission control requirements and permitted emission levels for simple-cycle power plant gas turbines. This table, which includes information regarding limits for VOC, CO, PM_{10}, SO_2 and ammonia, shows that most of the recently-permitted simple-cycle gas turbine projects in California have been required to meet PM_{10} limits of 3.0 lb/hr.

[26] Ibid, Table I-1.

Federal NSPS

Title 40 CFR Part 60 Subpart GG contains the applicable NSPS for combustion gas turbines. Section III.H previously identified the requirements of Subpart GG applicable to the proposed combustion gas turbine; Subpart GG does not regulate PM_{10} emissions.

District Prohibitory Rules

Published prohibitory rules from the District, SCAQMD, SJVUAPCD, SMAQMD, and SDCAPCD were reviewed to identify the PM_{10} standards that govern existing small natural gas-fired combustion gas turbines:

- BAAQMD adopted Rule 9-9 (Nitrogen Oxides from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 9-9 does not regulate PM_{10} emissions.
- BAAQMD Regulation 6 (Particulate Matter and Visible Emissions) specifies a PM emission limit of 0.15 gr/dscf for sources of PM emissions.
- The SMAQMD adopted Rule 413 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 413 does not regulate PM_{10} emissions.
- SMAQMD Rule 404 (Particulate Matter) specifies a PM emission limit of 0.1 gr/dscf for sources of PM emissions.
- SMAQMD Rule 406 (Specific Contaminants) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.
- The SDCAPCD adopted Rule 69.3.1 (Stationary Gas Turbine Engines – Best Available Retrofit Control Technology) to limit NOx emissions from these devices. Rule 69.3.1 does not regulate PM_{10} emissions.
- SDCAPCD Rule 52 (Particulate Matter) specifies a PM_{10} emission limit of 0.1 gr/dscf for sources of PM emissions.
- SDCAPCD Rule 53 (Specific Air Contaminants) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.
- The SJVUAPCD adopted Rule 4703 (Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 4703 does not regulate PM_{10} emissions.
- SJVUAPCD Rule 4201 (Particulate Matter - Concentration) specifies a PM emission limit of 0.1 gr/dscf for sources of PM emissions.
- SJVUAPCD Rule 4301 (Fuel Burning Equipment) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.
- The SCAQMD adopted Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) to limit NOx emissions from these devices. Rule 1134 does not regulate PM_{10} emissions.
- SCAQMD Rule 404 (Particulate Matter - Concentration) specifies a PM emission limit of 0.0437 gr/dscf for sources of PM emissions.

- SCAQMD Rule 409 (Combustion Contaminants) specifies a PM emission limit of 0.1 gr/dscf @ 12% CO_2 for combustion sources.

Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the BAAQMD BACT guideline reflects the most stringent PM_{10} emission limit. The District established a requirement for the use of natural gas as the primary fuel to control PM_{10} emissions from combustion gas turbines. Therefore, the use of natural gas as the primary fuel source constitutes BACT for PM_{10} emissions from small simple cycle combustion gas turbines. Through the use of natural gas, the turbines are expected to be able to meet the proposed emission limit of 3.0 lb/hr per turbine.

Sulfur Oxides

The BACT analysis performed for SOx included the following:

- Review of published BACT guidelines for small natural gas-fired simple cycle combustion turbines;
- Review of recent BACT decisions for natural gas-fired simple-cycle gas turbines;
- Review of federal NSPS for small natural gas-fired simple cycle combustion gas turbines; and
- Review of published prohibitory rules for small natural gas-fired simple cycle combustion gas turbines.

Published BACT Guidelines

Published BACT determinations from the following agencies were reviewed to identify any previously established BACT guidelines:

- ARB;
- BAAQMD;
- SJVUAPCD; and
- SCAQMD.

The CARB BACT Clearinghouse, as well as the BAAQMD and SJVUAPCD BACT guidelines, identify the use of PUC-quality natural gas or natural gas with a limit on the sulfur content (i.e., 1 grain/100 scf) as the primary fuel as "achieved in practice" for the control of SOx for small simple cycle combustion gas turbines. The two most recent BACT determinations in the SCAQMD did not indicate BACT for SOx.

Recent BACT Decisions

The ARB staff has prepared a draft table of NOx emission controls required for simple-cycle power plant gas turbines. This table, which includes information regarding limits for VOC, CO, PM_{10}, SO_2 and ammonia) showed that most of the recently permitted

simple-cycle gas turbine projects in California have been required to meet hourly SO_2 limits that correspond to fuel sulfur content limits of between 0.33 and 1.0 gr/100 scf.

Federal NSPS

Title 40 CFR Part 60 Subpart GG contains the applicable NSPS for combustion gas turbines. Section III.B previously identified the requirements of Subpart GG applicable to the proposed combustion gas turbine. A combustion gas turbine is subject to a SO_2 emission limit of 0.015% by volume (150 ppmv) @ 15% O_2. The NSPS also limits the sulfur content of fuel to 0.8% by weight.

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SJVUAPCD, and SCAQMD were reviewed to identify the SO_2 standards that govern existing gas turbines.

- BAAQMD Rule 9-9 (Nitrogen Oxides from Stationary Gas Turbines) is the BAAQMD's only prohibitory rule that specifically addresses gas turbines but does not limit SO_2 emissions. The BAAQMD adopted Rule 9-1 (Sulfur Dioxide) to limit SO_2 emissions from all sources. Rule 9-1 prohibits SO_2 emissions in excess of 300 ppm. No other BAAQMD Rule or Regulation contains a relevant prohibitory rule regulating either the sulfur content in the fuel or the emission of SO_2 from gas turbines.
- SJVUAPCD Rule 4703 (Stationary Gas Turbines) is the SJVUAPCD's only prohibitory rule that specifically addresses gas turbines but does not limit SO_2 emissions. The SJVUAPCD adopted Rule 4301 (Fuel Burning Equipment) to limit SO_2 emissions from these devices. Rule 4301 specifies a SO_2 emission limit of 200 pounds per hour. The SJVUAPCD also adopted Rule 4801 (Sulfur Compounds) to limit emissions of sulfur compounds. Rule 4801 specifies a SO_2 emission limit of 0.2%, or 2,000 ppm.
- SCAQMD Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines) is the SCAQMD's only prohibitory rule that specifically addresses gas turbines but does not limit SO_2 emissions. The SCAQMD adopted Rule 431.1 (Sulfur Content of Gaseous Fuels) to reduce SOx emissions from the burning of gaseous fuels in stationary equipment. Rule 431.1 specifies a sulfur limit of 16 grains/100 scf (as H_2S) in natural gas sold within the SCAQMD. The SCAQMD also adopted Rule 407 (Liquid and Gaseous Air Contaminants) to limit SO_2 emissions from all sources. Rule 407 specifies an emission limit of 2,000 ppm for sulfur compounds (calculated as SO_2).

Conclusions

BACT must be at least as stringent as the most stringent BACT determination, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the CARB database and BAAQMD and SJVUAPCD BACT guidelines reflect the most stringent SOx emission limit. These sources established a requirement for the use of natural gas as the primary fuel to control SOx emissions from combustion gas turbines. Therefore, the use of natural gas as the primary fuel source constitutes BACT for SOx emissions from small simple cycle combustion gas turbines.

Summary

The criteria that constitute BACT for the proposed natural gas-fired simple cycle combustion gas turbine are summarized in Table 8.1E-4 and compared against the design criteria for the proposed combustion gas turbine.

Table 8.1E-4
Summary of Emission Limits and BACT Requirements

Pollutant	BACT	Proposed Control Level
NOx	Emission Limit = 2.5 ppmv @ 15% O_2	Design Exhaust Concentration = 2.5 ppmv @ 15% O_2
CO	Emission Limit = 4 ppmv @ 15% O_2	Design Exhaust Concentration = 4 ppmv @ 15% O_2
VOC	Emission Limit = 2 ppmv @ 15% O_2	Design Exhaust Concentration = 2 ppmv @ 15% O_2
SOx	Natural gas fuel	Natural gas fuel
PM_{10}	Natural gas fuel	Natural gas fuel

Figure 8.1E-1

SCR Cost-Effectiveness Calculation

1999 SCR Cost Comparison

			5 MW Class	25 MW Class	50 MW Class	150 MW Class
Turbine Model			Solar Centaur 50	GE LM2500	GE LM6000	GE Frame 7FA
Turbine Output			4.2 MW	23 MW	47.5 MW	161 MW
Direct Capital Costs (DC)		Source				
Purchased Equip. Cost (PE)		MHIA				
Basic Equipment (A)		MHIA	$ 240,000	$ 660,000	$ 733,782	$ 210,000
Ammonia injection skid and storage	0.00 x A	MHIA	included	included	included	included
Instrumentation	0.00 x A	OAQPS	included	included	included	included
Taxes and freight	0.08 A x B	OAQPS	$ 19,015	$ 52,746	$ 58,703	$ 169,530
PE Total			$ 256,704	$ 712,066	$ 792,484	$ 2,288,649
Direct Installation Costs (DI)						
Foundation & supports	0.08 x PE	OAQPS	$ 20,536	$ 56,965	$ 63,399	$ 183,092
Handling and erection	0.14 x PE	OAQPS	$ 35,939	$ 99,689	$ 110,948	$ 320,411
Electrical	0.04 x PE	OAQPS	$ 10,268	$ 28,483	$ 31,699	$ 91,546
Piping	0.02 x PE	OAQPS	$ 5,134	$ 14,241	$ 15,850	$ 45,773
Insulation	0.01 x PE	OAQPS	$ 2,567	$ 7,121	$ 7,925	$ 22,886
Painting	0.01 x PE	OAQPS	$ 2,567	$ 7,121	$ 7,925	$ 22,886
DI Total			$ 77,011	$ 213,620	$ 237,745	$ 686,595
DC Total			$ 333,715	$ 925,686	$ 1,030,229	$ 2,975,244
Indirect Costs (IC)						
Engineering:			$ 25,670	$ 71,207	$ 79,248	$ 100,000
Construction and field expenses			$ 12,835	$ 35,603	$ 39,624	$ 114,432
Contrctor fees			$ 25,670	$ 71,207	$ 79,248	$ 228,865
Start-up			$ 5,134	$ 14,241	$ 15,850	$ 45,773
Performance testing			$ 2,567	$ 7,121	$ 7,925	$ 22,886
Contingencies			$ 7,701	$ 21,362	$ 23,775	$ 68,659
IC Total			$ 79,578	$ 220,740	$ 245,670	$ 580,616
Total Capital Investment (TCI = DC + IC)			$ 413,293	$ 1,146,426	$ 1,275,899	$ 3,555,860
Direct Annual Costs (DAC)						
Operating Costs (O)	24 hrs/day, 7 days/wk, 50 wks/yr					
Operator	0.5 hrs/shift $25/hr	OAQPS	$ 13,125	$ 13,125	$ 13,125	$ 13,125
Supervisor	15% of Operator	OAQPS	$ 1,969	$ 1,969	$ 1,969	$ 1,969
Maintenance Costs (M)						
Labor	0.5 hrs/shift $25/hr	OAQPS	$ 13,125	$ 13,125	$ 13,125	$ 13,125
Material	100% of labor cost	OAQPS	$ 13,125	$ 13,125	$ 13,125	$ 13,125
Utility Costs						
Perf Loss	0.50%					
Electricity cost	0.06 ($/kwh) performance penalty	variable	$ 10,584	$ 57,960	$ 119,700	$ 405,720
Catalyst replacement			$ 10,352	$ 56,690	$ 117,077	$ 396,833
Catalyst disposal			$ 388	$ 2,126	$ 4,391	$ 14,881
Ammonia	$360/ton * tons NOx*17/46		$ 3,510	$ 14,820	$ 9,965	$ 108,257
NH3 injection skid			$ 5,040	$ 7,560	$ 11,228	$ 77,589
Total DAC			$ 71,218	$ 180,500	$ 303,705	$ 1,044,624
Indirect Annual Costs (IAC)						
Overhead	60% of O&M		$ 24,806	$ 24,806	$ 24,806	$ 24,806
Administrative	0.02 x TCI		$ 8,266	$ 22,929	$ 25,518	$ 71,117
Insurance	0.01 x TCI		$ 4,133	$ 11,464	$ 12,759	$ 35,559
Property tax	0.01 x TCI		$ 4,133	$ 11,464	$ 12,759	$ 35,559
Capital recovery	10% interest rate, 15 yr period					
	0.13 x TCI		$ 53,037	$ 147,119	$ 163,734	$ 456,316
Total IAC			$ 94,375	$ 217,782	$ 239,576	$ 623,357
Total Annual Cost (DAC + IAC)			$ 165,593	$ 398,282	$ 543,281	$ 1,667,981

NOx Emission Rate (tons/yr) at 25 ppm		88.2		
NOx Removed (TPY) at 2.5 ppm	90% removal efficiency	74.9		
Cost Effectiveness ($/ton)		7,253.41		
Electricity Cost Impact (c/kwh)		0.381		
Increased natural gas use		20,033	135,800	MCF
	1017 Btu/scf	20,373	138,109	MMBtu

Figure 8.1E-2

SCONOX Cost Effectiveness Calculation

1999 SCONOx Cost Comparison

			5 MW Class	25 MW Class	50 MW Class	150 MW Class
Turbine			Solar Centaur			GE Frame
Model			50	GE LM2500	GE LM6000	7FA
Turbine Output			4.2 MW	23 MW	47.5 MW	161 MW
Direct Capital Costs (DC)		Source				
Purchased Equip. Cost (PE)		Goalline				
Basic Equipment (A)		Goalline	$ 620,000	$ 1,960,000	$ 2,759,107	$ 7,700,000
Ammonia injection skid and storage	0.00 x A	Goalline	included	included	included	included
Instrumentation	0.00 x A	OAQPS	included	included	included	included
Taxes and freight	0.08 A x B	OAQPS	$ 49,760	$ 157,105	$ 220,729	$ 612,238
PE Total			$ 671,760	$ 2,120,916	$ 2,979,836	$ 8,265,208
Direct Installation Costs (DI)						
Foundation & supports	0.08 x PE	OAQPS	$ 53,741	$ 169,673	$ 238,387	$ 661,217
Handling and erection	0.14 x PE	OAQPS	$ 94,046	$ 296,928	$ 417,177	$ 1,157,129
Electrical	0.04 x PE	OAQPS	$ 26,870	$ 84,837	$ 119,193	$ 330,608
Piping	0.02 x PE	OAQPS	$ 13,435	$ 42,418	$ 59,597	$ 165,304
Insulation	0.01 x PE	OAQPS	$ 6,718	$ 21,209	$ 29,798	$ 82,652
Painting	0.01 x PE	OAQPS	$ 6,718	$ 21,209	$ 29,798	$ 82,652
DI Total			$ 201,528	$ 636,275	$ 893,951	$ 2,479,562
DC Total			$ 873,288	$ 2,757,191	$ 3,873,786	$ 10,744,770
Indirect Costs (IC)						
Engineering:			$ 67,176	$ 212,092	$ 297,984	$ 826,521
Construction and field expenses			$ 33,588	$ 106,046	$ 148,992	$ 413,260
Contrctor fees			$ 67,176	$ 212,092	$ 297,984	$ 826,521
Start-up			$ 13,435	$ 42,418	$ 59,597	$ 165,304
Performance testing			$ 6,718	$ 21,209	$ 29,798	$ 82,652
Contingencies			$ 20,153	$ 63,627	$ 89,395	$ 247,956
IC Total			$ 208,246	$ 657,484	$ 923,749	$ 2,562,214
Total Capital Investment (TCI = DC + IC)			$ 1,081,534	$ 3,414,675	$ 4,797,535	$ 13,306,985
Direct Annual Costs (DAC)						
Operating Costs (O)	24 hrs/day, 7 days/wk, 50 wks/yr					
Operator	0.5 hrs/shift $25/hr	OAQPS	$ 13,125	$ 13,125	$ 13,125	$ 13,125
Supervisor	15% of Operator	OAQPS	$ 1,969	$ 1,969	$ 1,969	$ 1,969
Maintenance Costs (M)						
Labor	0.5 hrs/shift $25/hr	OAQPS	$ 13,125	$ 13,125	$ 13,125	$ 13,125
Material	100% of labor cost	OAQPS	$ 13,125	$ 13,125	$ 13,125	$ 13,125
Utility Costs						
Perf Loss	0.50%					
Electricity cost	0.06 ($/kwh) performance penalt	variable	$ 10,584	$ 57,960	$ 119,700	$ 428,400
Catalyst replacement	(note 2)		$ 25,880	$ 106,295	$ 219,522	$ 785,655
Catalyst disposal	precious metal recovery: 1/3 replacement cost		$ (8,618)	$ (35,396)	$ (73,174)	$ (261,623)
H2 carrier steam	(note 3)		$ 19,686	$ 107,806	$ 222,643	$ 796,824
H2 reforming	(note 4)		$ 1,916	$ 10,495	$ 21,674	$ 77,589
H2 skid demand	(note 5) (0.6 kW/MW capacity)		$ 1,270	$ 6,955	$ 14,364	$ 51,408
Total DAC			$ 92,062	$ 295,459	$ 566,073	$ 1,919,597
Indirect Annual Costs (IAC)						
Overhead	60% of O&M		$ 24,806	$ 24,806	$ 24,806	$ 24,806
Administrative	0.02 x TCI		$ 21,631	$ 68,293	$ 95,951	$ 266,140
Insurance	0.01 x TCI		$ 10,815	$ 34,147	$ 47,975	$ 133,070
Property tax	0.01 x TCI		$ 10,815	$ 34,147	$ 47,975	$ 133,070
Capital recovery	10% interest rate, 15 yr period					
	0.13 x TCI		$ 138,791	$ 438,198	$ 615,658	$ 1,707,659
Total IAC			$ 206,859	$ 599,592	$ 832,366	$ 2,264,744
Total Annual Cost (DAC + IAC)			$ 298,920	$ 895,050	$ 1,398,439	$ 4,184,341

NOx Emission Rate (tons/yr) at 25 ppm		88.2		
NOx Removed (TPY) at 2.5 ppm	90% removal efficiency	74.9		
Cost Effectiveness ($/ton)		18,670.74		
Electricity Cost Impact (c/kwh)		0.981		
Increased natural gas use		35,994	244,000	MCF
	1017 Btu/scf	36,606	248,148	MMBtu

Note 2: 300 kcfh/MW; s.v.=20 kcfh/ft^3; $1,500/ft^3 catalyst; 7 yr. life
Note 3: Scaled from GE LM2500 data in SYCOM report table
Note 4: Scaled from GE LM2500 data in SYCOM report table
Note 5: Interpolated for LM6000 from data for LM2500 and Frame 7FA in SYCOM report table

APPENDIX 8.1F

Cumulative Impacts Analysis for the SFERP Facility

APPENDIX 8.1F

CUMULATIVE IMPACTS ANALYSIS FOR THE SFERP FACILITY

8.1F OVERVIEW OF THE ANALYSIS

Cumulative air quality impacts from the SFERP and other reasonably foreseeable projects are both regional and localized in nature. Regional air quality impacts are possible for pollutants such as ozone, which is formed through a photochemical process that can take hours to occur. Carbon monoxide, NOx and SOx impacts are generally localized in the area in which they are emitted. PM_{10} can create a local air quality problem in the vicinity of its emission source, but can also be a regional issue when it is formed in the atmosphere from POC, SOx and NOx.

This cumulative impacts analysis considers the potential for both regional and localized impacts due to emissions from proposed operation of SFERP. Regional impacts were evaluated by comparing maximum daily and annual emissions from SFERP with emissions of ozone and PM_{10} precursors in both San Francisco County and the entire BAAQMD. Localized impacts were evaluated by looking at other local sources of pollutants that are not included in the background air quality data to determine whether these sources in combination with SFERP would be expected to cause significant cumulative air quality impacts.

The modeling shows that the SFERP is not expected to contribute significantly to cumulative localized NO_2 or PM_{10} ambient impacts. Nonetheless, there will be impacts from the SFERP in both Potrero and Bayview/Hunters Point. To address these concerns, the City is developing, with community input, a PM_{10} community benefit package. The City will target the mitigations to the areas affected by the impacts from the project.

8.1F-1 Regional Impacts

Regional impacts are evaluated by assessing SFERP's contribution to regional emissions. Although the relative importance of POC and NOx emissions in ozone formation differs from region to region and from day to day, state law requires reductions in emissions of both precursors to reduce both Bay Area and downwind air basin ozone levels. The change in the sum of emissions of these pollutants, equally weighted, provides a rough estimate of the impact of SFERP on regional ozone levels. Similarly, a comparison of the emissions of PM_{10} precursor emissions from SFERP with regional PM_{10} precursor emissions provides an estimate of the impact of SFERP on regional PM_{10} levels.

Under BAAQMD regulations, SFERP will be required to provide offsets for increases in NOx emissions from the project at a 1.15 to 1 ratio. SFERP will also provide additional NOx ERCs to mitigate total NOx and POC emissions from the project at a 1.0 to 1 ratio. Therefore, emissions of ozone precursors from the project will be fully mitigated. While SFERP is developing a mitigation program to address potential PM_{10} impacts from the project, the benefits of this mitigation program have not been considered in this cumulative impact analysis. Regulatory offset requirements are calculated based on tons per year of emissions from the project. The inventories are expressed in tons per day of emissions; comparisons are shown on both a daily and annual basis.

The following tables summarize these comparisons; detailed calculations are shown in the attached tables. SFERP emissions are compared with regional emissions in 2005, as the project is expected to begin operation in the second quarter of 2007. San Francisco County and BAAQMD emissions projections for 2005 were taken from the Air Resources Board's

web-based emission inventory projection software, available at www.arb.ca.gov/app/emsinv/emssumcat.php.

These comparisons show that even when mitigation is not accounted for, SFERP emissions will have an extremely small impact on regional ozone and PM_{10} formation. When mitigation is taken into account, regional cumulative impacts will be almost negligible. An additional, unquantified benefit of the project will be the displacement of generation from older, less efficient and higher emitting generating facilities in San Francisco. The emissions comparison below does not account for the longer-term reductions expected from future retrofits and/or shutdowns of units at the Potrero and Hunters Point power plants. Potential future reductions under various scenarios are shown in the tables that are included in the attachment to this appendix.

Table 8.1F-1
Comparison of SFERP Emissions to Regional Precursor Emissions in 2005: Daily Basis

	San Francisco County		BAAQMD
Ozone Precursors – Daily Basis			
Total Ozone Precursors, tons/day	99.2		939.0
Total SFERP Ozone Precursor Emissions, tons/day		0.42	
SFERP Ozone Precursor Emissions as Percent of Regional Total	0.42%		0.04%
SFERP Offsets, average tons/day		0.13	
SFERP Ozone Precursor Emissions after offsets, tons/day[1]		0.29	
SFERP Ozone Precursor Emissions as Percent of Regional Total, after offsets	0.29%		0.03%
PM_{10} Precursors – Daily Basis			
Total PM_{10} Precursors, tons/day	118.8		1218.0
Total SFERP PM_{10} Precursors, tons/day		0.55	
SFERP PM_{10} Precursors as Percent of Regional Total	0.46%		0.04%
SFERP Offsets, average tons/day		0.13	
SFERP PM_{10} Precursors after offsets, tons/day	0.35%		0.03%

8.1F-2 Localized Impacts

The AFC presented the results of several dispersion modeling analyses to allow evaluation of the localized impacts of emissions from SFERP. The results are summarized in Table 8.1F-3 below (from Table 8.1-28 of the AFC).

[1] The 0.29 tons per day difference between SFERP ozone precursor emissions and the offsets to be obtained for the SFERP reflects the difference between the **maximum** possible daily emissions from the SFERP, assuming that all three units are operating, and the **average** daily emissions represented by the offsets. As show in table 8.1F-2, on an annual basis, the SFERP will obtain offsets for **all** its ozone precursor emissions at a 1.0 to 1 ratio.

Table 8.1F-2
Comparison of SFERP Emissions to Regional Precursor Emissions in 2005: Annual Basis*

	San Francisco County		BAAQMD
Ozone Precursors – Annual Basis			
Total Ozone Precursors, tons/year	36,208		342,735
Total SFERP Ozone Precursor Emissions, tons/year		47.5	
SFERP Ozone Precursor Emissions as Percent of Regional Total	0.13%		0.01%
SFERP Offsets, tons/year		47.5	
SFERP Ozone Precursor Emissions after offsets, tons/year		0	
PM_{10} Precursors – Annual Basis			
Total PM_{10} Precursors, tons/year	43,362		444,570
Total SFERP PM_{10} Precursor Emissions, tons/year		68.4	
SFERP PM_{10} Precursor Emissions as Percent of Regional Total	0.16%		0.02%
SFERP Offsets, tons/year		47.5	
SFERP PM_{10} Precursor Emissions after offsets, tons/year	0.05%		<0.01%

Note: * County and BAAQMD emissions calculated as 365 times daily emissions.

Table 8.1F-3
Maximum Modeled Project Impacts and PSD Significance Thresholds

Pollutant	Averaging Prd	Max Facility Impact, ug/m^3	PSD Significance Threshold, ug/m^3
NOx	1-hour	8.3	19[a]
	annual	0.1	1.0
SO_2	3-hour	1.0	25
	24-hour	0.1	5
	annual	0.006	1.0
CO	1-hour	27.8	2000
	8-hour	6.3	500
PM_{10}[b]	24-hour	1.2	5
	annual	0.2	1.0

Notes:
a. BAAQMD significance threshold only.
b. Includes cooling tower.

As shown in the table, SFERP impacts are well below the significance thresholds. As project impacts are not significant as that term is defined in federal air quality modeling guidelines, no significant cumulative impacts are expected to occur. At present, there are no PSD significance thresholds for $PM_{2.5}$.

The only pollutants for which SFERP could be considered to have the potential for significant impacts are NOx and PM_{10}, because the BAAQMD is currently classified as a

nonattainment area with respect to state air quality standards for both ozone (for which NOx is a precursor) and PM_{10}, and for the new national 8-hour ozone standard.[2]

To evaluate potential cumulative impacts of SFERP in combination with other projects in the area, we requested from the BAAQMD staff information regarding projects in San Francisco County for which permits to construct have been issued but had not yet begun operation. The list provided by the District staff included 25 facilities. As discussed in the cumulative impacts protocol, projects for which the emissions changes are smaller than 5 tons per year are assumed to be *de minimis* and are not included in the dispersion modeling analysis. Therefore only three projects, with permitted NOx emissions increases of 16.2, 18.9 and 7.1 tons per year, respectively, are included in the cumulative impacts analysis. However, two additional operating facilities, PG&E Hunters Point and Mirant Potrero power plants, were also considered in the dispersion modeling analysis to assess potential localized cumulative air quality impacts for NO_2 and PM_{10}.

Three different modeling analyses were performed to evaluate various future Hunters Point and Potrero operating scenarios. Maximum future emissions from SFERP and the three new facilities were modeled for each scenario. As Hunters Point and Potrero historical emissions are reflected in ambient background concentrations, future operating scenarios evaluate differences in NOx and PM_{10} emissions at the power plants relative to historical levels.

- Maximum future emissions: Future generation at Hunters Point and Potrero would be increased to the maximum levels allowed under existing permits and equipment ratings. Future NOx emissions from Hunters Point Unit 4 and Potrero Unit 3 would be controlled to comply with BAAQMD regulatory requirements, so NOx emissions from these units are modeled as reductions. The difference between average historical and maximum future NOx and PM_{10} emissions from Hunters Point Units 1 and 4 and Potrero Units 3, 4, 5 and 6 are modeled as increases.
- Hunters Point and Potrero operating at historic levels: Future generation at Hunters Point and Potrero would remain at historical levels; however, future NOx emissions from Hunters Point Unit 4 and Potrero Unit 3 would be lower to comply with BAAQMD regulatory requirements. The difference between average historical and projected future NOx emissions from the boilers are treated as reductions. There is no change in PM_{10} emissions.
- Potrero and Hunters Point shut down: Average historical NOx and PM_{10} emissions from all units are modeled as reductions.

Under any reasonably foreseeable scenario, Hunters Point will be shut down. The City does not expect that the Hunters Point power plant will continue to operate beyond 2007. In addition, as described in section 3, Purpose and Need, and section 4, Environmental Justice, the SFERP, in combination with certain additional projects, will provide for the termination of the RMR Agreement for units at the Potrero power plant. The removal of the RMR Agreement from units at the Potrero Power Plant would eliminate an important

[2] The Bay Area is designated as an attainment area for the national 1-hour average ozone standard and the national PM_{10} air quality standards. The District is unclassified for the national $PM_{2.5}$ air quality standards.

source of revenue to Mirant from continued operation of the units and would allow the owner, Mirant Potrero LLC, to shut down the units.

All three future scenarios assume that Potrero Unit 7 will not be built. The Applicant does not believe it is reasonably foreseeable that Potrero Unit 7 will be constructed and operated for the following reasons:

1. The proponent of Potrero Unit 7, Mirant, is in bankruptcy proceedings and the Potrero Unit 7 licensing proceeding has been suspended since November 13, 2003; and
2. It is formal City policy to oppose the construction of Potrero Unit 7.

Accordingly, the City considers the construction of Potrero Unit 7 to be highly unlikely.

The results of the cumulative impact modeling analysis are summarized in the tables below. These results show that the maximum modeled NO_2 and PM_{10} impacts of SFERP are much smaller than the maximum modeled impacts of the other cumulative impact sources. These other sources, which are assumed to be backup Diesel engine generators, are expected to have very high but very localized one-hour and annual average NO_2 impacts. Because their impacts are localized, they do not overlap with impacts from SFERP, Potrero or Hunters Point. Modeled impacts from SFERP and the three other cumulative impact sources are shown in Figures 8.1F-1 through 8.1F-4. The available models do not correctly calculate the negative emission changes (reductions). The presence of the negative emission rates in each case prevents us from including the Potrero and Hunters Point units in the isopleths, although the results for these units are presented in the tables.

The <u>overall</u> reductions from the shutdown of the existing power plants are much larger than the maximum increases in modeled ambient concentrations from the new project. Nonetheless, the modeled impacts in particular locations do not directly overlap and thus do not fully cancel one another out. Because of the relative locations of the Potrero power plant and the SFERP, the Potrero modeled impacts partially overlap with the SFERP modeled impacts. However, the Hunters Point power plant is far enough away that its modeled impacts do not coincide with the maximum impact from the SFERP. If generation at Potrero power plant remains at historical levels, the modeling shows that once the power plant boiler is retrofitted to meet the limitations of the District power plant NOx rule the reductions in maximum modeled NO_2 impacts from this unit will offset some of the localized modeled NO_2 increases from the proposed project. If generation at Potrero is increased to the maximum levels allowable under existing permits, the modeling shows that there will be localized increases in NO_2 and PM_{10} concentrations due to the increased operation. If the existing power plants are shut down, the modeling shows that localized reductions in ambient NO_2 and PM_{10} impacts would directly offset some of the localized impacts of the SFERP.

In summary, the modeling shows that the SFERP is not expected to contribute significantly to cumulative localized NO_2 or PM_{10} ambient impacts. Nonetheless, there will be PM_{10} impacts from the SFERP in both Potrero and Bayview/Hunters Point. To address these concerns, the City is developing, with community input, a PM_{10} mitigation/community benefits package. The City will target the mitigation to the areas affected by the impacts from the project.

Table 8.1F-4

Cumulative Air Quality Impacts: Scenario A (Potrero and Hunters Point at Historical Generating Levels with Required NOx Retrofits)

Pollutant/ Avg. Prd.	Maximum Modeled Concentration, ug/m^3 At Location of SFERP Max Impact				Maximum Modeled Concentration, ug/m^3 At Location of Maximum Combined Impact				Current Background[c]	Total Cumulative Impact, All Sources, ug/m^3
	SFERP	Other Cumulative Sources[a]	POT/HP[b]	Total	SFERP	Other Cumulative Sources[a]	POT/HP[b]	Total		
NOx: 1-hr avg	8.3	0	-1.1	7.2	0	172	0	172	141	313
NOx: annual avg[e]	0.1	0.1	-0.4	-0.2	0.02	11.4	-0.1	11.3	36	47
PM_{10}: 24-hr avg	1.2	0.01	0	1.2	0	8.7	0	8.7	74	82.7
PM_{10}: annual avg	0.2	0.01	0	0.2	0.02	0.6	0	0.6	26.3	26.9

Notes:

a. SF Self Storage, SF Wave Exchange and UCSF.

b. Potrero and Hunters Point future emissions based on historical generating levels; compliance with future regulations.

c. Maximum monitored ambient concentrations at Arkansas Street, 2001-2003.

d. 1-hr avg NOx ozone-limited using concurrent ozone data for hour of maximum modeled impact.

e. Annual average NOx ozone-limited using ARM and national default factor of 0.75.

Table 8.1F-5

Cumulative Air Quality Impacts: Scenario B (Potrero and Hunters Point Maximum Future Emissions)

Pollutant/ Avg. Prd.	Maximum Modeled Concentration, ug/m^3 At Location of SFERP Max Impact				Maximum Modeled Concentration, ug/m^3 At Location of Maximum Combined Impact				Current Background[c]	Total Cumulative Impact, All Sources, ug/m^3
	SFERP	Other Cumulative Sources[a]	POT/HP[b]	Total	SFERP	Other Cumulative Sources[a]	POT/HP[b]	Total		
NOx: 1-hr avg	8.3	0	34.4	42.7	0	172	0	172	141	313
NOx: annual avg[e]	0.1	0.1	0.3	0.5	0.02	11.4	0.1	11.5	36	48
PM_{10}: 24-hr avg	1.2	0.01	1.2	2.4	0	8.7	0	8.7	74	82.7
PM_{10}: annual avg	0.2	0.01	0.2	0.4	0.02	0.6	0.03	0.7	26.3	27.0

Notes:

a. SF Self Storage, SF Wave Exchange and UCSF.

b. Potrero and Hunters Point future emissions based on maximum allowable generating levels; compliance with future regulations.

c. Maximum monitored ambient concentrations at Arkansas Street, 2001-2003.

d. 1-hr avg NOx ozone-limited using concurrent ozone data for hour of maximum modeled impact.

e. Annual average NOx ozone-limited using ARM and national default factor of 0.75.

Table 8.1F-6

Cumulative Air Quality Impacts: Scenario C (Potrero and Hunters Point Shut Down)

Pollutant/ Avg. Prd.	Maximum Modeled Concentration, ug/m^3 At Location of SFERP Max Impact				Maximum Modeled Concentration, ug/m^3 At Location of Maximum Combined Impact				Current Background[c]	Total Cumulative Impact, All Sources, ug/m^3
	SFERP	Other Cumulative Sources[a]	POT/HP[b]	Total	SFERP	Other Cumulative Sources[a]	POT/HP[b]	Total		
NOx: 1-hr avg	8.3	0	-1.7	6.6	0	172	0	172	141	313
NOx: annual avg[e]	0.1	0.1	-0.9	-0.7	0.02	11.4	-0.2	11.2	36	47
PM_{10}: 24-hr avg	1.2	0.01	-0.9	0.3	0	8.7	0	8.7	74	82.7
PM_{10}: annual avg	0.2	0.01	-0.15	0.05	0.02	0.6	-0.02	0.6	26.3	26.9

Notes:

a. SF Self Storage, SF Wave Exchange and UCSF.

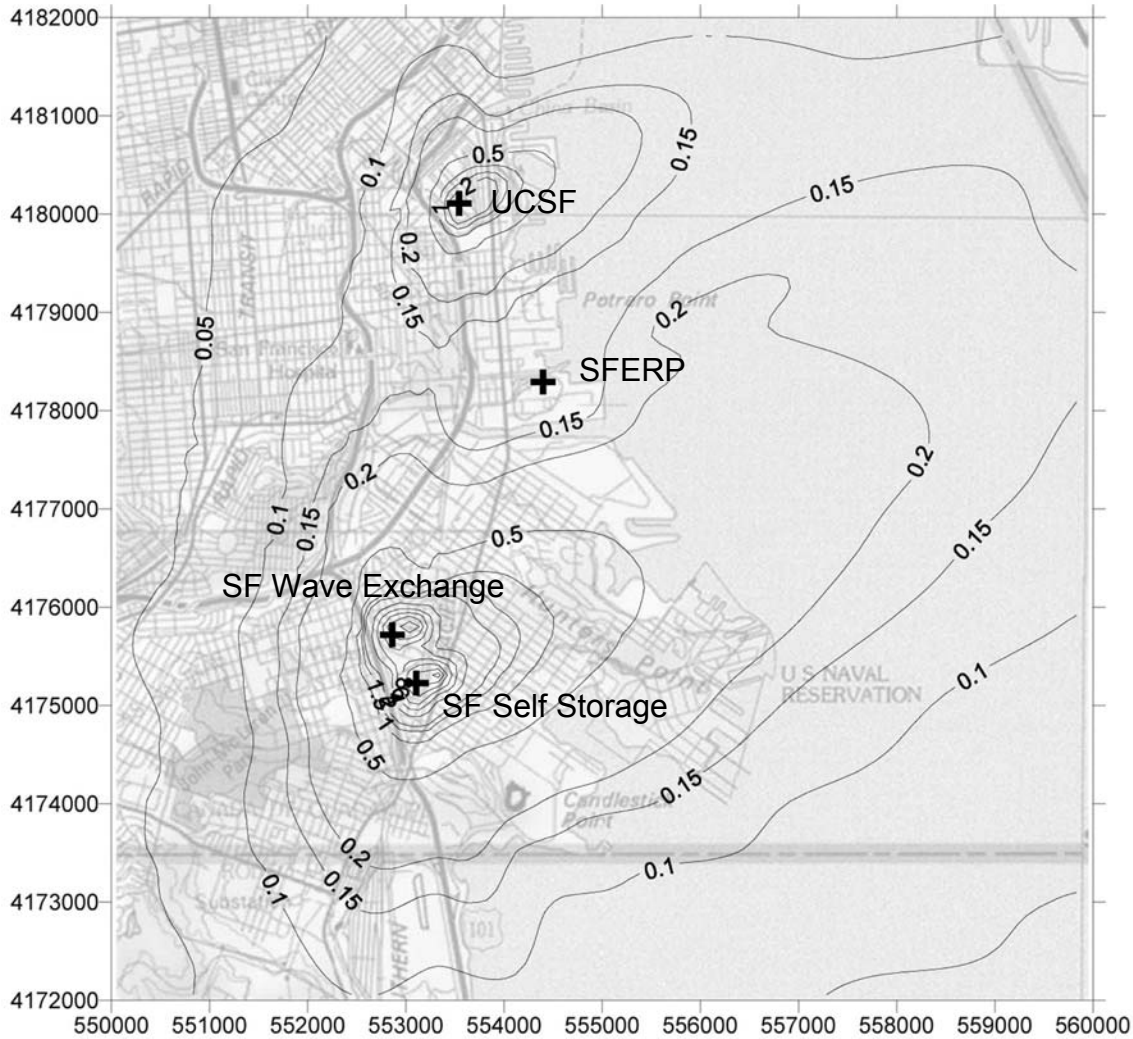
b. Potrero and Hunters Point shut down.

c. Maximum monitored ambient concentrations at Arkansas Street, 2001-2003.

d. 1-hr avg NOx ozone-limited using concurrent ozone data for hour of maximum modeled impact.

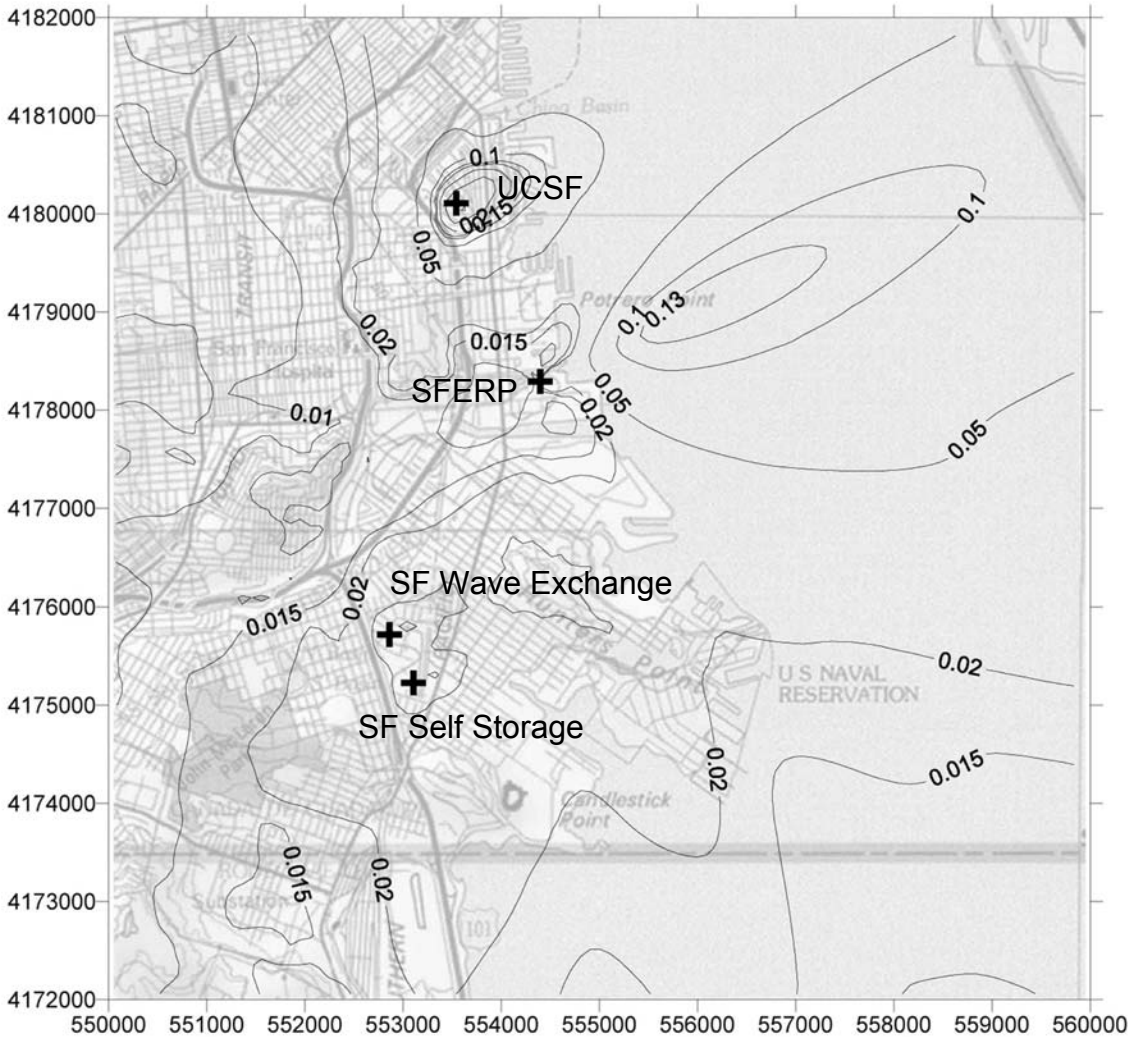
e. Annual average NOx ozone-limited using ARM and national default factor of 0.75.

Figure F-1
San Francisco Electric Reliability Project
Cumulative Impacts for Annual Average NO_2 (µg/m^3)
(Modeled concentrations shown are not ozone limited)



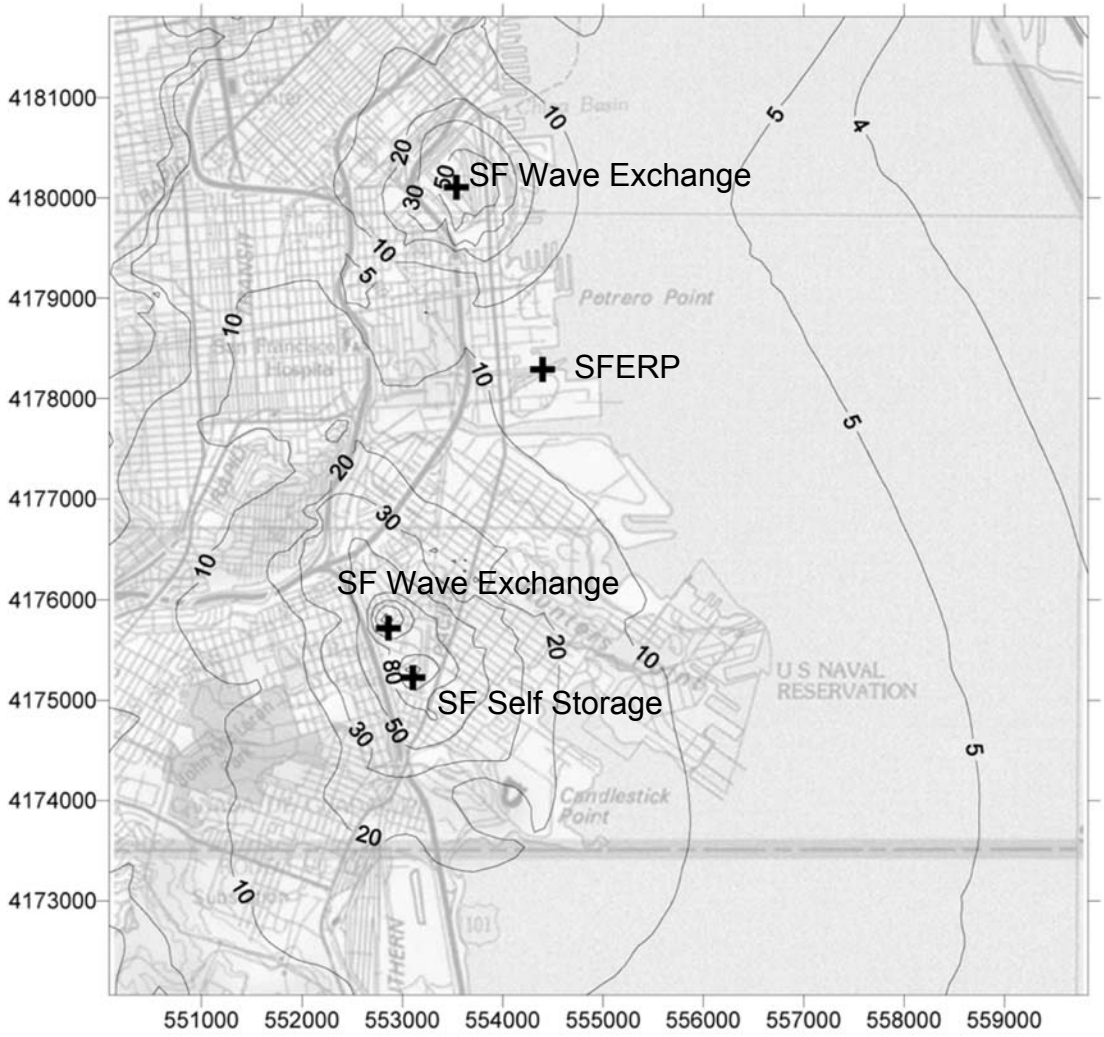
This figure shows the highest modeled annual average NO_2 impact from new sources in the project area that are not already in operation and therefore are not included in monitored background concentrations. The + symbols indicate the location of each modeled source.

Figure F-2
San Francisco Electric Reliability Project
Cumulative Impacts for Annual Average PM_{10} ($\mu g/m^3$)



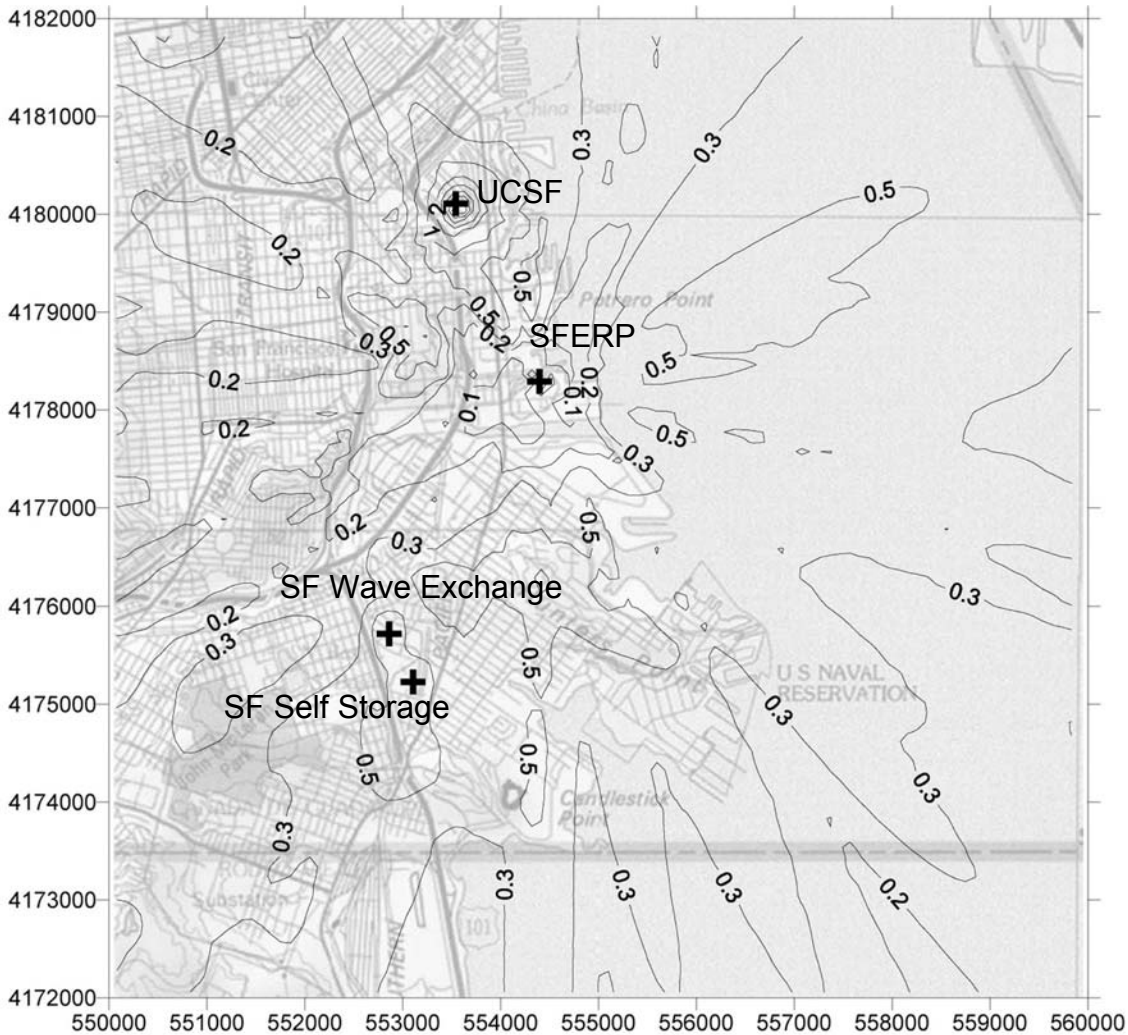
This figure shows the highest modeled annual average PM_{10} impact from new sources in the project area that are not already in operation and therefore are not included in monitored background concentrations. The + symbols indicate the location of each modeled source.

Figure F-3
San Francisco Electric Reliability Project
Cumulative Impacts for One-Hour Average NO_2 (µg/m^3)



This figure shows the highest modeled one-hour average NO_2 impact from new sources in the project area that are not already in operation and therefore are not included in monitored background concentrations. The + symbols indicate the location of each modeled source.

Figure F-4
San Francisco Electric Reliability Project
Cumulative Impacts for 24-Hour Average PM_{10} ($\mu g/m^3$)



This figure shows the highest modeled 24-hour average PM_{10} impact from new sources in the project area that are not already in operation and therefore are not included in monitored background concentrations. The + symbols indicate the location of each modeled source.

Potrero Power Plant: Rated Capacities and Historical Operations

							Fuel Use			
							2001	2002	2003	3-Year Avg
Unit ID	Source ID	Type	Rated Capacity, MW	Rated Heat Input, MMBtu/hr	Operating Limits?	NOx Em Limits	MMBtu	MMBtu	MMBtu	MMBtu
3	1	steam boiler	206	2150	no	0.018 lbs/Mmbtu (1)	10,683,200	5,927,227	8,590,000	8,400,142
4A	10	peaking turbine	26	406	877 hrs/yr	65 ppm	97,860	66,640	125,580	96,693
4B	11	peaking turbine	26	406	877 hrs/yr	65 ppm	302,820	68,880	125,860	165,853
5A	12	peaking turbine	26	406	877 hrs/yr	65 ppm	324,100	67,900	80,220	157,407
5B	13	peaking turbine	26	406	877 hrs/yr	65 ppm	347,760	66,640	76,720	163,707
6A	14	peaking turbine	26	406	877 hrs/yr	65 ppm	358,120	55,300	70,840	161,420
6B	15	peaking turbine	26	406	877 hrs/yr	65 ppm	336,560	57,400	70,560	154,840
Total			362				12,450,420	6,309,987	9,139,780	9,300,062

Note: (1) NOx emission limit effective 1/1/06.

Potrero Power Plant

	NOx Emissions				SOx Emissions				CO Emissions			
	2001	2002	2003	3-Year Avg	2001	2002	2003	3-Year Avg	2001	2002	2003	3-Year Avg
Unit ID	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
3	368.5	366.3	199.3	311.4	3.2	3.2	2.5	3.0	209.9	208.6	167.8	195.4
4A	18.2	5.6	16.3	13.4	8.0	2.5	3.2	4.5	3.0	0.9	5.1	3.0
4B	16.9	17.4	16.3	16.9	7.4	7.6	3.2	6.1	2.8	2.9	5.1	3.6
5A	37.3	47.1	10.4	31.6	6.5	8.2	2.0	5.5	2.5	3.1	3.2	2.9
5B	42.6	50.6	9.9	34.4	7.4	8.8	1.9	6.0	2.8	3.4	3.1	3.1
6A	36.2	41.8	9.2	29.1	7.8	9.0	1.8	6.2	3.0	3.4	2.9	3.1
6B	35.3	39.3	9.1	27.9	7.6	8.5	1.8	5.9	2.9	3.2	2.8	3.0
Total	554.9	568.1	270.6	464.5	47.8	47.7	16.4	37.3	227.0	225.6	190.0	214.2

Potrero Power Plant

	POC Emissions				PM10 Emissions			
	2001	2002	2003	3-Year Avg	2001	2002	2003	3-Year Avg
Unit ID	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
3	9.2	9.1	7.0	8.4	15.9	15.8	12.7	14.8
4A	0.7	0.2	0.3	0.4	5.9	1.8	0.8	2.8
4B	0.7	0.7	0.3	0.6	5.5	5.6	0.8	4.0
5A	0.6	0.8	0.2	0.5	4.8	6.0	0.5	3.8
5B	0.7	0.8	0.2	0.6	5.4	6.5	0.5	4.1
6A	0.7	0.9	0.2	0.6	5.8	6.6	0.4	4.3
6B	0.7	0.8	0.2	0.6	5.6	6.2	0.4	4.1
Total	13.4	13.3	8.2	11.7	48.8	48.6	16.1	37.8

Potrero Power Plant: Max Future Emissions

Unit	Fuel Use, MMBtu/yr (1)	Emission Factor, lb/MMBtu (2) NOx	SO2	CO	VOC	PM10	Proj Future Emissions, tpy NOx	PM10	3-yr Avg Emissions, tpy NOx	PM10	Max Increment, tpy NOx	PM10	Future NOx, tpy NOx	Increment from Baseline, tpy NOx
3	18,834,000	0.018				0.004	169.51	33.13	311.35	14.78	-141.85	18.35	83.70	-227.65
4A	356,062	0.276				0.059	49.19	10.42	13.36	2.83	35.83	7.59		
4B	356,062	0.203				0.048	36.23	8.49	16.88	3.95	19.35	4.53		
5A	356,062	0.401				0.048	71.47	8.50	31.60	3.76	39.88	4.74		
5B	356,062	0.420				0.050	74.76	8.97	34.37	4.12	40.39	4.85		
6A	356,062	0.360				0.053	64.13	9.45	29.07	4.28	35.06	5.16		
6B	356,062	0.361				0.053	64.20	9.43	27.92	4.10	36.28	5.33		
Total							529.48	88.39						

Notes: (1) Based on max. permitted operation (8760 hrs/yr for boiler, 877 hrs/yr per turbine)
(2) Future NOx emissions calculated from 3-yr average fuel use rate and 2005 emission limit of 0.018 lb/MMBtu

Hunters Point Power Plant: Rated Capacities and Historical Operations

							Fuel Use			
							2001	2002	2003	3-Year Avg
Unit ID	Source ID	Type	Rated Capacity, MW	Rated Heat Input, MMBtu/hr	Operating Limits?	NOx Em Limits	MMBtu	MMBtu	MMBtu	MMBtu
1	1	peaking turbine	26	356	877 hrs/yr	65 ppm	227,780	37,268	33,572	99,540
1	2	peaking turbine	26	356	877 hrs/yr	65 ppm	227,780	37,268	33,572	99,540
2	3	steam boiler	--	--	shut down	--	0	0	0	0
2	4	steam boiler	--	--	shut down	--	0	0	0	0
3	5	steam boiler	--	--	shut down	--	0	0	0	0
3	6	steam boiler	--	--	shut down	--	0	0	0	0
4	7	steam boiler	163	1720	no	0.018 lb/MMBtu (1)	4,486,825	5,319,800	3,150,000	4,318,875
Total			215				4,942,385	5,394,336	3,217,144	4,517,955

Note: (1) NOx emission limit effective 1/1/05.

Hunters Point PowerPlant

	NOx Emissions					SOx Emissions				CO Emissions			
	2000	2001	2002	2003	3-Year Avg	2001	2002	2003	3-Year Avg	2001	2002	2003	3-Year Avg
Unit ID	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
1	5.9	33.9	32.0	4.7	23.5	27.6	26.0	0.4	18.0	2.3	2.2	0.3	1.6
1	5.9	33.9	32.0	4.7	23.5	27.6	26.0	0.4	18.0	2.3	2.2	0.3	1.6
2	90.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	63.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	108.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	100.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	197.6	167.4	153.8	107.9	143.0	1.4	1.3	0.9	1.2	95.3	87.6	61.4	81.5
Total	572.3	235.3	217.8	117.3	190.1	56.6	53.2	1.7	37.2	100.0	92.0	62.1	84.7

Hunters Point Power Plant

	POC Emissions				PM10 emissions			
	2001	2002	2003	3-Year Avg	2001	2002	2003	3-Year Avg
Unit ID	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
1	0.6	0.5	0.1	0.4	4.5	4.2	0.6	3.1
1	0.6	0.5	0.1	0.4	4.5	4.2	0.6	3.1
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4.2	3.8	2.7	3.6	7.2	6.6	4.7	6.2
Total	5.3	4.9	2.8	4.4	16.2	15.1	5.9	12.4

Hunters Point Power Plant: Max Future Emissions

Unit	Fuel Use, MMBtu/yr (1)	Emission Factor, lb/MMBtu (2) NOx	SO2	CO	VOC	PM10	Max Future Em. Tpy NOx	PM10	3-yr Average Emissions, tpy NOx	PM10	Max. Increment, tpy NOx	PM10	Future NOx, tpy NOx	Reduction, tpy NOx
1	312,212	0.473	0.361	0.033	0.008	0.063	73.84	9.77	23.5	3.11	50.30	6.65		
2	312,212	0.473	0.361	0.033	0.008	0.063	73.84	9.77	23.54	3.11	50.30	6.65		
4	15,067,200	0.018	0.001	0.038	0.002	0.003	135.60	21.50	143.04	6.16	-7.43	15.34	38.87	-104.17
Total							283.29	41.04						

Notes: (1) Fuel use for peaker turbines based on 877 hrs/yr of peaking generation; fuel use for boiler based on average use during 2000-2002.
(2) Unit 4 NOx emission factors from permit limits. All others from calculated from BAAQMD emission inventory reports