APPENDIX I
AIR QUALITY DATA AND MODELING PROTOCOL

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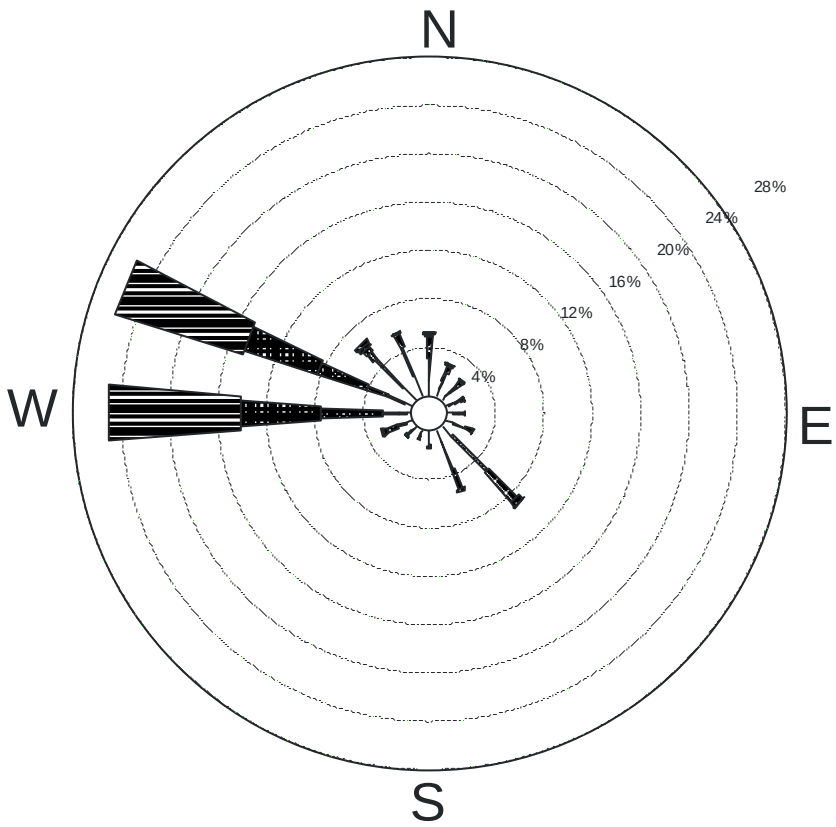
TABLE OF CONTENTS

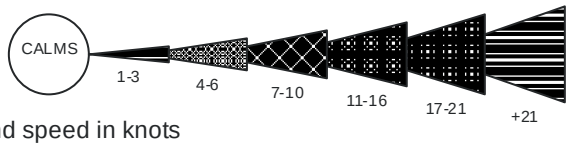
Appendix I-1	**Seasonal Windroses**
Appendix I-2	**Construction Emissions**
Appendix I-3	**Operating Emissions**
Appendix I-4	**Greenhouse Emissions**
Appendix I-5	**Modeling Protocol**
Appendix I-6	**VISCREEN AND PLUVUE 2 Modeling Inputs**
Appendix I-7	**BACT Analysis**

APPENDIX I-1
SEASONAL WINDROSES



NOTE: Frequencies indicate direction from which the wind is blowing.

CALM WINDS 0.00%



Wind speed in knots

CSEP - 1988-91 Wintec AERMOD

APPENDIX I-2
CONSTRUCTION EMISSIONS

Table I-2-1 Daily Maximum Construction Emissions of Criteria Pollutants (lbs/day)						
Activity	**PM_{10}**	**$PM_{2.5}$**	**CO**	**ROC**	**NO_x**	**SO_x**
Onsite Combustion Emissions						
Diesel Construction Equipment	6.80	6.26	61.37	18.37	110.19	0.11
Dump trucks, pickup trucks and worker vehicles	0.02	0.00	0.32	0.05	0.76	0.001
Construction Combustion Subtotal (lbs)	***6.8***	***6.3***	***61.4***	***18.4***	***110.2***	***0.1***
Onsite Fugitive Dust Emissions						
Vehicle Travel on Unpaved Roads and Parking Lot	1.55	0.33				
Earth clearing/Bulldozing	1.46	0.30				
Earth Loading/Storage	2.46	0.51				
Subtotal of Offsite Emissions (lbs)	***5.5***	***1.1***				
Offsite On-Highway Emissions						
Worker Passenger Vehicle – Combustion Emissions	0.02	0.01	2.34	0.25	0.25	0.002
Worker Passenger Vehicle – Paved Road Dust	1.38	0.23				
Subtotal of Offsite Emissions (lbs)	***1.38***	***0.23***	***2.34***	***0.25***	***0.25***	***0.002***
Total Max. Daily Emissions (lbs)	**13.7**	**7.6**	**63.7**	**18.6**	**110.4**	**0.1**

Notes:
PM_{10} = particulate matter less than 10 micrometers in diameter
$PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter
ROC = reactive organic compounds
CO = carbon monoxide
NO_x = nitrogen oxide(s)
SO_x = sulfur oxide(s)

Table I-2-2 Maximum Annual Construction Emissions of Criteria Pollutants (ton/year [tpy])						
Activity	**PM_{10}**	**$PM_{2.5}$**	**CO**	**ROC**	**NO_x**	**SO_x**
Onsite Combustion Emissions						
Diesel Construction Equipment	0.91	0.84	8.18	2.54	14.67	0.02
Dump trucks, pickup trucks and worker vehicles	0.001	0.001	0.115	0.013	0.042	0.000
Construction Combustion Subtotal (tpy)	***0.9***	***0.8***	***8.2***	***2.5***	***14.7***	***0.0***
Onsite Fugitive Dust Emissions						
Vehicle Travel on Unpaved Roads and Parking Lot	0.03	0.01				
Earth clearing/Bulldozing	1.12	0.23				
Earth Loading/Storage	0.15	0.03				
Subtotal of Offsite Emissions (tpy)	***1.3***	***0.3***				
Offsite On-Highway Emissions						
Worker Passenger Vehicle – Combustion Emissions	0.003	0.002	0.421	0.046	0.044	0.000
Worker Passenger Vehicle – Paved Road Dust	0.25	0.04				
Subtotal of Offsite Emissions (tpy)	***0.25***	***0.04***	***0.42***	***0.05***	***0.04***	***0.000***
Total Max. Daily Emissions (tpy)	**2.5**	**1.2**	**8.6**	**2.6**	**14.7**	**0.0**

Notes:
PM_{10} = particulate matter less than 10 micrometers in diameter
$PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter
ROC = reactive organic compounds
CO = carbon monoxide
NO_x = nitrogen oxide(s)
SO_x = sulfur oxide(s)

TABLE I-2-3
CONSTRUCTION EQUIPMENT AND MATERIALS

Project Name: CSEP
Project No:
Project Location: Riverside County, CA

DESCRIPTION		USAGE MONTHS FOR PURCHASED AND LEASED EQUIPMENT																									Total All Months	% Usage	Machine Total Hours
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Rolling 12 month Total									
CONSTRUCTION EQUIPMENT & VEHICLES	**Horse power**	**(List Purchased Equipment Separately Below)**																											
																											0		
1 Ton Flat Bed Truck	220		1	1	1	1	1	1	1	1	1	1	2	4	4	4	4	8	8	12	16	19	22	25	32	39	44	50%	4,400
Farm Tractor	72																1	1	1	0	0	0	0	1	2	3	3	70%	420
Ingersoll Rand VR-90 Rough Terrain Forklift (9,000 Lb)	113			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	22	24	24	24	24	24	32	50%	3,200
Fuel/Lube Truck (150 Gal Gas/ 850 Gal Diesel)	250	1	1	1	1	1														5	4	3	2	1	0	0	5	70%	700
Service Truck	315	1	2	2	1	1														7	6	4	2	1	0	0	7	50%	700
Liebherr 500 Ton Truck Crane @ Rail Siding	408							1	1	1	1	1	1							6	6	6	6	6	6	6	6	25%	300
Manitowoc 888 Series II Crawler Crane	330				1	1	1	1	1	1	1	1	1	1	1					9	10	11	11	10	9	8	11	50%	1,100
Grove RT865B Rough Terrain Hydraulic Crane (65 Ton)	250				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	10	11	12	12	12	12	15	65%	1,950
Grove RT745 Rough Terrain Hydraulic Crane (45 Ton)	195				1	1	1	1	1	1	1	1	1	1	1	1	1	1		9	10	11	12	12	12	11	14	65%	1,820
Grove AMZ66 Articulating Boom Manlift, Diesel, (66 ft)	70				1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	17	19	21	23	24	24	24	29	65%	3,770
Ingersoll Rand 250 CFM Diesel Air Compressor	95					1	1	1	1	1	1	1	1	1	1	1	1	1		8	9	10	11	12	12	11	13	25%	650
Caterpillar 416B Backhoe Loader, 4 x 4, 74 HP	75					2	2	2	2	2	2	2	2	2	2	2	2	2	1	16	18	20	22	24	24	23	27	75%	4,050
Ditchwitch Trencher 3610 Model	34													1	1	1	1	1	1	0	1	2	3	4	5	6	6	45%	540
Caterpillar Wheel Loader	175	1	1	1	1										1	1	1	1		4	3	3	3	3	4	4	8	70%	1,120
Caterpillar Elevating Scrapers	175	4	6	1	2															13	9	3	2	0	0	0	13	90%	2,340
Caterpillar Articulated Dump Truck 30 Ton	300	1	1	1	1															4	3	2	1	0	0	0	4	75%	600
Caterpillar 325L Crawler Excavator, 1.5 CY Bucket	168	1	1	1	1	1	1	1	1	1	1	1								11	10	9	8	7	6	5	11	85%	1,870
Caterpillar D5M XL Dozer	110			1	1															2	2	2	1	0	0	0	2	90%	360
Caterpillar D9 Dozer with Ripper	405		2																	2	2	0	0	0	0	0	2	90%	360
Bomag BW 172 Vibratory Roller	76		4	4	1	1	1	1	1	1	1	1								16	16	12	8	7	6	5	16	90%	2,880
Bomag Walk Behind Vibratory Roller	13.5					1	1	1	1	1	1	1	1	1	1					8	9	10	10	10	9	8	10	90%	1,800
Dump Truck Operated & Maintained	250					1	1	1	1	1	1	1	1	1	1	1	1			8	9	10	11	12	11	10	12	35%	840
Caterpillar Motor Grader, 155 HP	175			1	1	1	1	1	1	1							1	1	1	7	7	7	6	6	6	6	10	90%	1,800
Jumping Jacks Compactors	3.3			4	3	2	1	1	1	1	1	1	1	1	1	1	1	1		16	17	18	15	13	12	11	21	50%	2,100
Vibratory Plate Compactors	8.5			5	2	2	2	2	2	2	2	1	1	1	1	1	1	1		22	23	24	20	19	18	16	27	50%	2,700
Water Truck 4,000 Gal with Monitor	250	1	3	3	2															9	8	5	2	0	0	0	9	50%	900
Concrete Pumper Truck Services	250						1	2	2	2	2	2	2	2	2	2	2	2		13	15	17	19	21	23	22	23	15%	690
Welder, Trailer Mounted Diesel, Miller, 400 Amp	48					2	2	2	2	2	2	2	2	2	2	2	1	1		16	18	20	22	23	22	20	24	25%	1,200
Light Plant, 8 kW w/ Four 1,000 Watt Lights	12			2	2	2	2	2	2	2	2	2	2	2	2	2				20	22	24	24	22	20	18	26	30%	1,560
																											0		
TOTAL		11	23	31	27	27	25	27	27	27	26	26	24	26	27	25	24	27	18	301	316	320	314	311	311	304	448		49,420

Construction Month	12/29/08	1/26/09	2/23/09	3/30/09	4/27/09	5/25/09	6/29/09	7/27/09	8/31/09	9/28/09	10/26/09	11/30/09	12/28/09	1/25/10	2/22/10	3/29/10	4/26/10	5/31/10
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Const. Discipline																		
Civil / Concrete	5	6	44	147	166	168	111	61	21	20	12	6	0	0	0	1	1	0
Commissioning	0	0	0	0	0	0	0	0	6	5	5	15	35	46	31	28	29	9
Electrical	0	0	0	2	34	60	78	76	60	58	58	52	53	49	37	19	17	6
Erection	0	0	0	3	5	5	5	5	37	82	96	86	82	81	81	6	6	0
Mechanical	0	0	0	34	70	89	85	51	50	63	64	62	49	39	20	14	17	6
Structural	0	8	2	0	3	4	4	4	4	3	3	3	3	3	3	3	3	0
Sub Contract	6	14	17	9	15	20	21	27	39	32	30	22	6	0	0	3	3	0
Owner GC	5	5	5	8	10	12	12	12	12	12	12	12	12	9	8	8	8	8
General GC	5	5	5	8	8	8	8	8	8	8	8	8	8	8	8	5	5	4
Operators (Facilities)	0	0	0	0	0	0	0	0	0	0	0	8	14	14	14	14	14	14
T-Line Construction	6	6	7	9	9	9	6	1	0	0	0	0	0	0	0	0	0	0
Gas Line Construction	0	0	0	0	0	0	9	9	9	9	2	0	0	0	0	0	0	0
Well & Water Pipe Construction							5	5	5	5	5							
Total Man Months	**26**	**43**	**81**	**220**	**320**	**376**	**346**	**260**	**251**	**298**	**295**	**275**	**261**	**249**	**202**	**101**	**103**	**47**

Worker Commuting Emissions

Combustion EMISSION FACTOR FOR ONROAD VEHICLES

Onroad Vehicle	Fuel Type	Total Vehicle Count/ Year	Vehicle Count/ Constr Project	Weight (lbs)	Vehicle Type	EF (lbs/mile)					
						PM_{10}	$PM_{2.5}$	CO	VOC	NOx	SO_2
Passenger Vehicles	G/D	2584	3003	1000	LDA	8.10E-05	6.38E-05	1.08E-02	1.18E-03	1.14E-03	9.00E-06

EMISSION CALCULATION FOR ONROAD VEHICLES

	Total Days / Year	Total Days / Constr. Project	Daily VMT / Vehicle	Annual VMT	Constr Project Total VMT	Daily Emissions (lbs/day)					
						PM_{10}	$PM_{2.5}$	CO	VOC	NOx	SO_2
Highway Vehicles											
Passenger Vehicles	360	540	30	77534.7572	90075.87349	0.02	0.01	2.34	0.25	0.25	0.00

Annual Emission Rate (tons/year)						Total Project Emission Rate (tons)					
PM_{10}	$PM_{2.5}$	CO	VOC	NOx	SO_2	PM_{10}	$PM_{2.5}$	CO	VOC	NOx	SO_2
0.003	0.002	0.421	0.046	0.044	0.000	0.004	0.003	0.489	0.053	0.051	0.000

Emission Factors from
SCAQMD Prepared - Highest (Most Conservative) Emfac 2002 (version 2.2)
Emission Factors for On-Road Passenger Vehicles
Scenario Year: 2009
All model years in the range 1965 to 2009

Passenger vehicle travel on paved roads

0.0064 PM10 lb/VMT (from Table A9-9-B-1 for major streets/highways)

Equipment	Daily PM10 Emissions (lb/day)	Annual PM10 Emissions (tons/yr)	Constr Project PM10 Emissions (tons)	Daily PM2.5 Emissions (lb/day)	Annual PM2.5 Emissions (tons/yr)	Constr Project PM2.5 Emissions (tons)
Employee Vehicles	1.38	0.25	0.29	0.23	0.04	0.05

Assumed average distance travelled off site for all employees commuting will be 15 miles
times 2 for return trip 30 miles
Each worker on makes 1 return trip per day
3753 = Total number employees on site for entire 18 month construction period
3231 = Total number employees on site for months 2-13
Assumed 1.25 employees per vehicle
30 Maximum number of days per month of construction

Annual Combustion Emissions

Maximum annual construction equipment activity occurs in months 3 - 14.

Diesel Fired Offroad Equipment

Equipment	Quantity/ year	Hours/ Day	CARB EF HP	Horsepower	Days/ month	Emission factors (lb/hr) PM10	CO	ROC	NOx	SOx	Annual Emissions (ton/yr) PM10	PM2.5	CO	VOC	NOx	SOx
Tractor	0	8.4	50	72	30	0.0337	0.3685	0.1394	0.3165	0.0004	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	24	6	120	113	30	0.0373	0.2272	0.0662	0.3757	0.0004	0.1	0.1	0.5	0.1	0.8	0.0
500 Ton Truck Crane	6	3	500	408	30	0.0726	0.7157	0.1913	1.8770	0.0018	0.0	0.0	0.2	0.1	0.5	0.0
Crane	11	6	250	330	30	0.0501	0.3664	0.1314	1.3105	0.0013	0.0	0.0	0.4	0.1	1.3	0.0
Hydraulic Crane (65 Ton)	11	7.8	250	250	30	0.0501	0.3664	0.1314	1.3105	0.0013	0.1	0.1	0.5	0.2	1.7	0.0
Hydraulic Crane (45 Ton)	11	7.8	175	195	30	0.0564	0.4905	0.1276	0.9849	0.0009	0.1	0.1	0.6	0.2	1.3	0.0
Boom Manlift,	21	7.8	50	70	30	0.0197	0.1979	0.0798	0.2013	0.0003	0.0	0.0	0.5	0.2	0.5	0.0
Diesel Air Compressor	10	3	120	95	30	0.0563	0.3375	0.1066	0.6253	0.0006	0.0	0.0	0.2	0.0	0.3	0.0
Backhoe Loader,	20	9	50	75	30	0.0337	0.3685	0.1394	0.3165	0.0004	0.1	0.1	1.0	0.4	0.9	0.0
Trencher	2	5.4	50	34	30	0.0421	0.4460	0.1929	0.3666	0.0004	0.0	0.0	0.1	0.0	0.1	0.0
Wheel Loader	3	8.4	175	175	30	0.0698	0.6351	0.1564	1.2251	0.0012	0.0	0.0	0.2	0.1	0.5	0.0
Elevating Scrapers	3	10.8	175	175	30	0.1101	0.9371	0.2510	1.9271	0.0017	0.1	0.0	0.5	0.1	0.9	0.0
Dump Truck 30 Ton	2	9	250	300	30	0.0614	0.4534	0.1725	1.7336	0.0019	0.0	0.0	0.1	0.0	0.5	0.0
Crawler Excavator,	9	10.2	175	168	30	0.0704	0.6716	0.1564	1.1993	0.0013	0.1	0.1	0.9	0.2	1.7	0.0
Dozer	2	10.8	175	110	30	0.0896	0.7662	0.2041	1.5613	0.0014	0.0	0.0	0.2	0.1	0.5	0.0
Dozer with Ripper	0	10.8	500	405	30	0.1431	1.8608	0.3754	3.3530	0.0026	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Roller	12	10.8	50	76	30	0.0307	0.3258	0.1354	0.2795	0.0003	0.1	0.1	0.6	0.3	0.5	0.0
Walk Behind Vibratory Roller	10	10.8	15	13.5	30	0.0023	0.0386	0.0074	0.0462	0.0001	0.0	0.0	0.1	0.0	0.1	0.0
Grader, 155 HP	10	10.8	250	215	30	0.0823	0.7443	0.1846	1.4391	0.0014	0.1	0.1	1.2	0.3	2.3	0.0
Compactors	7	6	15	3.3	30	0.0018	0.0263	0.0051	0.0321	0.0001	0.0	0.0	0.0	0.0	0.0	0.0
Vibratory Plate Compactors	24	6	15	8.5	30	0.0018	0.0263	0.0051	0.0321	0.0001	0.0	0.0	0.1	0.0	0.1	0.0
Welder	20	3	50	48	30	0.0299	0.3084	0.1292	0.2760	0.0003	0.0	0.0	0.3	0.1	0.2	0.0
Light Plant	24	3.6	15	12	30	0.0037	0.0617	0.0118	0.0739	0.0002	0.0	0.0	0.1	0.0	0.1	0.0
	242									**Total**	**0.9**	**0.8**	**8.2**	**2.5**	**14.7**	**0.0**

Notes:
Emission factors from SCAQMD composite off-road emission factors from CARB's Off-Road Model for year 2009.
Equipment list, quantity, horsepower, and hours of operation from client.
PM2.5 emission factors from updated CEIDARS List with PM2.5 fractions. PM2.5 numbers obtained by multiplying the PM10 values by fraction in CEIDARS list for onroad or offroad diesel vehicles.
Light Plant is Other Construction Equipment

Combustion Exhaust from Travel on Unpaved Roads						Emission factor (lb/mile)							Annual Emissions (ton/yr)					
Vehicle Type	Quantity/year[1]	Round Trips /Day/ Unit	Round Trip Distance (mile)	Daily VMT per Unit	Annual VMT for all Units	PM10	PM2.5	CO	VOC	NOx	SOx	Emission factor vehicle type	PM10	PM2.5	CO	VOC	NOx	SOx
Pickup, 1/2 Ton, 4 x 2	12	4	0.5	2	720	0.0001	0.0001	0.0108	0.0012	0.0011	0.0000	passenger	0.000	0.000	0.004	0.000	0.000	3.2E-06
Flat Bed Truck	16	1	0.25	0.25	120	0.0004	0.0003	0.0145	0.0023	0.0215	0.0000	Delivery	0.000	0.000	0.001	0.000	0.001	2E-06
Fuel/Lube Truck	4	1	0	0	0	0.0004	0.0003	0.0145	0.0023	0.0215	0.0000	Delivery	0.000	0.000	0.000	0.000	0.000	0
Service Truck	6	1	0	0	0	0.0006	0.0004	0.0047	0.0010	0.0295	0.0000	HHD truck	0.000	0.000	0.000	0.000	0.000	0
Dump Truck	3	1	1	1	90	0.0006	0.0004	0.0047	0.0010	0.0295	0.0000	HHD truck	0.000	0.000	0.000	0.000	0.001	2.1E-06
Water Truck 4,000 Gal with Mo	8	4	2	8	1920	0.0006	0.0004	0.0047	0.0010	0.0295	0.0000	HHD truck	0.001	0.000	0.005	0.001	0.028	4.4E-05
Concrete Pumper Truck	15	1	0	0	0	0.0006	0.0004	0.0047	0.0010	0.0295	0.0000	HHD truck	0.000	0.000	0.000	0.000	0.000	0
Worker Vehicles in Parking lot	2584	1	0.25	0.25	19384	0.0001	0.0001	0.0108	0.0012	0.0011	0.0000	passenger	0.001	0.001	0.105	0.011	0.011	8.7E-05
												Total Unpaved Road	**0.001**	**0.001**	**0.115**	**0.013**	**0.042**	**0.000**

Notes:
SCAQMD Prepared - Highest (Most Conservative) Emfac 2002 (version 2.2)
Emission Factors for On-Road Passenger Vehicles & Delivery Trucks & Heavy Heavy Duty Diesel Trucks
Scenario Year: 2009
All model years in the range 1965 to 2009
1. Truck quantity based on monthly maximums, worker vehicle quantity based on total vehicles per day per month
30 Maximum number of days per month of construction

Emission location	Activity
Various	excavation

	Pieces of Equipment Onsite	Percentage
MAINDUST	196	0.810
TLINE (5 sources)	10	0.041
LAYDUST	28	0.116
GAS LINE (20 sources)	8	0.033
Total Equipment onsite annually	242	
Roads	truck & worker travel	

	number of sources
Roads	2

Main Site

Total MODEL EMISSION RATE (lb/hr) NOx Annual	PM10 Annual	SO2 Annual	PM2.5 Annual
5.4247	0.3381	5.59E-03	0.3111

Laydown Area

Total MODEL EMISSION RATE (lb/hr) NOx Annual	PM10 Annual	SO2 Annual	PM2.5 Annual
0.7750	0.0483	0.0008	0.0444

Transmission Line

Total MODEL EMISSION RATE (lb/hr) NOx Annual	PM10 Annual	SO2 Annual	PM2.5 Annual
0.0554	0.0034	5.71E-05	0.0032

Gas Line

Total MODEL EMISSION RATE (lb/hr) NOx Annual	PM10 Annual	SO2 Annual	PM2.5 Annual
1.11E-02	6.90E-04	1.14E-05	6.35E-04

NOx Annual	PM10 Annual	SO2 Annual	PM2.5 Annual
0.0097	0.00032	3.17E-05	0.00025

Annual Fugitive Dust Emissions

Maximum annual construction equipment activity occurs in months 3 - 14.

Bulldozing/Earth clearing

$E = 0.45 * G^{1.5} / H^{1.4} * 2.2046$ PM10 Emissions from bulldozing (lb/hr) from SCAQMD Table A9-9-F

7.5 G = Silt content (%) (from Table A9-9-F-1 for overburden)

15 H = Moisture content of surface material (%) (from Table A9-9-F-2 for moist dirt)

0.46 lb/hr of PM10

Equipment	Quantity/ year	Hours/ Day	Hours/ year/ Unit	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Excavator	9	10.2	1224	90%	0.25	0.05
Backhoe	20	9	1080	90%	0.50	0.10
Grader	7	10.8	1296	90%	0.21	0.04
Scraper	3	10.8	1296	90%	0.09	0.02
Tracked Dozer	0	10.8	1296	90%	0.00	0.00
Wheeled Loader	3	8.4	1008	90%	0.07	0.01
				Total	**1.12**	**0.23**

4 Total months of soil movement

12 hours per work day

30 construction days per month

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

Dirt Piling or Material Handling

$E = 0.00112 * (G/5)^{1.3} / (H/2)^{1.4}$ PM10 Emissions from Dirt Piling or Material Handling (lb/hr) from SCAQMD Table A9-9-G

12 G = Mean Wind speed (mph) default

15 H = Moisture content of surface material (%) (from Table A9-9-G-1 for moist dirt)

0.00021 lb/ton of PM10

Equipment	Quantity/ year	Hours/ Day	Annual Material Handled (ton)	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Wheeled Loader	3	8.4	280,452	90%	0.0029	0.0006
Dump Trucks	2	9	280,452	90%	0.0029	0.0006
				Total	**0.0058**	**0.0012**

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

1631 yd3/day 2337 ton/day

195,778 yd3 280,452 tons 2865 density of soil (lb/yd3)

(USDA NRCS Physical Soil Properties from Riverside County

Coachella Valley for Carsitas Gravelly Sand soil)

80.9 acres = 195,778 cubic yds, assume depth of soils moved is 0.5 yd (1.5 ft)

Cover Storage Pile

SCAQMD Table A9-9-E

E = 1.7 * G/1.5 * (365-H)/235 * I/15 * J

PM10 Emission factor from wind erosion of storage piles per day per acre

7.5 G = Silt content (%) (from Table A9-9-E-1 for overburden)

17 H = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Palm Springs COOP Station)

28.55 I = Percentage of time that the unobstructed wind speed exceeds 12 mph at mean pile height

0.5 J = Fraction of TSP that is PM10 = 0.5

11.979 lb/acre/day

wind speed percentage based on 1988-91 (4 yrs) of wind speed data (actual hours > 10.00 knots) as recorded at Wintec station

Source	Quantity	Size of Pile (acre)	Days / year	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Cover Storage Pile	2	1	120	90%	0.14	0.030

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

pile size assumed

Days per year accounts for weekend days also, not just work days

Travel on unpaved road

$F = 2.1 * G/12 * H/30 * (J/3)^{0.7} * (I/4)^{0.5} * (365-K)/365$ SCAQMD Table A9-9-D

Emission factor for vehicle travel on unpaved roads (lb/VMT)

4 G = Surface silt loading (%) (value for gravel road)

5 H = Mean vehicle speed (mph)

value listed in table I = Mean number of wheels on vehicle

value listed in table J = Mean vehicle weight (ton)

17 K = Mean number of days per year with at least 0.01 inches of precipitation (from WRCC for Palm Springs COOP Station)

Vehicle Type	Quantity/ year[1]	Round Trips /Day/ Unit	Round Trip Distance (mile)	Daily VMT per Unit	Annual VMT for all Units	Mean Vehicle Weight (tons)	Number of Wheels on Vehicle	PM10 EF (lbs/VMT)	Watering Control Efficiency	PM10 Emissions (tons/yr)	PM2.5 Emissions (tons/yr)
Pickup, 1/2 Ton, 4 x 2	12	4	0.5	2	720	3	4	0.11	90%	0.004	0.001
1 Ton Flat Bed Truck	19	1	0.25	0.25	142.5	5	6	0.19	90%	0.001	0.000
Forklift (9,000 Lb)	24	1	0.5	0.5	360	13	4	0.31	90%	0.006	0.001
Fuel/Lube Truck (150 Gal Gas/ 85	3	1	0	0	0	13	10	0.49	90%	0.000	0.000
Service Truck	4	1	0	0	0	13	10	0.49	90%	0.000	0.000
500 Ton Truck Crane @ Rail Sidi	6	0	0	0	0	165	16	3.68	90%	0.000	0.000
Crawler Crane	11	0	0	0	0	324	0	0.00	90%	0.000	0.000
Hydraulic Crane (65 Ton)	11	1	0.25	0.25	82.5	54	4	0.84	90%	0.003	0.001
Rough Terrain Hydraulic Crane (4	11	1	0.25	0.25	82.5	43	4	0.72	90%	0.003	0.001
Boom Manlift, Diesel, (66 ft)	21	1	0.25	0.25	157.5	13	4	0.31	90%	0.002	0.001
Diesel Air Compressor	10	0	0	0	0	0.5	2	0.02	90%	0.000	0.000
Backhoe Loader, 4 x 4, 74 HP	20	1	0.25	0.25	150	11	4	0.28	90%	0.002	0.000
Trencher 3610 Model	2	1	0.25	0.25	15	1	4	0.05	90%	0.000	0.000
Wheel Loader	3	1	0.5	0.5	45	26	4	0.50	90%	0.001	0.000
Elevating Scrapers	3	1	1	1	90	48	4	0.77	90%	0.003	0.001
Dump Truck 30 Ton	2	1	1	1	60	31	10	0.90	90%	0.003	0.001
Crawler Excavator, 1.5 CY Bucke	9	1	0.5	0.5	135	17	4	0.37	90%	0.003	0.001
Dozer	2	1	0.5	0.5	30	10	0	0.00	90%	0.000	0.000
Dozer with Ripper	0	1	0.5	0.5	0	53	0	0.00	90%	0.000	0.000
Vibratory Roller	12	1	0.25	0.25	90	8	3	0.19	90%	0.001	0.000
Walk Behind Vibratory Roller	10	1	0.25	0.25	75	0.5	2	0.02	90%	0.000	0.000
Dump Truck Operated & Maintain	10	1	1	1	300	13	10	0.49	90%	0.007	0.002
Motor Grader, 155 HP	7	1	1	1	7	16	4	0.36	90%	0.000	0.000
Jumping Jacks Compactors	18	1	0.01	0.01	0	0	0	0.00	90%	0.000	0.000
Vibratory Plate Compactors	24	1	0.01	0.01	0	0	0	0.00	90%	0.000	0.000
Water Truck 4,000 Gal with Monit	5	4	2	8	40	13	10	0.49	90%	0.001	0.000
Concrete Pumper Truck Services	17	1	0	0	0	13	10	0.49	90%	0.000	0.000
Welder, Trailer Mounted Diesel, M	20	0	0	0	0	0.5	2	0.02	90%	0.000	0.000
Light Plant, 8 kW w/ Four 1,000 W	24	0	0	0	0	0.5	2	0.02	90%	0.000	0.000
worker passenger vehicles	2584	1	0.25	0.25	646	2	4	0.08	90%	0.003	0.001
									Total	**0.033**	**0.007**

Assumed maximum travel speed is 5 mph

Equipment weight from SCAQMD Table A9-9-D-3 and various websites

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

PM2.5 emission factors from updated CEIDARS List with PM2.5 fractions.

PM2.5 numbers obtained by multiplying the PM10 values by fraction in CEIDARS list for appropriate fugitive dust sources.

Water trucks operate at least 4 times per day. Service trucks use 1 trip per day.

Distances measured from plot plan from highway along access road to center of construction area and parking lot.

1. Truck quantity based on monthly maximums, worker vehicle quantity based on total vehicles per day per month

30 Maximum number of days per month of construction

		Main Site		Laydown		Transmission Line	
		Total MODEL EMISSION RATE (lb		Total MODEL EMISSION RATE (lb/		Total MODEL EMISSION RATE (lb/hr)	
Emission location	Activity	PM10 Annual	PM2.5 Annual	PM10 Annual	PM2.5 Annual	PM10 Annual	PM2.5 Annual
Various	excavation	0.3823	0.0795	0.1881	0.0391	6.93E-05	1.44E-05

		Gas Line	
		Total MODEL EMISSION RATE (lb/hr)	
		PM10 Annual	PM2.5 Annual
Roads (2 sources)	truck & worker travel	3.90E-04	8.11E-05

					MODEL EMISSION RATE per Source (g/s-m2)	
					PM10	PM2.5
Location	X (m)	Y (m)	AREA (m2)	percent of total area	Annual	Annual
MAINDUST	180	613	110340	0.661	2.89E-07	6.00E-08
TLINE	10	10	100	0.001	2.89E-07	6.00E-08
LAYDUST	126	431	54306	0.325	2.89E-07	6.00E-08
GAS LINE	150	15	2250	0.013	2.89E-07	6.00E-08
Total Construction Area			166996			
ROAD1	50	500	25000	0.500	9.64E-07	2.01E-07
ROAD2	50	500	25000	0.500	9.64E-07	2.01E-07
Total Road Area			50000			

Short Term Combustion Exhaust Emissions

Maximum construction activity occurs in month 3.

Diesel Fired Offroad Equipment

Equipment	Quantity	Hours /Day	Horsepower	Emission factors (lb/hr) PM10	CO	ROC	NOx	SOx	Hourly Emissions (lb/hr) PM10	PM2.5	CO	VOC	NOx	SOx	Daily Emissions (lb/day) PM10	PM2.5	CO	VOC	NOx	SOx
Forklift	2	6	113	0.0373	0.2272	0.0662	0.3757	0.0004	0.07	0.07	0.45	0.13	0.75	7.33E-04	0.45	0.41	2.73	0.79	4.51	0.00
Wheel Loader	1	8.4	175	0.0698	0.6351	0.1564	1.2251	0.0012	0.07	0.06	0.64	0.16	1.23	1.20E-03	0.59	0.54	5.33	1.31	10.29	0.01
Elevating Scrapers	1	10.8	175	0.1101	0.9371	0.2510	1.9271	0.0017	0.11	0.10	0.94	0.25	1.93	1.70E-03	1.19	1.09	10.12	2.71	20.81	0.02
Dump Truck 30 Ton	1	9	300	0.0614	0.4534	0.1725	1.7336	0.0019	0.06	0.06	0.45	0.17	1.73	1.90E-03	0.55	0.51	4.08	1.55	15.60	0.02
Crawler Excavator,	1	10.2	168	0.0704	0.6716	0.1564	1.1993	0.0013	0.07	0.06	0.67	0.16	1.20	1.26E-03	0.72	0.66	6.85	1.60	12.23	0.01
Dozer	1	10.8	110	0.0896	0.7662	0.2041	1.5613	0.0014	0.09	0.08	0.77	0.20	1.56	1.40E-03	0.97	0.89	8.27	2.20	16.86	0.02
Grader	1	10.8	175	0.0823	0.7443	0.1846	1.4391	0.0014	0.08	0.08	0.74	0.18	1.44	1.40E-03	0.89	0.82	8.04	1.99	15.54	0.02
Compactors	4	6	3.3	0.0018	0.0263	0.0051	0.0321	0.0001	7.10E-03	6.53E-03	0.11	0.02	0.13	2.69E-04	0.04	0.04	0.63	0.12	0.77	0.00
light plant	2	3.6	12	0.0037	0.0617	0.0118	0.0739	0.0002	0.01	0.01	0.12	0.02	0.15	4.00E-04	0.03	0.02	0.44	0.08	0.53	0.00
vibratory roller	4	10.8	76	0.0307	0.3258	0.1354	0.2795	0.0003	0.12	0.11	1.30	0.54	1.12	1.34E-03	1.33	1.22	14.08	5.85	12.07	0.01
Vibratory Plate Compactors	5	6	8.5	0.0018	0.0263	0.0051	0.0321	0.0001	8.87E-03	8.16E-03	0.13	0.03	0.16	3.36E-04	0.05	0.05	0.79	0.15	0.96	0.00
Total Equipment	23							**Total**	**0.70**	**0.65**	**6.33**	**1.87**	**11.39**	**0.01**	**6.80**	**6.26**	**61.37**	**18.37**	**110.19**	**0.11**

Notes:

Emission factors from SCAQMD composite off-road emission factors from CARB's Off-Road Model for year 2009.

Equipment list, quantity, horsepower, and hours of operation from client.

PM2.5 emission factors from updated CEIDARS List with PM2.5 fractions. PM2.5 numbers obtained by multiplying the PM10 values by fraction in CEIDARS list for onroad or offroad diesel vehicles.

Construction day is assumed to be 12 hours long (7 am to 7 pm).

Combustion Exhaust from Travel on Unpaved Roads

Vehicle Type	No. Of Unit	Round Trips /Day/ Unit[3]	Round Trip Distance (mile)	Daily VMT (all units)	Emission factor (lb/mile) PM10	PM2.5	CO	VOC	NOx	SOx	Emission factor vehicle type	Hourly Emissions (lb/hr) PM10	PM2.5	CO	VOC	NOx	SOx	Daily Emissions (lb/day) PM10	PM2.5	CO	VOC	NOx	SOx
Pickup, 1/2 Ton, 4 x 2	1	4	0.5	2	0.0001	0.0000	0.0108	0.0012	0.0011	0.0000	passenger	0.000	0.000	0.002	0.000	0.000	0.000	0.000162	3.434E-05	0.021698	0.002358	0.002276	0.000018
Flat Bed Truck	1	1	0.25	0.25	0.0004	0.0001	0.0145	0.0023	0.0215	0.0000	Delivery	0.000	0.000	0.000	0.000	0.000	0.000	0.0001	0.0000212	0.003635	0.0005738	0.0053753	8.25E-06
Fuel/Lube Truck	1	1	0	0	0.0004	0.0001	0.0145	0.0023	0.0215	0.0000	Delivery	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0
Service Truck	2	1	0	0	0.0006	0.0001	0.0047	0.0010	0.0295	0.0000	HHD truck	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0	0
Dump Truck	1	1	1	1	0.0006	0.0001	0.0047	0.0010	0.0295	0.0000	HHD truck	0.000	0.000	0.000	0.000	0.002	0.000	0.000559	0.0001185	0.004738	0.001042	0.029455	0.0000461
Water Truck 4,000 Gal with I	3	4	2	24	0.0006	0.0001	0.0047	0.0010	0.0295	0.0000	HHD truck	0.001	0.000	0.009	0.002	0.059	0.000	0.013416	0.0028442	0.113712	0.025008	0.70692	0.0011064
Worker Vehicles in Parking l	65	1	0.25	16	0.0001	0.0000	0.0108	0.0012	0.0011	0.0000	passenger	0.000	0.000	0.015	0.002	0.002	0.000	0.0013078	0.0002772	0.1751609	0.0190354	0.0183734	0.0001453
Total Equipment	71									**Total Unpaved Road**		**0.0013**	**0.0003**	**0.0266**	**0.0040**	**0.0635**	**0.0001**	**0.0155448**	**0.0032955**	**0.3189439**	**0.0480171**	**0.7623997**	**0.0013241**

Notes:

SCAQMD Prepared - Highest (Most Conservative) Emfac 2002 (version 2.2)

Emission Factors for On-Road Passenger Vehicles & Delivery Trucks & Heavy Heavy Duty Diesel Trucks

Scenario Year: 2009

All model years in the range 1965 to 2009

Number of workers in month 3/1.25 people per car

Construction day is assumed to be 12 hours long (7 am to 7 pm).

12 Maximum number of construction work hours per day

Emission location	Activity	Number of Sources	MODEL EMISSION RATE per source (lb/hr) NOx 1-hr	CO 1 & 8 hr	PM10 24hr	SO2 1 & 3 hr	SO2 24hr	PM2.5 24hr	MODEL EMISSION RATE per source (g/s) NOx 1-hr	CO 1 & 8 hr	PM10 24hr	SO2 1 & 3 hr	SO2 24hr	PM2.5 24hr
Various	excavation	23	0.495	0.275	2.46E-02	5.19E-04	4.08E-04	2.27E-02	6.25E-02	3.47E-02	3.11E-03	6.55E-05	5.15E-05	2.86E-03
Roads	truck & worker travel	2	0.0318	0.013289	0.000648	5.52E-05	5.5E-05	0.00014	4.01E-03	1.68E-03	8.17E-05	6.96E-06	6.96E-06	1.73E-05

17 sources in main construction area

4 sources in laydown area

2 sources in transmission line area

Short term Fugitive Dust Emissions

Maximum construction activity occurs in month 3.

Bulldozing/Earth clearing

$E = 0.45 * G^{1.5} / H^{1.4} * 2.2046$ PM10 Emissions from bulldozing (lb/hr) from SCAQMD Table A9-9-F

7.5 G = Silt content (%) (from Table A9-9-F-1 for overburden)

15 H = Moisture content of surface material (%) (from Table A9-9-F-2 for moist dirt)

0.46 lb/hr of PM10

Equipment	Quantity	Hours/Day	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Excavator	1	10.2	90%	0.05	0.47	0.01	0.10
Grader	1	10.8	90%	0.05	0.50	0.01	0.10
Scraper	1	10.8	90%	0.05	0.50	0.01	0.10
			Total	**0.14**	**1.46**	**0.03**	**0.30**

30 construction days per month

4 Total months of soil movement

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

Dirt Piling or Material Handling

$E = 0.00112 * (G/5)^{1.3} / (H/2)^{1.4}$ PM10 Emissions from Dirt Piling or Material Handling (lb/hr) from SCAQMD Table A9-9-G

12 G = Mean Wind speed (mph) default

15 H = Moisture content of surface material (%) (from Table A9-9-G-1 for moist dirt)

0.00021 lb/ton of PM10

Equipment	Quantity	Hours/Day	Material Handled (ton/day)	Material Handled (ton)	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Wheeled Loader	1	8.4	1647	197,599	90%	0.0041	0.0343	0.0008	0.0071
Dump Trucks	1	9	1647	197,599	90%	0.0038	0.0343	0.0008	0.0071
					Total	**0.0079**	**0.0686**	**0.0016**	**0.0143**

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

1150 yd3/day 1647 ton/day

137,940 yd3 197,599 tons 2865 density of soil (lb/yd3)

(USDA NRCS Physical Soil Properties from Riverside County Coachella Valley for Carsitas Gravelly Sand soil)

57 acres = 137,940 cubic yds, assume depth of soils moved is 0.5 yd

Cover Storage Pile

SCAQMD Table A9-9-E

$E = 1.7 * G/1.5 * (365-H)/235 * I/15 * J$

PM10 Emission factor from wind erosion of storage piles per day per acre

7.5 G = Silt content (%) (from Table A9-9-E-1 for overburden)

17 H = Mean number of days per year with at least 0.01 inches of precipitation (from Western Regional Climate Center for Palm Springs COOP Station)

28.55 I = Percentage of time that the unobstructed wind speed exceeds 12 mph at mean pile height

0.5 J = Fraction of TSP that is PM10 = 0.5

11.979 lb/acre/day

wind speed percentage based on 1988-91 (4 yrs) of wind speed data (actual hours > 10.00 knots) as recorded at Wintec station

Source	Quantity	Size of Pile (acre)	Hours/Day	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Cover Storage Pile	2	1	24	90%	0.10	2.40	0.021	0.498

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

pile size assumed

Travel on unpaved road

$F = 2.1 * G/12 * H/30 * (J/3)^{0.7} * (I/4)^{0.5} * (365-K)/365$ SCAQMD Table A9-9-D

Emission factor for vehicle travel on unpaved roads (lb/VMT)

4 G = Surface silt loading (%) (value for gravel road)

5 H = Mean vehicle speed (mph)

value listed in table I = Mean number of wheels on vehicle

value listed in table J = Mean vehicle weight (ton)

17 K = Mean number of days per year with at least 0.01 inches of precipitation (from Western Regional Climate Center for Palm Springs COOP Station)

Vehicle Type	No. Of Unit	Round Trips /Day/ Unit	Round Trip Distance (mile)	Daily VMT (all units)	Mean Vehicle Weight (tons)	Number of Wheels on Vehicle	PM10 EF (lbs/VMT)	Watering Control Efficiency	PM10 Emissions (lb/hr)	PM10 Emissions (lb/day)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (lb/day)
Pickup, 1/2 Ton, 4 x 2	1	4	0.5	2	3	4	0.11	90%	0.00	0.02	0.00	0.00
1 Ton Flat Bed Truck	1	1	0.25	0.25	5	6	0.19	90%	0.00	0.00	0.00	0.00
Forklift (9,000 Lb)	2	1	0.5	1	13	4	0.31	90%	0.00	0.03	0.00	0.01
Fuel/Lube Truck (150 Gal Gas/ 850 Ga	1	1	0	0	13	10	0.49	90%	0.00	0.00	0.00	0.00
Service Truck	2	1	0	0	13	10	0.49	90%	0.00	0.00	0.00	0.00
500 Ton Truck Crane @ Rail Siding	0	1	0	0	165	16	3.68	90%	0.00	0.00	0.00	0.00
Crawler Crane	0	1	0	0	324	0	0.00	90%	0.00	0.00	0.00	0.00
Hydraulic Crane (65 Ton)	0	1	0.25	0	54	4	0.84	90%	0.00	0.00	0.00	0.00
Rough Terrain Hydraulic Crane (45 Toı	0	1	0.25	0	43	4	0.72	90%	0.00	0.00	0.00	0.00
Boom Manlift, Diesel, (66 ft)	0	1	0.25	0	13	4	0.31	90%	0.00	0.00	0.00	0.00
Diesel Air Compressor	0	0	0	0	0.5	2	0.02	90%	0.00	0.00	0.00	0.00
Backhoe Loader, 4 x 4, 74 HP	0	1	0.25	0	11	4	0.28	90%	0.00	0.00	0.00	0.00
Trencher 3610 Model	0	1	0.25	0	1	4	0.05	90%	0.00	0.00	0.00	0.00
Wheel Loader	1	1	0.5	0.5	26	4	0.50	90%	0.00	0.03	0.00	0.01
Elevating Scrapers	1	1	1	1	48	4	0.77	90%	0.01	0.08	0.00	0.02
Dump Truck 30 Ton	1	1	1	1	31	10	0.90	90%	0.01	0.09	0.00	0.02
Crawler Excavator, 1.5 CY Bucket	1	1	0.5	0.5	17	4	0.37	90%	0.00	0.02	0.00	0.00
Dozer	1	1	0.5	0.5	10	0	0.00	90%	0.00	0.00	0.00	0.00
Dozer with Ripper	0	1	0.5	0	53	0	0.00	90%	0.00	0.00	0.00	0.00
Vibratory Roller	4	1	0.25	1	8	3	0.19	90%	0.00	0.02	0.00	0.00
Walk Behind Vibratory Roller	0	1	0.25	0	0.5	2	0.02	90%	0.00	0.00	0.00	0.00
Dump Truck Operated & Maintained	0	1	1	0	13	10	0.49	90%	0.00	0.00	0.00	0.00
Motor Grader, 155 HP	1	1	1	1	16	4	0.36	90%	0.00	0.04	0.00	0.01
Jumping Jacks Compactors	4	1	0.01	0.04	0	0	0.00	90%	0.00	0.00	0.00	0.00
Vibratory Plate Compactors	5	1	0.01	0.05	0	0	0.00	90%	0.00	0.00	0.00	0.00
Water Truck 4,000 Gal with Monitor	3	4	2	24	13	10	0.49	90%	0.10	1.18	0.02	0.25
Concrete Pumper Truck Services	0	1	0	0	13	10	0.49	90%	0.00	0.00	0.00	0.00
Welder, Trailer Mounted Diesel, Miller,	0	0	0	0	0.5	2	0.02	90%	0.00	0.00	0.00	0.00
Light Plant, 8 kW w/ Four 1,000 Watt L	2	0	0	0	0.5	2	0.02	90%	0.00	0.00	0.00	0.00
worker passenger vehicles	65	1	0.25	16	0.5	4	0.03	90%	0.00	0.05	0.00	0.01
								Total	**0.13**	**1.55**	**0.03**	**0.33**

Assumed maximum travel speed is 5 mph

Equipment weight from SCAQMD Table A9-9-D-3 and various websites

Water efficiency from CEQA Table 11-4 watering 3 times daily or using chemical suppressants

PM2.5 emission factors from updated CEIDARS List with PM2.5 fractions.

PM2.5 numbers obtained by multiplying the PM10 values by fraction in CEIDARS list for appropriate fugitive dust sources.

Water trucks operate at least 4 times per day. Service trucks use 1 trip per day.

Distances measured from plot plan from highway along access road to center of construction area and parking lot.

12 Maximum number of construction work hours per day

		Main Site		Laydown		Transmission Line	
		Total MODEL EMISSION RATE (lb/hr)		Total MODEL EMISSION RATE (lb/hr)		Total MODEL EMISSION RATE (lb/hr)	
		PM10	PM2.5	PM10	PM2.5	PM10	PM2.5
Emission location	**Activity**	**24hr**	**24hr**	**24hr**	**24hr**	**24hr**	**24hr**
Various	excavation	0.152	0.0317	0.075	0.0156	1.99E-04	4.13E-05

		PM10 24hr	PM2.5 24hr
Roads (2 sources)	truck & worker travel	0.0648	0.0137

Location	X (m)	Y (m)	AREA (m2)	percent of total area	MODEL EMISSION RATE per Source (g/s-m2) PM10 24hr	PM10 Annual	PM2.5 24hr	PM2.5 Annual
MAINDUST	180	613	110340	0.670	1.74E-07		3.62E-08	
TLINE (5 poles)	10	10	100	0.001	2.50E-07		5.21E-08	
LAYDUST	126	431	54306	0.330	1.74E-07		3.62E-08	
Total Construction Area			164746					
ROAD1	50	500	25000	0.500	3.84E-07		7.99E-08	
ROAD2	50	500	25000	0.500	3.84E-07		7.99E-08	
Total Road Area			50000					

APPENDIX I-3
OPERATING EMISSIONS

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **Larry Salguero**
Project Info: **CPV Ocotillo-Update (at Unit "H" elev with Blythe 2006 Fuel)**

Engine: **LMS100 PA**
Deck Info: **G0179C - 87o.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (35404)**
Fuel: **Site Gas Fuel#900-1531, 20600 Btu/lb,LHV**

Date: **04/26/2007**
Time: **2:07:36 PM**
Version: **3.5.10**

	PERMIT SUBSET											AMBIENT SPREAD												
Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**	**122**	**123**
Ambient Conditions																								
Dry Bulb, °F	17.0	17.0	17.0	72.0	72.0	72.0	72.0	107.0	107.0	107.0	107.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0
Wet Bulb, °F	15.8	15.8	15.8	57.1	57.1	57.1	57.1	72.2	72.2	72.2	72.2	-0.6	9.1	17.2	26.2	34.8	44.0	49.8	56.0	61.8	67.0	69.7	72.9	75.6
RH, %	80.0	80.0	80.0	40.0	40.0	40.0	40.0	18.4	18.4	18.4	18.4	80.0	80.0	60.0	60.0	60.0	62.7	49.0	41.5	35.6	30.2	21.7	16.8	12.7
Altitude, ft	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2	1080.2
Ambient Pressure, psia	14.132	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131	14.131
Engine Inlet																								
Comp Inlet Temp, °F	17.0	17.0	17.0	59.3	72.0	72.0	72.0	77.4	107.0	107.0	107.0	10.0	20.0	30.0	40.0	40.0	50.0	60.0	58.1	64.5	70.4	74.2	78.5	82.3
RH, %	80.0	80.0	80.0	87.8	40.0	40.0	40.0	78.3	18.4	18.4	18.4	47.9	49.0	37.5	39.9	60.0	62.7	49.0	88.2	86.2	84.1	80.2	77.3	74.2
Conditioning	NONE	NONE	NONE	EVAP	NONE	NONE	NONE	EVAP	NONE	NONE	NONE	HEAT	HEAT	HEAT	HEAT	NONE	NONE	NONE	EVAP	EVAP	EVAP	EVAP	EVAP	EVAP
Tons or kBtu/hr	0	0	0	0	0	0	0	0	0	0	0	4002	3927	3888	3967	0	0	0	0	0	0	0	0	0
Pressure Losses																								
Inlet Loss, inH20	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Exhaust Loss, inH20	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Partload %	**100**	**75**	**50**	**100-EVAP**	**100**	**75**	**50**	**100-EVAP**	**100**	**75**	**50**	**100-HEAT**	**100-HEAT**	**100-HEAT**	**100-HEAT**	**100**	**100**	**100**	**100-EVAP**	**100-EVAP**	**100-EVAP**	**100-EVAP**	**100-EVAP**	**100-EVAP**
kW, Gen Terms	**102611**	**76972**	**51327**	**100815**	**97647**	**73250**	**48845**	**94242**	**87682**	**65778**	**43866**	**102392**	**102717**	**103166**	**103687**	**103747**	**103576**	**101129**	**101180**	**99125**	**96823**	**95444**	**93840**	**92462**
Est. Btu/kW-hr, LHV	**7696**	**8096**	**8913**	**7832**	**7908**	**8265**	**9116**	**7958**	**8126**	**8526**	**9450**	**7686**	**7707**	**7739**	**7770**	**7767**	**7799**	**7844**	**7827**	**7857**	**7902**	**7932**	**7967**	**7998**
Fuel Flow																								
MMBtu/hr, LHV	789.8	623.2	457.5	789.6	772.2	605.5	445.3	750.0	712.5	560.8	414.5	787.0	791.7	798.4	805.7	805.8	807.8	793.2	791.9	778.8	765.1	757.1	747.7	739.6
lb/hr	38338	30251	22209	38331	37485	29391	21616	36409	34589	27224	20124	38205	38431	38758	39111	39118	39215	38507	38443	37806	37142	36751	36294	35902
NOx Control	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**
Water Injection																								
lb/hr	34407	24526	15618	31603	32072	22056	13838	28441	27730	18956	11812	34549	34784	35350	35685	35205	34801	33759	31908	30167	29265	28833	28310	27861
Temperature, °F	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Intercooler	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**	**Water-Air**
Humidification	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
IC Heat Extraction, btu/s	20364	14849	9124	25137	25843	20407	13606	27440	27252	21913	15084	19317	20771	22135	23505	23516	24700	25304	25078	25320	26292	26863	27617	28264
KOD Water Extraction, lb/s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.2	1.8	2.4
Control Parameters																								
HP Speed, RPM	9248	9098	8927	9353	9350	9142	8959	9357	9351	9135	8952	9235	9255	9283	9314	9318	9345	9346	9352	9356	9357	9357	9357	9358
LP Speed, RPM	5075	4729	4510	5317	5290	4941	4714	5272	5293	5026	4800	5038	5099	5185	5273	5276	5344	5330	5322	5287	5277	5275	5272	5269
PT Speed, RPM	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
PS3 - CDP, psia	567.0	468.9	362.9	552.8	540.4	450.5	349.6	526.1	500.0	418.4	326.3	567.0	567.0	567.0	567.0	567.0	564.5	554.6	554.3	545.8	536.5	530.9	524.5	518.9
T23 - Intcrl Inlet Temp, °F	285.1	259.2	223.1	335.9	348.8	327.8	290.5	350.5	382.3	362.2	325.3	275.4	289.1	302.4	315.8	315.8	328.2	337.7	334.8	340.2	344.9	348.0	351.3	354.3
P23 - Intcrl Inlet Pressure, psia	57.2	50.7	42.8	53.9	52.6	48.2	40.8	51.5	49.0	45.1	38.5	57.4	57.0	56.3	55.6	55.6	54.8	53.9	54.0	53.3	52.4	51.9	51.3	50.8
W23 - Intcrl Inlet Flow, lb/s	455.6	401.2	351.3	437.5	427.4	368.8	322.3	418.2	395.8	342.8	300.6	459.1	455.0	452.8	450.4	450.3	446.4	438.6	438.6	432.0	425.5	421.6	417.1	413.2
T25 - HPC Inlet Temp, °F	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
T3CRF - CDT, °F	714	687	659	724	724	688	659	721	720	685	656	713	715	719	724	724	727	726	724	723	722	721	721	721
T48IN, °R	1986	1925	1857	2031	2031	1943	1876	2031	2031	1942	1874	1980	1989	2003	2017	2018	2031	2031	2031	2031	2031	2031	2031	2031
T48IN, °F	1526	1465	1398	1571	1571	1483	1416	1572	1571	1482	1415	1520	1530	1543	1558	1558	1571	1571	1571	1572	1572	1572	1572	1572
Exhaust Parameters																								
Temperature, °F	744.1	744.6	762.4	785.9	791.8	771.2	786.7	799.7	813.6	791.8	806.2	739.6	746.8	757.1	768.5	769.2	779.8	784.6	785.1	789.6	794.3	797.2	800.6	803.6
lb/sec	473.3	399.5	316.1	454.5	444.4	381.1	302.6	432.2	410.9	353.8	282.4	474.2	472.8	470.9	468.7	468.4	464.5	456.2	455.7	448.5	440.8	436.2	430.9	426.3
lb/hr	1703900	1438227	1138130	1636078	1599844	1371797	1089457	1556054	1479392	1273593	1016749	1707260	1702162	1695082	1687174	1686405	1672140	1642491	1640662	1614738	1586985	1570460	1551234	1534715
Energy, Btu/s- Ref 0 °R	146479	123075	98407	146897	144141	120629	96564	141518	135888	114110	91724	146054	146668	147523	148507	148631	148979	146978	147184	145563	143658	142515	141183	140036

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **Larry Salguero**
Project Info: **CPV Ocotillo-Update (at Unit "H" elev with Blythe 2006 Fuel)**

Engine: **LMS100 PA**
Deck Info: **G0179C - 87o.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (35404)**
Fuel: **Site Gas Fuel#900-1531, 20600 Btu/lb,LHV**

Date: **04/26/2007**
Time: **2:07:36 PM**
Version: **3.5.10**

	PERMIT SUBSET											AMBIENT SPREAD												
Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**	**122**	**123**
Cp, Btu/lb-R	0.2729	0.2714	0.2704	0.2767	0.2764	0.2735	0.2724	0.2775	0.2775	0.2746	0.2734	0.2725	0.2730	0.2737	0.2746	0.2748	0.2757	0.2760	0.2766	0.2770	0.2773	0.2774	0.2775	0.2777
Emissions (NOT FOR USE IN ENVIRONMENTAL PERMITS)																								
NOx ppmvd Ref 15% O2	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
NOx as NO2, lb/hr	79	63	46	79	78	61	45	75	72	56	42	79	80	80	81	81	81	80	80	78	77	76	75	74
CO ppmvd Ref 15% O2	153	153	134	125	132	130	111	116	120	116	96	157	153	149	145	142	139	137	126	119	117	116	115	115
CO, lb/hr	295.37	232.47	149.89	241.07	248.83	191.85	120.74	212.42	209.12	158.76	97.36	302.31	296.68	291.14	286.48	280.42	275.08	265.12	244.11	227.08	219.25	215.67	211.33	207.60
CO2, lb/hr	102784.70	81150.75	59652.54	102821.00	100531.60	78887.77	58090.98	97693.12	92799.31	73103.20	54107.54	102421.40	103030.60	103911.00	104859.40	104886.80	105148.10	103255.90	103118.50	101431.30	99657.07	98609.01	97386.46	96335.63
HC ppmvd Ref 15% O2	8	8	6	6	6	6	4	5	5	5	3	8	8	7	7	7	7	6	6	5	5	5	5	5
HC, lb/hr	8.33	6.55	3.91	6.00	6.43	4.90	2.73	4.99	5.05	3.73	1.90	8.64	8.37	8.10	7.86	7.60	7.36	7.01	6.12	5.46	5.20	5.09	4.95	4.84
SOX as SO2, lb/hr	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum Emissions (GE)																								
NOx ppmvd Ref 15% O2	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
NOx as NO2, lb/hr	**79.390**	**62.610**	**45.950**	**79.420**	**77.660**	**60.850**	**44.730**	**75.440**	**71.720**	**56.370**	**41.650**	**79**	**80**	**80**	**81**	**81**	**81**	**80**	**80**	**78**	**77**	**76**	**75**	**74**
CO ppmvd Ref 15% O2	**111**	**111**	**111**	**92**	**78**	**78**	**78**	**73**	**68**	**68**	**68**	**111**	**110**	**110**	**108**	**108**	**101**	**92**	**94**	**86**	**79**	**76**	**73**	**71**
CO, lb/hr	**213.750**	**168.580**	**123.710**	**178.650**	**146.900**	**115.110**	**84.620**	**134.620**	**119.160**	**93.730**	**69.260**	**214**	**214**	**215**	**213**	**213**	**200**	**178**	**182**	**164**	**149**	**140**	**133**	**128**
HC ppmvd Ref 15% O2	**23**	**23**	**18**	**16**	**18**	**17**	**13**	**14**	**15**	**14**	**10**	**24**	**23**	**22**	**21**	**20**	**20**	**19**	**17**	**15**	**15**	**15**	**14**	**14**
HC, lb/hr	**25.080**	**19.710**	**11.790**	**18.070**	**19.360**	**14.760**	**8.220**	**15.020**	**15.220**	**11.220**	**5.790**	**26.0**	**25.2**	**24.4**	**23.7**	**22.9**	**22.2**	**21.1**	**18.4**	**16.4**	**15.7**	**15.3**	**14.9**	**14.6**
VOC ppmvd Ref 15% O2	**5**	**5**	**4**	**3**	**4**	**4**	**3**	**3**	**3**	**3**	**2**	**5**	**5**	**4**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**3**	**3**
VOC, lb/hr	**5.020**	**3.940**	**2.360**	**3.610**	**3.870**	**2.950**	**1.640**	**3.000**	**3.040**	**2.240**	**1.160**	**5.21**	**5.04**	**4.88**	**4.73**	**4.58**	**4.43**	**4.22**	**3.68**	**3.29**	**3.13**	**3.07**	**2.98**	**2.91**
PM10, lb/hr	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)																								
AR	1.2310	1.2369	1.2431	1.2210	1.2236	1.2312	1.2375	1.2193	1.2220	1.2295	1.2357	1.2322	1.2312	1.2300	1.2283	1.2273	1.2249	1.2245	1.2213	1.2197	1.2194	1.2194	1.2193	1.2192
N2	72.1967	72.5427	72.9072	71.6130	71.7635	72.2099	72.5806	71.5142	71.6735	72.1105	72.4720	72.2700	72.2093	72.1428	72.0400	71.9817	71.8444	71.8201	71.6301	71.5349	71.5203	71.5168	71.5134	71.5104
O2	13.5463	14.2113	14.9010	13.0110	13.0570	13.9580	14.6745	12.9915	13.0475	13.9454	14.6586	13.6155	13.5206	13.3903	13.2378	13.2141	13.0741	13.0696	13.0152	12.9924	12.9912	12.9912	12.9917	12.9922
CO2	6.0323	5.6424	5.2413	6.2846	6.2838	5.7507	5.3321	6.2783	6.2728	5.7399	5.3216	5.9992	6.0529	6.1301	6.2151	6.2196	6.2882	6.2865	6.2852	6.2816	6.2796	6.2790	6.2780	6.2771
H20	6.9728	6.3470	5.6911	7.8519	7.6527	6.8328	6.1611	7.9794	7.7664	6.9588	6.2996	6.8617	6.9649	7.0858	7.2581	7.3371	7.5481	7.5794	7.8296	7.9537	7.9720	7.9763	7.9804	7.9838
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0173	0.0162	0.0132	0.0147	0.0156	0.0140	0.0111	0.0137	0.0141	0.0125	0.0096	0.0177	0.0174	0.0172	0.0170	0.0166	0.0165	0.0161	0.0149	0.0141	0.0138	0.0137	0.0136	0.0135
HC	0.0005	0.0005	0.0003	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003
NOX	0.0032	0.0030	0.0028	0.0033	0.0033	0.0030	0.0028	0.0033	0.0033	0.0030	0.0028	0.0032	0.0032	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)																								
AR	0.9723	0.9695	0.9667	0.9743	0.9742	0.9704	0.9675	0.9743	0.9742	0.9704	0.9674	0.9721	0.9724	0.9730	0.9736	0.9737	0.9742	0.9742	0.9743	0.9744	0.9743	0.9743	0.9743	0.9743
N2	81.3204	81.0866	80.8488	81.4904	81.4827	81.1608	80.9112	81.4913	81.4804	81.1587	80.9093	81.2985	81.3315	81.3779	81.4307	81.4360	81.4815	81.4816	81.4899	81.4923	81.4918	81.4916	81.4912	81.4908
O2	13.3584	13.9072	14.4668	12.9622	12.9795	13.7349	14.3220	12.9608	12.9859	13.7411	14.3276	13.4095	13.3325	13.2238	13.1003	13.0883	12.9817	12.9816	12.9632	12.9581	12.9594	12.9600	12.9611	12.9621
CO2	4.3251	4.0147	3.6998	4.5522	4.5417	4.1144	3.7837	4.5540	4.5393	4.1122	3.7819	4.2959	4.3397	4.4017	4.4719	4.4791	4.5397	4.5400	4.5515	4.5552	4.5546	4.5544	4.5538	4.5534
H20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0195	0.0181	0.0146	0.0168	0.0177	0.0157	0.0124	0.0156	0.0161	0.0140	0.0107	0.0199	0.0196	0.0194	0.0192	0.0188	0.0187	0.0183	0.0169	0.0160	0.0157	0.0157	0.0155	0.0154
HC	0.0010	0.0009	0.0007	0.0007	0.0008	0.0007	0.0005	0.0006	0.0007	0.0006	0.0004	0.0010	0.0010	0.0009	0.0009	0.0009	0.0009	0.0009	0.0007	0.0007	0.0007	0.0006	0.0006	0.0006
NOX	0.0032	0.0030	0.0027	0.0034	0.0034	0.0030	0.0028	0.0034	0.0034	0.0030	0.0028	0.0032	0.0032	0.0033	0.0033	0.0033	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034	0.0034
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)																								
AR	0.8665	0.8732	0.8803	0.8555	0.8583	0.8669	0.8741	0.8536	0.8566	0.8650	0.8721	0.8679	0.8667	0.8654	0.8635	0.8624	0.8598	0.8593	0.8558	0.8540	0.8538	0.8537	0.8536	0.8536
N2	72.4696	73.0297	73.6234	71.5492	71.7834	72.5024	73.1035	71.3963	71.6441	72.3475	72.9330	72.5859	72.4886	72.3815	72.2173	72.1260	71.9089	71.8712	71.5758	71.4281	71.4057	71.4003	71.3951	71.3906
O2	11.9045	12.5254	13.1739	11.3809	11.4345	12.2697	12.9400	11.3552	11.4183	12.2492	12.9151	11.9724	11.8829	11.7619	11.6181	11.5920	11.4565	11.4504	11.3861	11.3578	11.3554	11.3551	11.3553	11.3555
CO2	3.8544	3.6158	3.3691	3.9969	4.0011	3.6754	3.4186	3.9899	3.9913	3.6658	3.4090	3.8355	3.8679	3.9151	3.9660	3.9670	4.0064	4.0046	3.9978	3.9926	3.9909	3.9904	3.9897	3.9890
H20	10.8839	9.9361	8.9369	12.1992	11.9036	10.6683	9.6497	12.3878	12.0720	10.8568	9.8584	10.7169	10.8726	11.0551	11.3145	11.4323	11.7482	11.7947	12.1660	12.3499	12.3769	12.3833	12.3892	12.3943
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0174	0.0163	0.0133	0.0147	0.0156	0.0140	0.0112	0.0136	0.0141	0.0125	0.0096	0.0178	0.0175	0.0172	0.0170	0.0167	0.0165	0.0162	0.0149	0.0140	0.0138	0.0137	0.0136	0.0135
HC	0.0009	0.0008	0.0006	0.0006	0.0007	0.0006	0.0004	0.0006	0.0006	0.0005	0.0003	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0008	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **Larry Salguero**
Project Info: **CPV Ocotillo-Update (at Unit "H" elev with Blythe 2006 Fuel)**

Engine: **LMS100 PA**
Deck Info: **G0179C - 87o.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (35404)**
Fuel: **Site Gas Fuel#900-1531, 20600 Btu/lb,LHV**

Date: **04/26/2007**
Time: **2:07:36 PM**
Version: **3.5.10**

	PERMIT SUBSET										
Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**
NOX	0.0028	0.0027	0.0025	0.0030	0.0030	0.0027	0.0025	0.0029	0.0030	0.0027	0.0025
O2 Correction Factor	0.7838	0.8448	0.9178	0.7449	0.7465	0.8247	0.8977	0.7448	0.7471	0.8254	0.8985
Exhaust Molecular Weight	28.120	28.202	28.289	27.989	28.022	28.128	28.216	27.968	28.003	28.106	28.192
Stack Emissions (after SCR/oxcat)											
NOx ppmvd Ref 15% O2	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
CO ppmvd Ref 15% O2	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**
VOC ppmvd Ref 15% O2	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
NH3 ppmvd Ref 15% O2	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
NOx as NO2, lb/hr	**7.9241**	**6.253**	**4.591**	**7.9245**	**7.749**	**6.076**	**4.470**	**7.528**	**7.151**	**5.629**	**4.162**
CO, lb/hr	**11.579**	**9.137**	**6.709**	**11.580**	**11.323**	**8.879**	**6.531**	**11.000**	**10.450**	**8.225**	**6.081**
VOC, lb/hr	**2.211**	**1.744**	**1.281**	**2.211**	**2.162**	**1.695**	**1.247**	**2.100**	**1.995**	**1.570**	**1.161**
NH3, lb/hr	**5.867**	**4.629**	**3.399**	**5.867**	**5.737**	**4.499**	**3.309**	**5.573**	**5.294**	**4.167**	**3.081**
SOX, lb/hr (based on 0.25 gr/SCF)	**0.614535**	**0.485**	**0.356**	**0.614379**	**0.601**	**0.471**	**0.346**	**0.584**	**0.554**	**0.436**	**0.323**
PM10, lb/hr	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**	**6.000**
CO Removal, pct	94.58%	94.58%	94.58%	93.52%	92.29%	92.29%	92.28%	91.83%	91.23%	91.22%	91.22%
VOC Removal, pct	55.96%	55.73%	45.73%	38.76%	44.14%	42.54%	23.97%	30.00%	34.37%	29.90%	-0.08%

	AMBIENT SPREAD												
Case #	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**	**122**	**123**
NOX	0.0028	0.0029	0.0029	0.0029	0.0029	0.0030	0.0030	0.0030	0.0029	0.0030	0.0029	0.0029	0.0029
O2 Correction Factor	0.7891	0.7811	0.7701	0.7580	0.7568	0.7467	0.7467	0.7450	0.7445	0.7446	0.7447	0.7448	0.7449
Exhaust Molecular Weight	28.137	28.123	28.107	28.083	28.070	28.039	28.034	27.993	27.972	27.969	27.969	27.968	27.967
Stack Emissions (after SCR/oxcat)													
NOx ppmvd Ref 15% O2	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
CO ppmvd Ref 15% O2	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**
VOC ppmvd Ref 15% O2	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
NH3 ppmvd Ref 15% O2	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
NOx as NO2, lb/hr	**7.9**	**7.9**	**8.0**	**8.1**	**8.1**	**8.1**	**8.0**	**7.9**	**7.8**	**7.7**	**7.6**	**7.5**	**7.4**
CO, lb/hr	**11.5**	**11.6**	**11.7**	**11.8**	**11.8**	**11.8**	**11.6**	**11.6**	**11.4**	**11.2**	**11.1**	**11.0**	**10.8**
VOC, lb/hr	**2.2**	**2.2**	**2.2**	**2.3**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	**2.1**	**2.1**	**2.1**	**2.1**
NH3, lb/hr	**5.8**	**5.9**	**5.9**	**6.0**	**6.0**	**6.0**	**5.9**	**5.9**	**5.8**	**5.7**	**5.6**	**5.6**	**5.5**
SOX, lb/hr (based on 0.25 gr/SCF)	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
PM10, lb/hr	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**	**6.0**
CO Removal, pct	94.61%	94.57%	94.55%	94.45%	94.45%	94.08%	93.46%	93.62%	93.04%	92.45%	92.09%	91.75%	91.54%
VOC Removal, pct	57.72%	56.03%	54.20%	52.32%	50.75%	48.95%	47.38%	39.75%	33.72%	31.55%	30.95%	29.75%	28.84%

Aero Energy Fuel Number	**900-1531 (CPV-SCG Blythe 2006 Avg)**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	95.9992	91.2962
Ethane	1.7359	3.0943
Ethylene	0.0000	0.0000
Propane	0.3325	0.8692
Propylene	0.0000	0.0000
Butane	0.1224	0.4217
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0343	0.1467
Cyclopentane	0.0000	0.0000
Hexane	0.0258	0.1318
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.1961	3.1207
Nitrogen	0.5537	0.9195
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000
Btu/lb, LHV	20600	
Btu/scf, LHV	918	
Btu/scf, HHV	1018	
Btu/lb, HHV	22838	
Fuel Temp, °F	77.0	
NOx Scalar	0.983	
Specific Gravity	0.58	

Engine Exhaust																								
Exhaust MW	28.1	28.2	28.3	28.0	28.0	28.1	28.2	28.0	28.0	28.1	28.2	28.1	28.1	28.1	28.1	28.1	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN

GE Energy

Performance By: **Larry Salguero**
Project Info: **CPV Ocotillo-Update (at Unit "H" elev with Blythe 2006 Fuel)**

Engine: **LMS100 PA**
Deck Info: **G0179C - 87o.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (35404)**
Fuel: **Site Gas Fuel#900-1531, 20600 Btu/lb,LHV**

Date: **04/26/2007**
Time: **2:07:36 PM**
Version: **3.5.10**

	PERMIT SUBSET											AMBIENT SPREAD												
Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**	**121**	**122**	**123**
Exhaust Flow, ACFM	895116	753658	603394	893509	876874	736700	590603	859907	825501	695946	560261	893009	896135	900514	905491	906034	907104	894632	895334	885011	873175	866090	857832	850723
Exhaust Flow, SCFM	366361	308338	243249	353424	345193	294875	233452	336392	319423	273975	218054	366868	365955	364637	363243	363242	360567	354241	354366	349024	343063	339499	335351	331788
Exhaust Flow, Btu/lb	309	308	311	323	324	317	319	327	331	323	325	308	310	313	317	317	321	322	323	325	326	327	328	328
Exhaust Flow, Calories/s	36912700	31014815	24798635	37018032	36323426	30398628	24334051	35662438	34243725	28755795	23114446	36805730	36960454	37175887	37423768	37455012	37542791	37038527	37090376	36681770	36201694	35913812	35578179	35289052
Inlet Flow Wet, pps	455.8	401.4	351.4	437.7	427.6	369.0	322.5	418.4	396.0	343.0	300.7	459.3	455.2	453.0	450.6	450.5	446.6	438.8	438.8	432.3	425.7	421.8	417.3	413.4
Inlet Flow Dry, pps	455.1	400.8	350.9	433.4	424.7	366.4	320.3	411.5	392.2	339.7	297.8	459.0	454.7	452.4	449.6	449.1	444.4	436.4	434.7	427.2	419.8	415.4	410.2	405.8
Shaft HP	139504	104903	70353	137079	132800	99885	67013	128203	119350	89815	60312	139208	139648	140254	140958	141038	140808	137503	137571	134796	131688	129826	127660	125801
Generator Information																								
Capacity kW	201459	201459	201459	170534	179625	170534	170534	138446	166257	138446	138446	207681	204123	200258	195942	191052	185489	179175	172058	164103	155302	145668	135236	124063
Efficiency	0.986	0.984	0.978	0.986	0.983	0.983	0.977	0.986	0.982	0.982	0.975	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986	0.986
Inlet Temp, °F	17.0	17.0	17.0	72.0	72.0	72.0	72.0	107.0	107.0	107.0	107.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0
Gear Box Loss	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8th Stage Bleed																								
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Temperature, °R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CDP Bleed																								
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CardPack	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**	**87o**
Intercooler CardPack	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**	**87m**
NSI	**332**	**0**	**0**	**334**	**334**	**0**	**0**	**334**	**334**	**0**	**0**	**332**	**332**	**332**	**332**	**332**	**334**	**334**	**334**	**334**	**334**	**334**	**334**	**334**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
XNENG																								

Transient Emissions Summary

LMS100 PA Estimated Startup / Shutdown Emissions at Package Exit

T2 (°F / °C)		CO (lb)*	NOx (lb)*	VOC (lb)*	PM10 (lb)*	Startup Fuel, MMBtu (LHV)	Sulfur, lb
-30 / -34.4	Start	15	5	3	11	28	0.02
	Shutdown	59	6	3	11		
59 / 15	Start	13	5	3	11	28	0.02
	Shutdown	35	6	3	11		
78 / 25.5	Start	13	5	3	11	28	0.02
	Shutdown	29	6	3	11		
90 / 32.2	Start	13	5	3	11	28	0.02
	Shutdown	29	6	3	11		

* Margined average engine emissions - NOT A GUARANTEE

Assumptions: Natural gas, sea level, 4"/6" losses, water injection to 25 PPM NOx @ 15% O2

May 22, 2006

Notes: The table shown above was provided by GE (and confirmed on 4/27/07).
Based on the table, the cold start CO used is 14 lb.
All other startup values at all other ambients are a constant.
PM_{10} emissions are limited to 6 pounds per hour, not 11 as presented in the table.

Complete Start (Ignition to full compliance)		CO lb	NOx lb	VOC lb	PM10 lb	Fuel MMBtu	SO2** lb
Cold Day (17°F)	Initial 10 minutes	14.0	5.0	3.0	1.0	26.0	0.02
	Final 15 minutes *	2.9	19.8	1.3	1.5	197.5	0.15
	Total	16.9	24.8	4.3	2.5	223.5	0.17
Avg Day (72°F)	Initial 10 minutes	13.0	5.0	3.0	1.0	26.0	0.02
	Final 15 minutes *	2.9	19.9	1.0	1.5	197.4	0.15
	Total	15.9	24.9	4.0	2.5	223.4	0.17
Hot Day (107°F)	Initial 10 minutes	13.0	5.0	3.0	1.0	26.0	0.02
	Final 15 minutes *	2.7	18.9	0.8	1.5	187.5	0.15
	Total	15.7	23.9	3.8	2.5	213.5	0.17

*Notes: * Oxidation catalyst expected to be fully effective at end of GE 10 minute start interval.*
Other emissions during start-up and all emissions during transient assumed to be unabated.

Cold Day	59	6	3	1.03	26	0.02
Average Day	35	6	3	1.03		
Hot day	29	6	3	1.03		

Operating and stack parameter for LMS100 Commissioning

Description	Power Level	Corrected Operating Hours	Estimated Fuel Rate (MMBtu/hr)	Total Estimated Emission per Event				Exhaust Temperature (deg F)	Exhaust Flow (ACFM)
				NO_X (lbs)	CO (lbs)	VOC (lbs)	PM_{10} (lbs)		
*** First fire the unit & then shutdown to check for leaks, etc**									
	Core/Sync Idle	16	73.5	178	727	18.5	96	859	163836
*** Synch & Check E-stop**									
	Sync Idle	12	73.5	133.5	545.2	13.9	72	859	163836
Totals for First Fire		28		311.5	1272.2	32.4	168		
*** Additional AVR Commissioning**									
	5%	12	92.8	251	363.2	8.7	72	864	226630
*** Break-in Run**									
	5%	8	92.8	167.3	242.1	5.8	48	864	226630
Totals for Break in		20		418.3	605.3	14.5	120		
*** Dynamic Commissioning of AVR & Commission Water**									
Load Step 1	10.00%	4	166.1	66.8	277	21	24	868	289675
Load Step 2	20.00%	4	245.5	98.6	181	10.4	24	827	380155
Load Step 3	30.00%	4	319.3	128	181	10.6	24	806	456411
Load Step 4	40.00%	4	389.1	156	160	10.7	24	785	524273
Load Step 5	50.00%	4	457.4	184	132	11.3	24	770	588755
Load Step 6	60.00%	4	524.6	211	180	13.5	24	760	648646
Load Step 7	70.00%	4	590.8	237	247	16.3	24	752	706812
Load Step 8	80.00%	4	658.5	265	349	20.7	24	752	761888
Load Step 9	90.00%	4	727.9	292	516	29.5	24	758	817320
Load Step 10	100.00%	4	798.1	321	789	47.9	24	767	873543
Totals for Dynamic AVR		40		1959.4	3012	191.9	240		
*** Base load AVR Commissioning**									
	100%	16	798.1	2689	4890	239	96	767	873543

Case	100	101	102	103	104	105	106	107	108	109	110
Ambient Temperature (°F)	17	17	17	72	72	72	72	107	107	107	107
Stack Diameter (ft)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Exhaust Flow (lb/hr)	1,703,900	1,438,227	1,138,130	1,636,078	1,599,844	1,371,797	1,089,457	1,556,054	1,479,392	1,273,593	1,016,749
CTG Load Level (%)	**100**	**75**	**50**	**100-EVAP**	**100**	**75**	**50**	**100-EVAP**	**100**	**75**	**50**
Evap. Cooler	NONE	NONE	NONE	EVAP	NONE	NONE	NONE	EVAP	NONE	NONE	NONE
Data from Vendor					Area =	143.14	ft^2				

Expected Operation of Each Gas Turbine - Normal Operation

(Reference: CPV Ocotillo Update 4/26/07 GE LMS100 PA Turbine/Site Specific (1080.2 ft elev) Information)

Heat Consumed (MMBTU/hr) - LHV	789.8	623.2	457.5	789.6	772.2	605.5	445.3	750.0	712.5	560.8	414.5
Turbine Outlet Temperature (°F)	744.1	744.6	762.4	785.9	791.8	771.2	786.7	799.7	813.6	791.8	806.2
Turbine Outlet Temperature (°K)	668.8	669.0	678.9	692.0	695.3	683.8	692.4	699.7	707.4	695.3	703.3
Exhaust Flow (acfm)	863264	728966	585388	857686	842663	710654	571496	824772	792793	670822	541700
Stack Exit Velocity, ft/m	6031.0	5092.7	4089.7	5992.0	5887.0	4964.8	3992.6	5762.0	5538.6	4686.5	3784.4
Stack Exit Velocity, m/s	30.64	25.87	20.78	30.44	29.91	25.22	20.28	29.27	28.14	23.81	19.22
Nitrogen, % Vol	81.32	81.09	80.85	81.49	81.48	81.16	80.91	81.49	81.48	81.16	80.91
Oxygen, % Vol	13.36	13.91	14.47	12.96	12.98	13.73	14.32	12.96	12.99	13.74	14.33
Carbon Dioxide, % Vol	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Argon, % Vol	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Water Vapor, % Vol	10.88	9.94	8.94	12.20	11.90	10.67	9.65	12.39	12.07	10.86	9.86
Molecular Weight	29.40	29.34	29.27	29.56	29.51	29.44	29.37	29.59	29.54	29.47	29.41

Average Emission Rates from Each Gas Turbine (lbs/hr) - Normal Operations

NO_X at 25 ppmvd pre-BACT level	79.39	62.61	45.95	79.42	77.66	60.85	44.73	75.44	71.72	56.37	41.65
NO_X at 2.5 ppmvd BACT level	7.92	6.253	4.591	7.92	7.75	6.08	4.47	7.53	7.15	5.63	4.16
CO at 111-68 ppmvd pre BACT level	213.75	168.58	123.71	178.65	146.90	115.11	84.62	134.62	119.16	93.73	69.26
CO at 6.0 ppmvd BACT level	11.58	9.14	6.71	11.58	11.32	8.88	6.53	11.00	10.45	8.23	6.08
UHC at 23-14 ppmvd pre-BACT level	25.08	19.71	11.79	18.07	19.36	14.76	8.22	15.02	15.22	11.22	5.79
VOC at 2.0 ppmvd BACT level	2.21	1.74	1.28	2.21	2.16	1.70	1.25	2.10	2.00	1.57	1.16
SO_2 short-term rate	0.61	0.48	0.36	0.61	0.60	0.47	0.35	0.58	0.55	0.44	0.32
SO_2 long-term rate	0.61	0.48	0.36	0.61	0.60	0.47	0.35	0.58	0.55	0.44	0.32
PM_{10}	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
NH_3 at 5 ppmvd BACT level	5.87	4.63	3.40	5.87	5.74	4.50	3.31	5.57	5.29	4.17	3.08
Sulfur content in fuel basis for above:	0.25	grains total S/100 scf	short-term								
	0.25	grains total S/100 scf	long-term	max hourly value							
Data from Vendor											

Startup / Shutdown Emissions from Turbine

Startup

duration in minutes	10	15	25	35	1 hour With Start up and Normal Operation	Emissions if starting up for an entire hour
	Startup Emissions	SCR Warmup Emissions	Total Startup Emissions	Normal Emissions		
	lb/event	**lb/event**	**lb/event**	lb/hour	lb/hour	lb/hour
NO_X	5.00	19.90	24.90	7.92	29.52	59.76
CO	13.00	2.89	15.89	11.58	22.65	38.15
VOC	3.00	1.30	4.30	2.21	5.59	10.32
SO_2	0.02	0.15	0.17	0.61	0.53	0.42
PM_{10}	1.00	1.50	2.50	6.00	6.00	6.00

Assumptions:

Startup Emissions for CO, NO_2, PM_{10}, and VOC integrated from data provided by GE.

Startup emissions are highest of three temperatures, all for cold day 17 degrees F.

SO_2 emissions assume complete conversion of all sulfur to SO_2.

Normal emissions are highest of eleven operating cases listed above (case 103).

Shutdown

duration in minutes	10.3	49.7	Emissions for 1 hour with a shut down and normal op.	Emissions if shutting down for an entire hour
	Shutdown Emissions	Normal Emissions		
	lb/event	lb/hour	lb/hr	lb/hour
NO_X	6.00	7.92	12.56	34.95
CO	35.00	11.58	44.59	203.88
VOC	3.00	2.21	4.83	17.48
SO_2	0.02	0.61	0.53	0.12
PM_{10}	1.03	6.00	6.00	6.00

Assumptions:

Shutdown Emissions for CO, NO_2, PM_{10}, and VOC integrated from data provided by GE.

SO_2 emissions assume complete conversion of all sulfur to SO_2.

Normal emissions are highest of all operating cases listed above (case 103).

Worst-Case 1-Hour Emissions per Turbine

Worst-Case (non-commissioning) 1-Hour Emissions consists of the maximum of an hour with 1 startup & normal operations; an hour with 1 shutdown and normal operations; or normal operations. Comparison of normal, startup and shutdown emissions presented below.

Emissions per turbine	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
NO_2	29.52	29.52	12.56	7.92					3.72
CO	44.59	22.65	44.59	11.58					5.62
VOC	5.59	5.59	4.83	2.21					0.70
SO_2	0.61	0.53	0.53	0.61					0.08
PM_{10}	6.00	6.00	6.00	6.00					0.76

Worst-Case 3 Hour Emission Rate per Turbine

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard.

Worst-case 3-Hour Scenario are equal to 3 hours at normal rate.

Emissions per turbine	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	3			3				3	
SO_2	0.61			0.61	1.84			1.84	0.08

Worst-Case 8-Hour Emission Rates

Only CO is considered for an average 8-hour Ambient Air Quality Standard.

Worst-case (non-commissioning) 8-Hour Scenario includes 1 startup & 1 shutdown and remaining time at normal rate.

Emissions per turbine	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	8	0.4	0.17	7.4		0.4	0.17	7.4	
CO	17.09	38.1	203.88	11.58	136.72	15.89	35.00	85.82	2.15

Worst-Case 24 Hour Emission Rate

Only SO_2 and PM_{10} are considered for an average 24-hour Ambient Air Quality Standard.

Worst-case 24-Hour Scenario for PM_{10} includes 2 Startups, 2 Shutdowns, and remaining time at normal rate.

Worst-case 24-hour scenario for SO_2 uses normal operations.

Emissions per turbine	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	24	0.83	0.34	22.82		0.83	0.34	22.82	
NO_X	10.11	59.76	34.95	7.92	242.66	49.80	12.00	180.86	1.27
CO	15.25	38.15	203.88	11.58	366.08	31.79	70.00	264.29	1.92
VOC	2.71	10.32	17.48	2.21	65.06	8.60	6.00	50.46	0.34
SO_2	0.60	0.42	0.12	0.61	14.41	0.35	0.04	14.03	0.08
PM_{10}	6.00	6.00	6.00	6.00	144.00	5.00	2.06	136.94	0.76

Average Annual Emissions

Average Operation lb/hr Emission Rates presented below for normal operations are based on normaloperation scenario (max emissions) for 2,628 total operating hours, plus 300 startup/warmup events and 300 shutdown events for 5 units (1-5) and 350 startup/warmup events and 350 shutdown events for 3 units (6-8).

Emissions per turbine	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	2805	125.00	51.50	2628					
Number per Scenario		300	300						
Duration of Event (min)		25	10.3	60					
NO_X	3.44	59.76	34.95	7.92	30095.58	7470.0	1800.0	20825.6	0.43
CO	5.22	38.15	203.88	11.58	45699.75	4768.5	10500.0	30431.3	0.66
VOC	0.91	10.32	17.48	2.21	7999.83	1290.0	900.0	5809.8	0.12
SO_2	0.19	0.42	0.12	0.61	1673.23	52.2	6.1	1615.0	0.02
PM_{10}	1.92	6.00	6.00	6.00	16827.00	750.0	309.0	15768.0	0.24

Note: Worst-case lb/hr is the total emissions (lbs) over 8,760 hours/year

Est. annual normal operating hours	2628					
Number of Turbines:	1	5		5 turbines +	5 turbines + cooling tower +	
ANNUAL TOTALS	1 unit	5 units at 30%		fire pump	fire pump	
NO_X	15.05	75.24	tpy	75.29	75.29	tpy
CO	22.85	114.25	tpy	114.26	114.26	tpy
VOC	4.00	20.00	tpy	20.01	20.01	tpy
SO_2	0.84	4.18	tpy	4.18	4.18	tpy
PM_{10}	8.41	42.07	tpy	42.07	43.19	tpy

Emissions per turbine 3200 hrs - 350 SU/SD	Worst-case Total	Startup /Warmup	Shutdown	Normal Operations	Total	Startup /Warmup	Shutdown	Normal Operations	Worst-case Total
	lb/hr				Total lbs				g/s
Total Hours of Operation	3406	145.83	60.08	3200					
Number per Scenario		350	350						
Duration of Event (min)		25	10.3	60					
NOX	4.13	59.76	34.95	7.92	36173.39	8715.0	2100.0	25358.4	0.52
CO	6.26	38.15	203.88	11.58	54868.05	5563.2	12250.0	37054.8	0.79
VOC	1.10	10.32	17.48	2.21	9629.38	1505.0	1050.0	7074.4	0.14
SO2	0.23	0.42	0.12	0.61	2034.44	60.9	7.1	1966.5	0.03
PM10	2.33	6.00	6.00	6.00	20435.50	875.0	360.5	19200.0	0.29

Note: Worst-case lb/hr is the total emissions (lbs) over 8,760 hours/year

Estimated annual normal operating hours	3200	
Number of Turbines:	1	3
ANNUAL TOTALS	1 unit	3 units at 37%
NOX	18.09	54.26

CO	27.43	82.30
VOC	4.81	14.44
SO2	1.02	3.05
PM10	10.22	30.65

Average Annual Emissions

ANNUAL TOTALS	**8 units (5 units at 30%, 3 units at 37%)**			turbines + fire pump	turbines + cooling tower + fire pump	
NOX	258,998	**129.50**	tpy	129.55	129.55	tpy
CO	393,103	**196.55**	tpy	196.56	196.56	tpy
VOC	68,887	**34.44**	tpy	34.46	34.46	tpy
SO2	14,469	**7.23**	tpy	7.23	7.23	tpy
PM10	145,442	**72.72**	tpy	72.72	73.84	tpy

Cooling Tower Drift Calculation

5 cell tower - North

Cooling Tower						
design circulating water rate		39,300	gallons/min			
cycles of concentration		1				
TDS		5000	mg/liter			
		41.72	lb/1000 gallons			
Drift Eliminator Control		0.000005				
Operating hours per year		2628				
Drift PM emissions	total	0.49	lb/hr	0.098	lb/hr	per cell (5)
		1292.7	lb/yr			
		0.65	**tpy**			

Cooling Tower Drift Calculation

3 cell tower - South

Cooling Tower						
design circulating water rate		23,580	gallons/min			
cycles of concentration		1				
TDS		5000	mg/liter			
		41.72	lb/1000 gallons			
Drift Eliminator Control		0.000005				
Operating hours per year		3200				
Drift PM emissions	total	0.30	lb/hr	0.098	lb/hr	per cell (3)
		944.5	lb/yr			
		0.47	**tpy**			

Emissions from Emergency Diesel Firewater Pump

Rated Horsepower	**240**	**BHP**			
Testing duration	**60**	**min/week**			
Yearly testing	**52**	**week/year**			
Expected non-emergency usage	**52**	**hr/yr**			
Diesel Fired	Emision Factor	Emission Rate per Testing	Yearly Emission Rate		
	g/HP/Hr	lb/hr	lb/yr		
NO_X	3.90	2.06	107.30	1.225E-02	
CO	0.59	0.31	16.23		
VOC (Total Hydrocarbons)	1.00	0.53	27.51		
SO_X		0.001	0.06	6.512E-06	
PM_{10}	0.14	0.07	3.85	4.397E-04	lb/hr

Note: SO_2 emission calculated from spec sheet gpm of fuel usage and sulfur content of 15 ppm in fuel.

Engine parameters

Flow Rate (acfm)	1227	
Exhaust Temp (degrees F)	891	
Stack Diameter (feet)	0.373	
Stack height (feet)	50	(12 ft building + 38 ft stack)
fuel usage (gph)	10.3	
diesel density (lb/gal)	7.1	

MNHC+NOx emission factor = 4.90
Sulfur content 15 ppm in fuel

Data from Vendor

Emissions from Black Start Engine Generator

Rated Horsepower	2206	**bhp**	
Max Engine Power	1500	Kw	
Total Efficiency	100	%	
Fuel Consumption	0.333	**lb/bhp-hr**	
Testing duration	1	**hr/month**	
Expected non-emergency usage	12	**hr/yr**	
Diesel Fuel Fired	Emision Factor	Emission Rate per Testing	Yearly Emission Rate
	g/Kw/Hr	lb/hr	lb/yr
NO_X	5.400	17.8575	214.29
CO	3.500	11.57	138.89
VOC (Total Hydrocarbons)	1.000	3.31	39.68
PM_{10}	0.200	0.66	7.94
	lb/hp-hr		
SO_2	2.05E-03	4.52	54.27

Note: SO_2 emission factors from EPA AP-42 Table 3.3-1 for diesel fuel Industrial Engines
PM_{10} emission rate includes filterable and condensable emissions.

Engine parameters

Flow Rate (acfm)	11,061	
Exhaust Temp (degrees F)	762.8	
Stack Diameter (feet)	0.66	
Stack height (feet)	50	(12 ft building + 38 ft stack)

Data from Vendor

1-Hour Worst-Case Emission Scenario for Ocotillo

Only NO_2, CO and SO_2 are considered for the 1-hour Ambient Air Quality Standard.
Worst-Case 1-Hour Emissions consists of the maximum of an hour with 1 startup & normal operations; an hour with 1 shutdown and normal operations; or normal operations plus fire pump.
Worst-case 1-Hour Scenario for SO_2 includes new turbines operating for 1 hour at normal rate.
Fire Pump operates 1 hour per week, black start engine operates 1 hour per month.

Emissions per Turbine	**lb/hr**	**g/s**
NO_2	29.52	3.72
CO	44.59	5.62
SO_2	0.615	0.08
Emissions from Fire Pump		
NO_2	2.06	0.26
CO	0.31	0.04
SO_2	0.001	1.38E-04
Emissions from Black Start Engine		
NO_2	17.86	2.25
CO	11.57	1.46
SO_2	4.52	0.57

3 Hour Emissions Scenarios for Ocotillo

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard.
The worst-case 3-hour emission rate is the maximum SO_2 rate for 100% load, normal operating case (72°F; with Evap. Cooler On).
Fire Pump operates 1 hour per week.

Emissions per Turbine	**lb/hr**	**g/s**
SO_2	0.615	0.08
Emissions from Fire Pump		
SO_2	0.0004	4.61E-05
Emissions from Black Start Engine		
SO_2	1.51	0.19

8-Hour Emissions Scenarios for Ocotillo

Only CO is considered for an average 8-hour Ambient Air Quality Standard.
Worst-case (non-commissioning) 8-Hour Scenario includes 1 startup & 1 shutdown and remaining time at normal rate.
Fire Pump operates 1 hour per week.

Emissions per Turbine	**lb/hr**	**g/s**
CO	17.09	2.15
Emissions from Fire Pump		
CO	0.04	0.00
Emissions from Black Start Engine		
CO	1.45	0.18

24-Hour Emissions Scenarios for Ocotillo

Only SO_2 and PM_{10} are considered for an average 24-hour Ambient Air Quality Standard.
Worst-case 24-Hour Scenario for PM_{10} includes 2 Startups, 2 Shutdowns, and remaining time at normal rate. SO_2 uses normal operating rate.
Fire Pump operates 1 hour per week, black start enginer operates one hour per month.

Emissions per Turbine	**lb/hr**	**g/s**
NO_2	10.11	1.27
CO	15.25	1.92
VOC	2.71	0.34
SO_2	0.601	0.08
PM_{10}	6.00	0.76
Emissions per Cooling Tower Cell	**lb/hr**	**g/s**
PM_{10}	0.098	0.01
Emissions from Fire Pump		
NO_2	0.086	0.01
CO	0.013	0.00
VOC	0.022	0.00
SO_2	4.57E-05	0.000
PM_{10}	0.003	0.00
Emissions from Black Start Engine		
NO_2	0.74	0.09
CO	0.48	0.06
VOC	0.14	0.02
SO_2	0.19	0.02
PM_{10}	0.01	0.00

Average Annual Emissions for Ocotillo

Average Operation Emission Rates are based on the annual operation scenarios for 2,628 hours plus
300 startup/shutdown events for 5 turbines, and 3,200 operating hours plus 350 startup/shutdown events for 3 turbines.
Fire Pump operates 52 hours per year. Cooling tower operates 5 cells @ 2,628 hours per year, and 3 cells @ 3,200 hours per year.
Annual SO_2 assumes 0.25 grains S/scf of natural gas.

	5 units (1-5)		3 units (6, 7, 8)	
Emissions per Turbine	**lb/hr**	**g/s**	**lb/hr**	**g/s**
NO_X	3.44	0.43	4.13	0.52
CO	5.22	0.66	6.26	0.79
VOC	0.91	0.12	1.10	0.14
SO_2	0.19	0.02	0.23	0.03
PM_{10}	1.92	0.24	2.33	0.29
Emissions per Cooling Tower Cell				
PM_{10}	0.030	3.72E-03	0.036	4.53E-03
Emissions from Fire Pump				
NO_2	1.22E-02	1.54E-03		
CO	1.85E-03	2.33E-04		
VOC	3.14E-03	3.96E-04		
SO_2	6.51E-06	8.20E-07		
PM_{10}	4.40E-04	5.54E-05		
Emissions from Black Start Engine				
NO_2	2.45E-02	3.08E-03		
CO	1.59E-02	2.00E-03		
VOC	4.53E-03	5.71E-04		
SO_2	6.19E-03	7.81E-04		
PM_{10}	9.06E-04	1.14E-04		

Note: Worst-case annual lb/hr is the total emissions (lbs) over 8,760 hours/year

APPENDIX I-4
GREENHOUSE EMISSIONS

The calculation below is referred to the "*Power/Utility Reporting Protocol Version 1.0 April 2005*", California Climate Action Registry

Step 1. Identify the annual consumption of each fossil and non-fossil fuel

Natural Gas for all turbines and the black start engine
Diesel for the firewater pump

Step 2. Determine annual consumption of the fuel

	Max Fuel Flow HHV (MMBtu/hr)	Hours of Operation (hr/yr)	Fuel Consumed (MMBtu)	number of unit	Total Annual Fuel Consumed (MMBtu)
One Turbine (LMS100 simple cycle)	885.20	2,628.00	2,326,305.60	1	2,326,306
Black start engine	5.62	12.00	20.22	1	20
Firewater pump	0.61	52.00	9.53	1	10
Total					2,326,335

note:
1. Max Fuel Flow HHV: used 885.2 MMBtu/hr for each turbine, 160 BHP for diesel fire pump (0.4074718 MMBtu/hr)
2. Annual capacity factor = 0.3

Step 3. Apply or Derive an Appropriate CO_2 Emission Factors for Each Fuel

Find the emission factors for natural gas and diesel

Natural gas	Diesel (Distillate Oil)	Unit
53.05	73.14	(kg CO2/MMBtu)
0.003901	0.000907	(kg CH4/MMBtu)
0.001361	0.000358	(kg N2O/MMBtu)

Step 4. Calculate fuel's carbon dioxide (CO_2) emissions

(1) One Turbine
Total Emissions (metric tons) = Adjusted Emission Factor (kg CO_2/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 123,410.51 metric tons

(2) Black start engine
Total Emissions (metric tons) = Adjusted Emission Factor (kg CO_2/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 1.072928887 metric tons

(3) Firewater pump
Total Emissions (metric tons) = Adjusted Emission Factor (kg CO_2/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 0.697378206 metric tons

Step 5a . Calculate each fuel's methane (CH_4) emissions .

(1) One turbine
Total Emissions (metric tons) = Adjusted Emission Factor (kg CH_4/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 9.074918146 metric tons

(2) Black start engine
Total Emissions (metric tons) = Adjusted Emission Factor (kg CH_4/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 7.88972E-05 metric tons

(3) Firewater pump
Total Emissions (metric tons) = Adjusted Emission Factor (kg CH_4/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 0.0000086 metric tons

Step 5b. Calculate each fuel's N_2O emissions

(1) One turbine
Total Emissions (metric tons) = Adjusted Emission Factor (kg N_2O/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 3.166101922 metric tons

(2) Black start engine
Total Emissions (metric tons) = Adjusted Emission Factor (kg N_2O /MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 2.7526E-05 metric tons

(3) Firewater pump
Total Emissions (metric tons) = Adjusted Emission Factor (kg N_2O /MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 0.0000034

Step 6. Convert CH_4 and N_2O emissions to CO_2 equivalents and sum all subtotals

Greenhouse Gas GWP (SAR, 1996)
Source: Intergovernmental Panel on Climate Change, Second Assessment Report (1996)

Greenhouse Gas	GWP (SAR, 1996)
CO2	1
CH4	21
N2O	310

RESULTS

One Turbine : Total Metric Tons of CO_2e = Total Metric Tons of CO_2 + CH_4 Tons of CO_2e + N_2O Tons of CO_2e
= 124,582.58

Cases \ Equipment	Turbine	Black start engine	Firewater pump	Total Metric Tons of CO_2e
8 turbines case (5 runs 2805 hours and 3 runs 3406 hours)	1,149,260	1.08	0.70	1,149,261.83

APPENDIX I-5
MODELING PROTOCOL

MODELING PROTOCOL FOR THE CPV OCOTILLO ENERGY PROJECT RIVERSIDE COUNTY, CALIFORNIA

Prepared for

South Coast Air Quality Management District and
California Energy Commission

Prepared on Behalf of

Competitive Power Ventures

May 8, 2007

URS

1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108-4314
619.294.9400 Fax: 619.293.7920

May 8, 2007

Mr. Mike Mills
Senior Air Quality Manager
South Coast Air Quality Management District
21865 E. Copley Drive
Diamond Bar, CA 91765-4182

Subject: Modeling Protocol for the CPV Ocotillo Energy Center
Riverside County, California

Dear Mike:

Please find enclosed for SCAQMD review and comment two copies of the air quality modeling protocol for the CPV Ocotillo Energy Center Project, which is being proposed by Competitive Power Ventures (CVP). Copies of the protocol are also being provided for review and comment to the California Energy Commission (CEC) air modeling staff. Please provide one of the enclosed copies to the District's air modeling specialist who is being assigned to this project.

The Project will consist primarily of eight simple cycle LMS100 peaker turbines with a combined maximum generating capacity of approximately 815 MW. The project site is southwest of Desert Hot Springs, approximately 1 mile east of State Route 62 (Twenty-nine Palms Highway), 1 mile north of I-10, and 2 miles west of Indian Avenue.

An Application for Certification for the proposed power generation facility will be submitted to CEC within approximately one month. We would thus appreciate receiving your review comments as soon as possible, so that any changes that may be required can be incorporated. Please distribute the protocol among your colleagues as appropriate.

Thank you in advance for your review of this protocol. Do not hesitate to contact me directly with any questions or concerns regarding any aspect of our intended modeling methodology.

Sincerely,

URS CORPORATION

John Lague
Senior Air Quality Consultant

JL:ml

Enclosures

TABLE OF CONTENTS

Section 1 Introduction 1-1

1.1 Background 1-1
1.2 Purpose 1-1

Section 2 Project Description 2-1

2.1 Project Location 2-1
2.2 Description of The Proposed SourceS 2-1

Section 3 Regulatory Setting 3-1

3.1 California Energy Commission Requirements 3-1
3.2 South Coast Air Quality Management District Requirements 3-1
3.3 U.S. Environmental Protection Agency Requirements 3-2

Section 4 Models Proposed and Modeling Techniques 4-1

4.1 Screening Modeling 4-1
4.2 Refined Modeling 4-1
4.3 Health Risk Assessment 4-5
4.4 Visibility Analysis 4-6
4.5 Modeling Emissions Inventory 4-13
4.6 Building Wake Effects 4-14
4.7 Receptor Grid 4-15
4.8 Meteorological Data 4-16
4.9 Air Quality Monitoring Data 4-18

Section 5 Presentation of Modeling Results 5-1

5.1 NAAQS and CAAQS Analysis 5-1
5.2 Visibility Analysis 5-1
5.3 Health Risk Assessment Analysis 5-1
5.4 Data Submittal 5-1

Section 6 References 6-1

Tables

Table 4-1 Relevant Ambient Air Quality Standards and Significance Levels
Table 4-2 Class I Areas Near the COEP
Table 4-3 Preliminary Estimated Emissions for Entire COEP
Table 4-4 COEP Land Use Characteristics
Table 4-5 Highest Monitored Concentrations Near COEP (2002 – 2006)

Figures

Figure 1-1 Aera Surrounding COEP Site
Figure 2-2 Area Surrounding COEP Site
Figure 4-1 Joshua Tree PLUVUE II Observer/Vista Locations
Figure 4-2 San Jacinto Wilderness Area PLUVUE II Observer/Vista Locations
Figure 4-3 San Gorgonio Wilderness Area PLUVUE II Observer/Vista Locations
Figure 4-4 Annual Windrose based 1988-1991 Wintec Wind Data

$\mu g/m^3$	Micrograms per cubic meter
μm	Micrometers
σ_z	Plume vertical spreading parameter
AAQS	Ambient Air Quality Standards
AERMOD	American Meteorological Society/Environmental Protection Agency regulatory model
AFC	Application for certification
AOI	Area of impact
APN	Assessors parcel number
AQRV	Air quality related values
ARB	Air Resources Board
ARM	Ambient ratio method
ATC	Authority to Construct
BACT	Best available control technology
BPIP	Building profile input program
C	Contrast
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CEC	California Energy Commission
CO	Carbon monoxide
COEP	CPV Ocotillo Energy Project
CTG	Combustion turbine generator
CVP	Competitive Power Ventures
°C	Degrees Celsius
dE	Difference index
DEM	Digital elevation model
DOC	Determination of Compliance
FLAG	Federal Land Managers Air Quality Related Values Workgroup
FLM	Federal land manager
g/s	Gram per second
GE	General Electric
GEP	Good engineering practice
H1H	High first high
HARP	Hotspots analysis and reporting program
HI	Hazard index
HNO_3	Nitric acid
HRA	Health risk assessment
ISCST3	Industrial Source Complex Short Term 3rd version

IWAQM	Interagency Workgroup on Air Quality Modeling
km	Kilometers
LCC	Lambert conformal conic
LORS	Laws, ordinances, regulations, and standards
m/s	Meter per second
MEI	Maximally exposed individual
m	Meter
MICR	Maximum individual cancer risk
mm	Millimeter
MM5	Mesoscale meteorological data
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NNSR	Non-attainment New Source Review
NO_2	Nitrogen dioxide
NO_3	Nitrates
NO_x	Nitrogen oxides
NPS	National Park Service
NSR	New Source Review
NWS	National Weather Service
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
OLM	Ozone limiting method
Pb	Lead
$PM_{2.5}$	Particulate matter less than 2.5 μm in diameter
PM_{10}	Particulate matter less than 10 μm in diameter
PMS	Particulate matter speciation
ppb	Parts per billion
ppm	Parts per million
PSD	Prevention of significant deterioration
ROC	Reactive organic compound
SCE	Southern California Edison
SCR	Selective catalytic reduction
SIL	Significant impact level
SCAQMD	South Coast Air Quality Management District
SO_2	Sulfur dioxide
SO_4	Sulfates
SOA	Secondary organic aerosol

TAC	Toxic air contaminants
T-BACT	Best available control technology for toxics
tpy	Tons per year
u	Wind speed
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

SECTION 1 INTRODUCTION

1.1 BACKGROUND

Competitive Power Ventures (CPV) is proposing to build and operate a new natural gas-fired simple cycle peaking plant with a generating capacity of approximately 850 megawatts (MW) using eight new General Electric (GE) LMS100 combustion turbine generators (CTG). The CPV Ocotillo Energy Project (COEP) site is in central Riverside County in the upper Coachella Valley about 1 mile west of State Highway 62 and 1 mile north of I-10 along Power Line Road (Figure 1-1). The project is subject to the site licensing requirements of the California Energy Commission (CEC). The CEC will coordinate its independent air quality evaluations with the South Coast Air Quality Management District (SCAQMD) through the Determination of Compliance (DOC) process. Annual emissions of all criteria pollutants will be below the emission level thresholds specified by the United States Environmental Protection Agency's (USEPA) Prevention of Significant Deterioration (PSD) regulations for Major Sources. Specifically, the COEP Facility will emit less than: 250 tons per year (tpy) of nitrogen oxides (NO_x), carbon monoxide (CO), reactive organic compounds (ROC) and sulfur dioxide (SO_2), less than 0.6 tons per year of lead (Pb) and less than 7.0 tons per year of sulfuric acid mist.

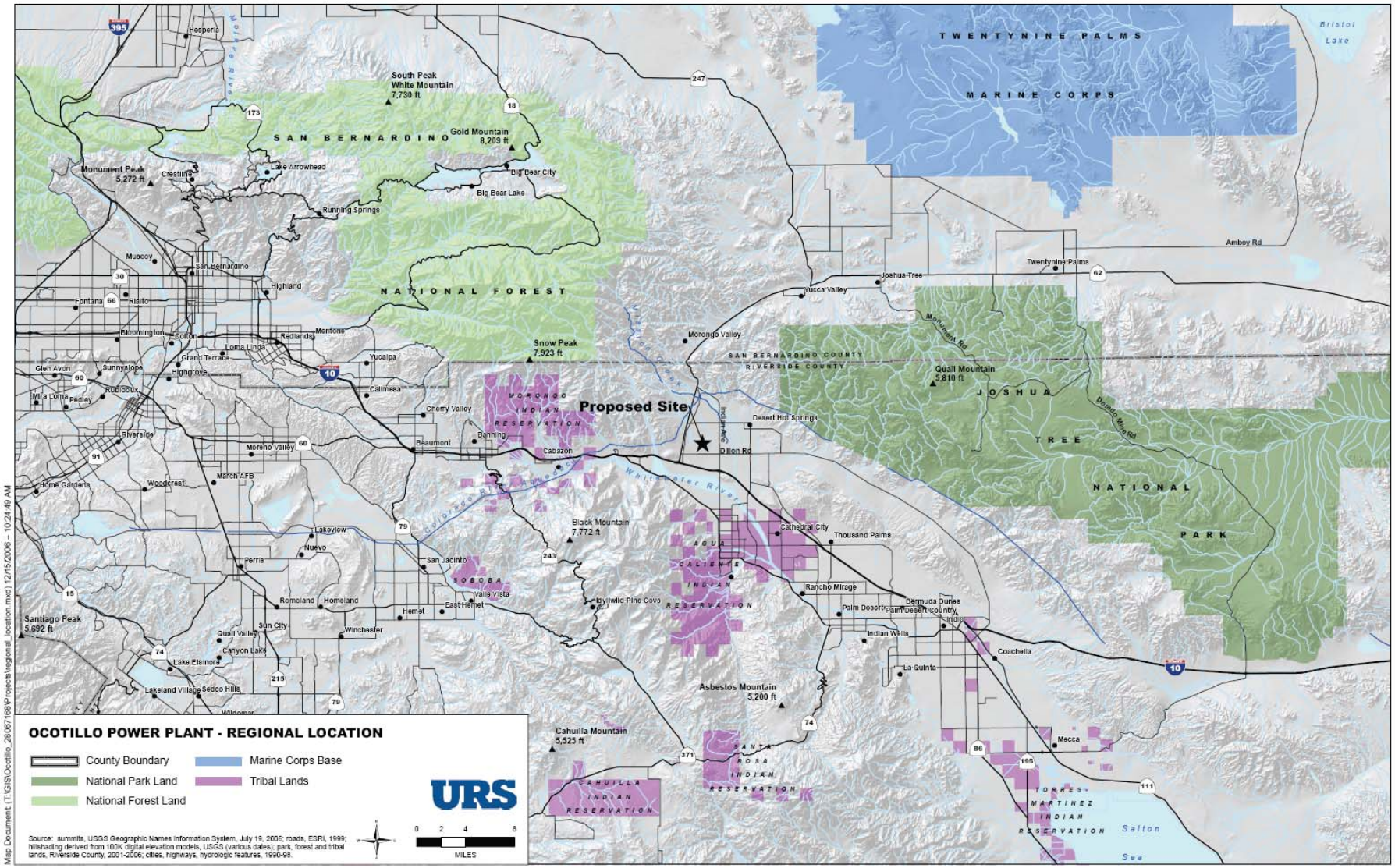
SCAQMD new source review (NSR) and non-attainment NSR (NNSR) regulations are potentially applicable to all criteria pollutants emitted by a new source, depending on the quantities of pollutants that will be emitted. The area around the COEP Facility is classified as national attainment/unclassified for nitrogen dioxide (NO_2), CO and SO_2, and non-attainment for ozone (O_3), particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$), and PM_{10}. With respect to the California Ambient Air Quality Standards (CAAQS), the area around the COEP is classified as attainment for CO, NO_2, sulfates, Pb, hydrogen sulfide, and SO_2, and non-attainment for O_3, $PM_{2.5}$, and PM_{10}. NO_2 and SO_2 are regulated as PM_{10} precursors, and NO_2 and ROC as O_3 precursors. Project emissions of non-attainment pollutants and their precursors will be offset to satisfy state and local NNSR regulations.

1.2 PURPOSE

The CEC and SCAQMD require the use of atmospheric dispersion modeling to demonstrate compliance with applicable air quality standards, and modeling is also required to evaluate the potential impacts on human health from toxic air contaminants. CEC siting regulations also require that the cumulative impacts of the proposed project and reasonably foreseeable projects within 6 miles (10 km) of the project site be assessed via modeling.

This document summarizes the procedures to be used for the air dispersion modeling for project certification and permitting. Modeling of both operational and construction emissions of the Project will be performed in accordance with CEC guidance (CEC, 1997). This protocol is being submitted to the CEC and SCAQMD for their review and comment prior to completion of the applicable permit applications. The proposed model selection and modeling approaches are is based on review of applicable regulations and agency guidance documents, and discussions with agency staff.

Figure 1-1 Area Surrounding COEP Site



SECTION 2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION

The proposed project will be located on approximately 37 acres located within unincorporated Riverside County. The 37-acre Project Site is within the upper Coachella Valley, roughly 100 miles east of Los Angeles. The site is within the existing Wintec wind energy complex. The westernmost Little San Bernardino Mountains, the southern part of Morongo Valley, the foothills of the San Bernardino Mountains, spurs of the San Jacinto Mountains, and the westernmost extension of the Indio Hills bound the site. It is positioned at the juncture of three geomorphic provinces – the Transverse Ranges north of San Gorgonio Pass, the Peninsular Ranges south of the Pass, and the Colorado Desert.

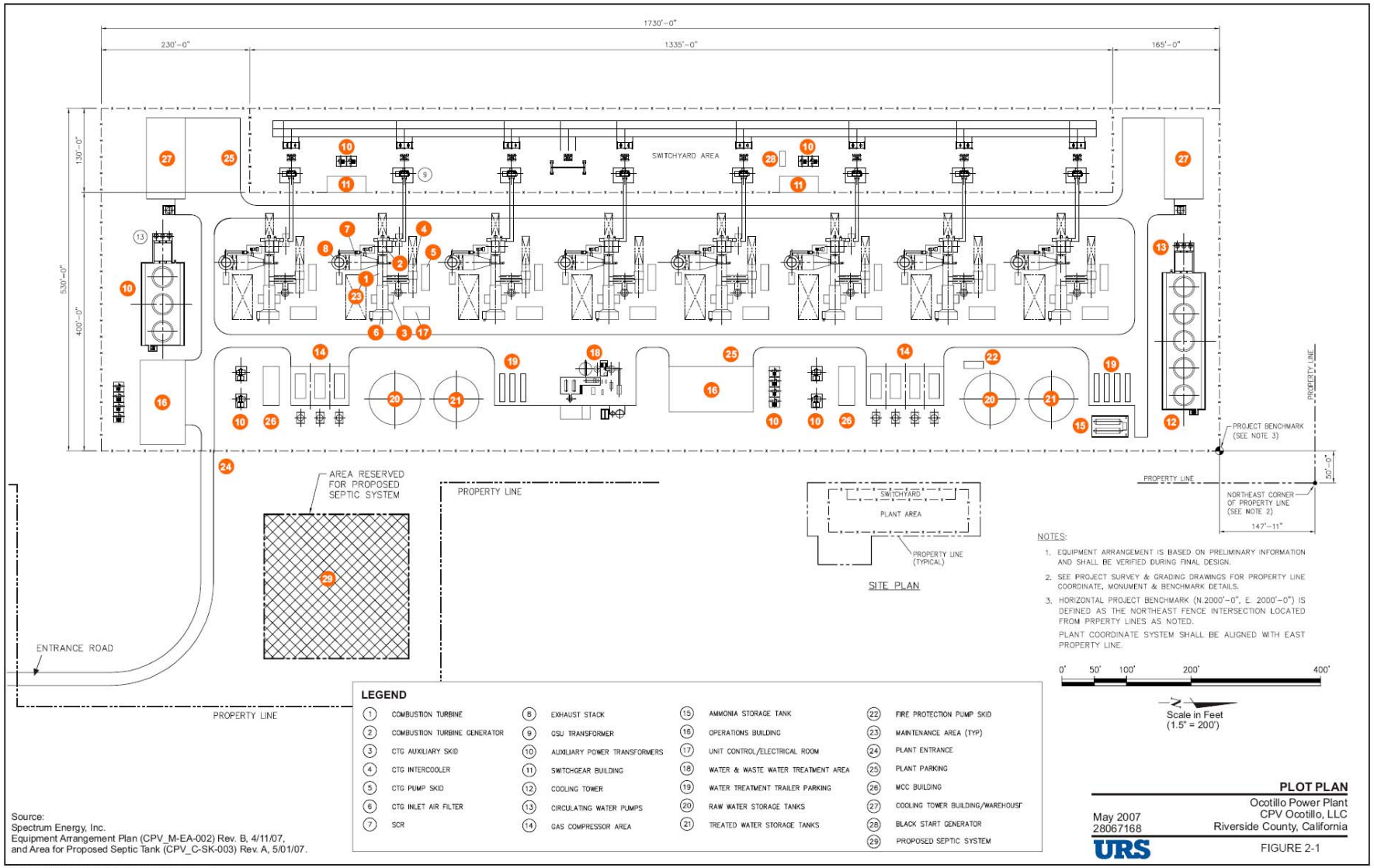
The Coachella Valley is the northwest part of the Colorado Desert that merges southeastward into the Imperial Valley near the northern shore of the Salton Sea. The Coachella Valley is about 50 miles long and from 10 to 20 miles wide. The site is in the northwestern-most portion of the Valley. Figure 2-1 shows the area surrounding the COEP site.

The site is within Riverside County. Nearby towns are the City of Palm Springs, North Palm Springs (unincorporated) and Desert Hot Springs. The site is located southwest of Desert Hot Springs, approximately 1 mile east of State Route 62 (Twentynine Palms Highway), 1 mile north of I-10, and 2 miles west of Indian Avenue. Power Line Road runs along the south side of the property. Approximately one quarter mile from the west border of the site is Diablo Road and a partially developed subdivision of single family homes. West of the Project Site is the Southern California Edison (SCE) Devers Substation. The surrounding area is dominated by the wind turbine generators and transmission lines. The project site is approximately 0.5 miles (0.8 kilometers [km]) from complex terrain (i.e., with elevation exceeding proposed stack heights) and is surrounded by vacant or industrial land. The nearest residential area is approximately 200 yards southeast of the proposed site property line.

2.2 DESCRIPTION OF THE PROPOSED SOURCES

The proposed project will entail the construction and operation of eight (8) GE LMS100 CTG, 2 evaporative cooling towers, associated transformers, water tanks, and other ancillary facilities. The gas turbines will be fired exclusively on natural gas and will be equipped with water injection and selective catalytic reduction (SCR) for the control of NOx emissions and an oxidation catalyst for control of CO emissions. Each CTG will operate in simple cycle mode and will have an exhaust stack with a height of 90 feet and a diameter of 13.5 feet. Aqueous ammonia will be used in the SCR system. One 250-horsepower diesel engine will act as the emergency firewater pump driver. One 1750 kilowatt diesel black start generator will be the only other fuel-fired emission source. The evaporative cooling tower will also be a relatively small source of PM10 (drift). Figure 2-1 is a scaled plot plan showing the layout of Project facilities.

Figure 2-2 Area Surrounding COEP Site



SECTION 3 REGULATORY SETTING

3.1 CALIFORNIA ENERGY COMMISSION REQUIREMENTS

An applicants for an electric power generation project with capacity 50 MW or greater is required to prepare and submit to CEC a comprehensive Application for Certification (AFC) document addressing the proposed project's environmental and engineering features. An AFC must include the following air quality information (CEC, 1997):

- A description of the project, including project emissions of air pollutants and greenhouse gases, fuel type(s), control technologies and stack characteristics;
- The basis for all emission estimates and/or calculations;
- An analysis of Best Available Control Technology (BACT) according to SCAQMD Rules;
- Existing baseline air quality data for all regulated pollutants;
- Existing meteorological data, including temperature, wind speed and direction and mixing height;
- A listing of applicable laws, ordinances, regulations and standards (LORS) and a determination of compliance with all applicable LORS;
- An emissions offset strategy;
- An air quality impact assessment (i.e., national and state ambient air quality standards [AAQS] and PSD review if applicable) and protocol for the assessment of cumulative impacts of the proposed project along with permitted and under construction projects within a 10 km radius; and
- An analysis of human exposure to air toxics (i.e., health risk assessment [HRA]).

For the COEP Project, the air quality impact assessment, the cumulative impacts assessment, and the HRA will be performed using dispersion models.

3.2 SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT REQUIREMENTS

The SCAQMD has promulgated new source review permitting requirements under Rule 1303. In general, all equipment with the potential to emit air pollutants is subject to the requirements of this rule, which has the following major requirements that potentially apply to new sources such as the COEP:

- Installation of BACT,
- Ambient air quality impact modeling to demonstrate compliance with NAAQS and CAAQS and to evaluate impacts to plume visibility in Class I areas near the proposed source(s),
- Emission offsets,
- Statewide compliance for all applicant-owned or operated facilities in California.

Rule 1401 (New Source Review of Toxic Air Contaminants [TAC]) establishes allowable risks for new or modified sources of TAC emissions. This rule specifies limits for maximum individual cancer risk

(MICR), cancer burden, and non-carcinogenic acute and chronic hazard indices (HI) for new or modified sources of TAC emissions. The health risks resulting from project emissions, as determined by a health risk assessment using approved modeling methos, must not exceed established threshold values. While Rule 1401 does not specifically require the application of best available control technology for toxics (T-BACT) to a new or modified source that emits carcinogenic TACs, the rule relaxes the MICR risk threshold when T-BACT is applied.

3.3 U.S. ENVIRONMENTAL PROTECTION AGENCY REQUIREMENTS

USEPA has promulgated PSD regulations applicable to major sources in Riverside County. The COEP facility will not be a major source for criteria pollutants; thus a PSD analysis will not be conducted. The applicant will accept a permit condition limiting the annual operating hours of the proposed plant to a level that will avoid triggering PSD requirements

SECTION 4 MODELS PROPOSED AND MODELING TECHNIQUES

This section describes the dispersion models and modeling techniques to be used in performing the air quality analysis for the COEP. The objectives of the modeling are to demonstrate that air emissions from the COEP will not cause or contribute significantly to an ambient air quality standard violation, and will not cause a significant health risk.

In November 2005, the USEPA officially recognized the American Meteorological Society/ Environmental Protection Agency Regulatory Model (AERMOD) as the preferred dispersion model for regulatory applications, replacing the Industrial Source Complex Short Term 3 (ISCST3) model. Thus, AERMOD will be used in this air quality impact analysis.

4.1 SCREENING MODELING

A turbine screening modeling analysis will be conducted with AERMOD (Version 04300) to determine the stack parameters that cause the maximum off-site ground-level pollutant concentrations due to the proposed combustion turbine generators.. This screening modeling will use the same meteorological data set as the refined modeling analysis. Screening modeling will be conducted with stack parameters corresponding to normal operating emissions of the proposed new turbines for different load conditions and ambient temperatures in order to determine the stack parameters and operating loads that correspond to maximum off-site impacts from the most important project sources, i.e., the CTGs. The stack parameters that align with the highest offsite impact from these sources for each pollutant and averaging time period will be used for subsequent the refined modeling simulations.

4.2 REFINED MODELING

The purpose of the refined modeling analysis is to demonstrate that air emissions from the COEP will not cause or contribute significantly to a violation of an ambient air quality standard (see Table 4-1). The AERMOD model (version 04300) will be used for the refined modeling of criteria pollutants. The regulatory default option will be selected. Specific modeling techniques for the AAQS analysis are discussed below.

Analysis of land use adjacent to the COEP was conducted in accordance with Section 8.2.8 of the *Guideline on Air Quality Models (EPA-450/2-78-027R* and Auer [1978]), *EPA AERMOD Implementation Guide (2004)*, and its addendum (2006). Based on the Auer land use procedure, more than 50 percent of the area within a 3-km radius of the COEP power plant is appropriately classified as rural. Since the Auer classification scheme requires more than 50 percent of the area within the 3-km radius around a proposed new source to be rural for a rural classification, the rural mode will be used in the AERMOD modeling analyses. The regulatory default options will be used, including building and stack tip downwash, default wind speed profiles, exclusion of deposition and gravitational settling, consideration of buoyant plume rise and complex terrain. In addition, the model will be instructed to exclude periods of missing meteorological data.

Table 4-1 Relevant Ambient Air Quality Standards and Significance Levels

Pollutant	Averaging Time	CAAQS (a,c)	NAAQS (b,c)	SCAQMD Significant Change in Air Quality Concentration (μg/m3)	PSD Significant Emission Rates (TPY)
CO	8-hour	9.0 ppm (10,000 μg/m^3)	9.0 ppm (10,000 μg/m^3)	500	250
	1-hour	20 ppm (23,000 μg/m^3)	35 ppm (40,000 μg/m^3)	1,100	
NO_2[d]	Annual	-	0.053 ppm (100 μg/m^3)	1	250
	1-hour	0.25 ppm (470 μg/m^3)	-	(20)[e]	
SO_2	Annual	-	0.03 ppm (80 μg/m^3)	-	250
	24-hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	-	
	3-hour	-	0.5 ppm (1,300 μg/m^3)	-	
	1-hour	0.25 ppm (655 μg/m^3)	-	-	
PM_{10}	Annual	20 μg/m^3	-	1	250
	24-hour	50 μg/m^3	150 μg/m^3	2.5[f]	
$PM_{2.5}$	Annual	12 μg/m^3	15 μg/m^3	-	-
	24-hour	-	35 μg/m^3	-	-
O_3	8-hour	0.07 ppm (137 μg/m^3)	0.08 ppm (157 μg/m^3)	-	250 (of ROCs)
	1-hour	0.09 ppm (180 μg/m^3)	See footnote[g]	-	-

a. California standards for ozone (as volatile organic compounds, carbon monoxide, sulfur dioxide (1-hour), nitrogen dioxide, and PM_{10}, are values that are not to be exceeded.

b. National standards, other than those for ozone, particulate matter, and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m3 is equal to or less than one. For $PM_{2.5}$, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

c. Concentrations are expressed first in units in which they were promulgated. Equivalent units are given in parentheses and based on a reference temperature of 25° Celsius (C) and a reference pressure of 760 millimeters (mm) of mercury (1,013.2 millibar)..

d. Nitrogen dioxide (NO_2) is the compound regulated as a criteria pollutant; however, emissions are usually based on the sum of all oxides of nitrogen (NO_x). On February 27,2007 the California Air Resources Board recommended that the NO2 1-hour and annual standards be lowered. The proposed levels are 0.18 ppm (338 μg/m^3) for 1-hour and 0.3 ppm (56 μg/m^3) for annual. These standards have not yet been approved by the Office of Administrative Law but are expected to be promulgated later in 2007.

e. Previous SCAQMD 1-hour NO_2 Significant Impact Level in Rule 1303 rescinded for NO_2 attainment areas on April 20, 2001.

Table 4-1
Relevant Ambient Air Quality Standards and Significance Level
(Continued)

f. Per SCAQMD Rule 1303 this threshold applies to each emission unit.
g. New federal 8-hour ozone and fine particulate matter ($PM_{2.5}$) standards were promulgated by USEPA on July 18, 1997. The federal 1-hour ozone standard was revoked by USEPA on June 15, 2005.

-	=	Not applicable
CAAQS	=	California Ambient Air Quality Standard
NAAQS	=	National Ambient Air Quality Standard
Ppm	=	parts per million by volume, or micromoles of pollutant per mole of gas
TPY	=	ton per year
$\mu g/m^3$	=	micrograms per cubic meter

4.2.1 Ambient Air Quality Standard Analysis

In accordance with SCAQMD Rule 1303(b)(1), the proposed COEP will be required to demonstrate compliance with one of the following requirements:

- The project impact plus background must not exceed the most stringent applicable ambient air quality standard for each attainment pollutant (NO_2, SO_2, CO).
- The incremental effect of each permit unit of the COEP may not exceed the Significant Change in Air Quality Concentration standards (listed in Table 4-1 as SCAQMD Significance Levels) for non-attainment pollutants (PM_{10}).

Compliance with these modeling requirements for attainment pollutants will be demonstrated by determining the maximum impact of the proposed Project at any receptor and adding a conservative background concentration based on recent data from the SCAQMD air quality monitoring station determined to be most representative of pre-project conditions in the project area.

Modeling will be conducted for maximum normal operational emissions scenarios, including startups and shutdowns for all averaging times and pollutants. Separate modeling will be conducted to determine the impacts from turbine commissioning due to the fact that commissioning is a short-term, one time event.

Initially, the modeling will assume full conversion of NO_x to NO_2. If required, a 75% conversion rate of NO_x to NO_2 will be assumed for purposes of modeling annual NO_2 impacts.[EPA Ambient Ratio Method (ARM)]. Alternatively the AERMOD option to employ the ozone limiting method (OLM) may be used for estimating hourly and annual concentrations of this pollutant . If 1-hour and annual concentrations do not exceed the applicable ambient air quality standard, then compliance is demonstrated and no further modeling is necessary for NO_2.

For PM_{10}, which is a non-attainment pollutant in the project area, the maximum incremental contribution from each individual turbine of the proposed COEP will be compared directly with the SCAQMD 24-hour and annual Significant Change in Air Quality Concentration thresholds shown in Table 4-1 If the maximum predicted values are below these significant change thresholds, no further demonstration of compliance for this pollutant is required. Note that emissions reduction credits will be provided by the applicant to provide offsets for all Project emissions increases of NO_x, ROC, PM_{10} and SO_2.

4.2.2 Construction Analysis

AERMOD will be used to estimate the worst-case short- and long-term air quality impacts from construction of COEP. The same meteorological input data used for the modeling of the Project's operational emissions will be used for the construction modeling. All fugitive dust sources will be modeled as area sources and all combustion sources will be modeled as point sources. Stack parameters for the combustion point sources will be obtained from the CARB document *Risk Management Guidance for the Permitting of New Stationary Source Diesel-Fueled Engines* (2000). If necessary the OLM method will be applied to calculate NO_2 impacts.

4.2.3 Fumigation

Fumigation occurs when a stable layer of air lies a short distance above the release point of a plume and unstable air lies below. Especially on sunny mornings with light winds, the heating of the earth's surface may cause a layer of turbulence which grows in depth over time and may intersect an elevated exhaust plume, rapidly drawing it down to ground level and creating relatively high pollutant concentrations for a short period. A fumigation modeling analysis will be conducted using SCREEN3, with rural dispersion, stack parameters for one turbine and unit emission rate (1 g/s). The results from SCREEN3 can then be multiplied by the actual emission rate from all turbines and scaled for the averaging time of concern. Only short-term impacts will be examined as fumigation conditions typically last no longer than a few hours.

4.2.4 Cumulative Impact Analysis Using Off-Property Sources

A request will be made to SCAQMD for a list of all new and planned sources of pollutant emissions that would be located within six miles from the proposed COEP facility. The list will include projects that are either currently either under construction, undergoing permitting or expected to be permitted in the near future. When provided, this list will be forwarded onto CEC for review. Based on this information, and CEC response, additional sources may be included in a cumulative source modeling analysis.

4.3 HEALTH RISK ASSESSMENT

The CEC and SCAQMD require a HRA to evaluate TAC emissions from the operation of the project. Contaminants emitted by the project with potential carcinogenic effects or chronic and/or acute non-carcinogenic effects will be considered. This health risk assessment will be performed following the SCAQMD Risk Assessment Procedures for Rules 1401 and 212 (SCAQMD, 2005), Supplemental Guidelines for Preparing Risk Assessments for the Toxics "Hot Spots" Information and Assessment Act (AB2588) (SCAQMD, 2005) and Office of Environmental Health Hazard Assessment (OEHHA), Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA, 2003). As recommended by the SCAQMD guideline, the California Air Resources Board (CARB) Hotspots Analysis and Reporting Program (HARP) (CARB, 2005) will be used to perform a refined SCAQMD Tier 4 and OEHHA Tier 1 health risk assessment for the project. HARP includes two modules: a dispersion module and a risk module. The HARP dispersion module incorporates the USEPA ISCST3 air dispersion model, and the HARP risk module implements the latest Risk Assessment Guidelines developed by OEHHA. CARB is currently working on a HARP interface with AERMOD, but this is still in early development and not ready for use by the general public. Thus HARP as presently designed with ISCST3 will be used to conduct the required HRA modeling.

First, ground-level concentrations from the COEP emissions will be estimated using the ISCST3 dispersion model within HARP. The HARP modeling analysis will be consistent with, and use similar source parameters, as the modeling approach discussed above for the AAQS analyses using AERMOD, except that the ISCST3 control parameter NOCALMS will be selected per SCAQMD requirements for HRAs. The same 5-year meteorological data set used for AERMOD will be processed for input into ISCST3, and used in the HRA. Based on the impacts determined by the ISCST3 model, the HARP model will be used to estimate the corresponding health risks. The ISCST3 results obtained for the year(s) of

meteorological data resulting in the highest 1-hour and annual impacts will be used and receptors will be placed at 25-meter spacing around the facility fenceline and 100-meter spacing outside the fence out to 10 km. All receptors that HARP creates inside the fenceline will be excluded. The HARP simulations will also include the census receptors out to 10 km, and additional receptors will be placed at all sensitive locations (e.g., schools, hospitals, etc.) out to a distance of 3 miles.

Per SCAQMD guidelines, cancer risk will be determined using the "Derived (Adjusted)" calculation method. Chronic non-cancer risks will be calculated with the "Derived (OEHHA)" method. Since the COEP site is in a desert environment, there are no cattle or water sources; thus the dairy milk/beef ingestion, fish and drinking water consumption pathways will not be included in this analysis.

The HRA performed by means of the HARP model will follow the following steps:

- Define the location of the MEI for residents and commercial/industrial (i.e., the location where the highest carcinogenic risk may occur);
- Define the locations of the maximum chronic non-carcinogenic adverse health effects and the maximum acute adverse health effects;
- Calculate concentrations and adverse health effects at locations of maximum impact for each pollutant;
- Calculate cancer burden if the maximum cancer risk is predicted to be greater than one in a million;
- Determine the zone of impact for cancer risk if the maximum cancer risk is predicted to be greater than or equal to one in a million; and
- Determine the zone of impact for acute and chronic health risks if the acute or chronic health index is predicted to be greater than or equal to 0.5.

4.4 VISIBILITY ANALYSIS

SCAQMD Rule 1303(b)(5) (C)(i) requires a plume visibility analysis if the net emissions increase from a new source will exceed 15 tpy of PM_{10} or 40 tpy of NO_x, provided that the source is located within specified distances from the nearest boundary of a Federal Class I area. The proposed COEP site is within the distances specified in Rule 1303 for 3 Class I areas. In addition, the Project emissions are expected to exceed both the NO_x and PM_{10}. threshold values. Accordingly, a plume visibility analysis will be conducted in the manner that meets the requirements of Rule 1303 Appendix B.

The Class I areas that will be included in the plume visibility analysis are listed in Table 4-2, along with the distances to each area from COEP. The federal authority in charge of the two Wilderness Areas identified in Table 4-2 is the United States Forest Service (USFS) and the National Park Service (NPS) has jurisdiction over Joshua Tree National Park. The visibility analyses for these areas will be conducted in a manner consistent with guidance from the NPS and USFS following the procedures set forth in the

Table 4-2 Class I Areas Near the COEP

Class I Area	Distance from COEP to Class I Area (km)	SCAQMD Rule 1303 Required Analysis Distance (km)
San Jacinto Wilderness Area	9	28
Joshua Tree National Park	10	29
San Gorgonio Wilderness Area	22	32

Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report (USFS, 2000), with any exceptions noted in this protocol due to SCAQMD requirements.

For these three Class I areas a visibility modeling analysis will be performed to address the proposed project's impacts in terms of plume contrast and color difference index. Initially, a series of Level I visibility screening analyses will be conducted to obtain a conservative evaluation of the proposed Project's potential to adversely affect visibility in the San Jacinto Wilderness Area, the San Gorgonio Wilderness Area, and the Joshua Tree National Park. The Level 1 analysis entails use of the USEPA VISCREEN model with simple, worst-case default input assumptions (i.e., extremely stable [Class F]) atmospheric turbulence conditions and a very low wind speed [1.0 meter per second] persisting for 12 consecutive hours in a direction that would transport the proposed turbine plumes toward a hypothetical observer at each Class I area. The only inputs required to execute the Level I analysis with the default parameter settings are: (1) projected short-term maximum turbine emission rates of fine particulate, and nitrogen oxides; per *USEPA Plume Visual Impact Screening Workbook (EPA, 1988 and 1992;* (2) the distances between the project stacks and a hypothetical observer at the nearest and farthest Park boundaries; and (3) representative background visual range values for the region(s) of concern.

The VISCREEN output for a Class I analysis provides the results of the following plume impact tests:

- Plume perceptibility based on color differences between the plume and a sky or terrain background (dE).
- Plume contrast relative to a sky or terrain background (C).

The VISCREEN model calculates the color difference index (dE) and the contrast (C) for four different lines of sight corresponding to two types of background (sky and terrain), and two assumed worst-case sun angles (10 degrees and 140 degrees). As part of the standard output, the four lines of sites will be calculated for both the observer's view inside the Class I area and the view outside the area. However, it should be noted that both the NPS and the USFS identify only the views inside the Class I area as the criteria for significance in this analysis.

Based upon the FLAG workbook, the significance criterion for the dE is less than 2, and a value of 0.05 or higher is considered significant for C. As recommended by the FLAG document, a Level II screening procedure should be conducted when the potential for impacts greater than the screening criteria is indicated by the results of the Level I analysis, as described in the *Plume Visual Impact Screening Workbook (EPA, 1988 and 1992)*.

The Level II procedure is similar to the Level I analysis, but allows more site-specific input data to be used in place of the extremely conservative default assumptions Specifically, the frequency of occurrence of the different dispersion conditions in the project vicinity will be established and ranked in terms of increasing values of the dispersion parameter '$\sigma_z u$' (i.e., the product of the wind speed (u) and the plume vertical spread parameter (σ_z) for the appropriate stability class) and the source-receptor distance. The VISCREEN model will then be run for the most restrictive combination of wind speed, wind direction and atmospheric stability that corresponds to a cumulative frequency of 1% (in combination with all the other combinations corresponding to lesser dispersion parameter values). A background ozone concentration of 0.065 ppm will be incorporated to represent the worst-case 24-hour ozone concentration in the region.

The Level II procedure consists of analyzing the available meteorological data to incorporate information on the frequency of conditions that may lead to adverse plume impacts in the Class I areas. The required meteorological statistics used for this refinement will be derived from the five-year hourly ISCST3 meteorological data set used in the HRA, which is discussed later in this protocol. Hourly wind data were measured at the Wintec wind farm, very near the proposed COEP site and are considered to be the most representative data available to characterize wind conditions at the site (see Section 4.8).

This data set will first be analyzed to determine the frequencies of various combinations of wind speed and stability occurring simultaneously with wind directions within the approximately 30 degree sectors that would carry the COEP facility plume toward each of the three Class I areas identified for analysis. Frequency distributions will be developed separately for four diurnal time periods (midnight-6:00 am, 6:00 am-noon, noon-6:00 pm, and 6:00 pm-midnight). For each 6-hour time period, the joint frequencies of five wind speed categories (0-1 meters per second (m/s), 1-2 m/s, 2-3 m/s, 3-4 m/s, and 4-5 m/s), six stability classes (Class A-most unstable through Class F-most stable - Class G is considered as Class F) and the specific wind direction compass sectors toward the Class I areas from the project site. For each time of day and each wind direction sector, 14 wind speed/stability combinations will be ranked in order of increasing values of the dispersion parameter, σ_z u as described above. The combinations will include F stability for wind speed classes 1 through 4, E stability with wind speed classes 1 through 5, and D stability with wind speed classes 1 through 5, as specified by the Level II guidance. Note that the lowest values of the dispersion parameter $\sigma_z u$ correspond to the most restrictive dispersion conditions. Finally, a table will be constructed showing the percent frequency of occurrence for each combination of stability and wind speed or, alternatively for each value of σ_z u. These data are tabulated in terms of the frequency of each combination, as well as the cumulative frequency of all combinations with lower values of σ_z u.

The meteorological condition for each Class I area with a cumulative frequency of 1 or greater, and with a wind speed fast enough to transport the plume to the given Class I area within 12 hours will be selected. The front edge of the San Jacinto Wilderness Area and San Gorgonio Wilderness Area lie in complex terrain. Since the elevation gain from the COEP to both these parks is greater than 500 meters, the worst-case stability class selected may be shifted to one category less stable, per the *Plume Visual Impact Screening Workbook (EPA, 1988 and 1992)*.. Thus the VISCREEN model will be run for one stability class less stable with the wind speed determined by the techniques described above to determine whether impacts above the model's screening criteria would be predicted for each Class I areas. Background visual ranges are provided in SCAQMD Rule 1303. The background visible range values to be used in all levels of analysis for San Jacinto Wilderness Area are 171 km, 180 km for Joshua Tree National Park, and

192 km for San Gorgonio Wilderness Area. For Level I and II visibility modeling, the maximum 24-hour averaged emission rates of NO_2 and PM_{10} from all sources will be used, per the *Plume Visual Impact Screening Workbook (EPA, 1988 and 1992)*.

If the plume parameters predicted by VISCREEN are above the screening criteria for locations inside the Class I areas, a Level III analysis using the USEPA PLUVUE II plume visibility model will be required to determine whether a less conservative screening approach would result in predicted significant impacts within the three Class I areas. According to the FLAG guidance, the significant impact levels for the Level III analysis are more stringent than those for the Level 1 and Level II modeling approach. Thus the dE and contrast numbers used as significance criteria in the PLUVUE II simulations will be 1.0 and 0.02, respectively.

As recommended in the EPA *Workbook for Plume Visual Impact Screening and Analysis*, the meteorology will be examined by season, time of day, stability class, wind speed and wind direction. Only daylight hours will be examined, as the plume will not be visible in the dark of night. Full details of the meteorological analysis used to determine realistic worst-case input scenarios will be provided with the model input and output files. A relative humidity value of 50% will conservatively be used in all of the PLUVUE simulations, although the average humidity in the desert area surrounding the proposed project site is considerably lower.

To ensure that different angles of the sun reflecting off the plumes from the COEP will be examined, both dawn and dusk hours will be modeled. The EPA *Workbook for Plume Visual Impact* advises that these times of day should produce the worst-case conditions. Full-load turbine stack parameters and maximum 24-hour averaged emission rates of NO_2, SO_2 and PM_{10} from all sources will be used in the analysis.

Per guidance provided from the United States Forest Service and National Park Service in 2001 for a previous version of the Ocotillo project, the observer/vista locations that will be analyzed in the PLUVUE II study are those shown in Figures 4-1 through 4-3. Also per the recommendation of the National Park Service, the background ozone level will be set to 65 ppb for all Class I Areas. The NO_x and coarse particle background values will be set to 0.010 $\mu g/m^3$ and 30 $\mu g/m^3$ respectively. These values are lower than the actual measured background values for each pollutant, as the PLUVUE II model will not allow higher values for these parameters when such a pristine background visual range is used. Default deposition and particle size parameters will be utilized.

Full details of the VISCREEN and PLUVUE simulations and meteorological analyses used in developing realistic worst-case impact scenarios will be provided with model input and output files for the plume visibility simulations.

Figure 4-1 Joshua Tree PLUVUE II Observer/Vista Locations

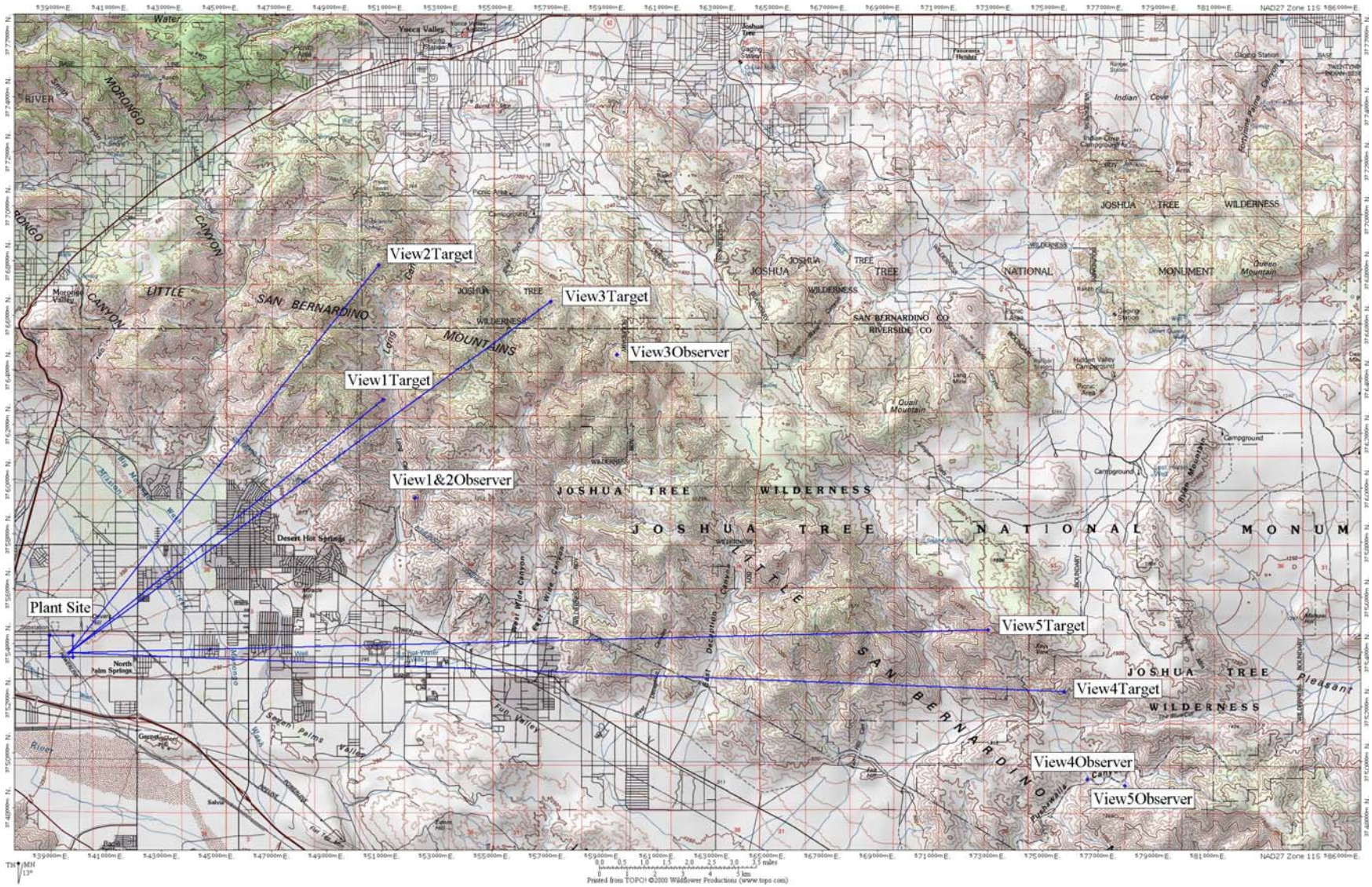


Figure 4-2 San Jacinto Wilderness Area PLUVUE II Observer/Vista Locations

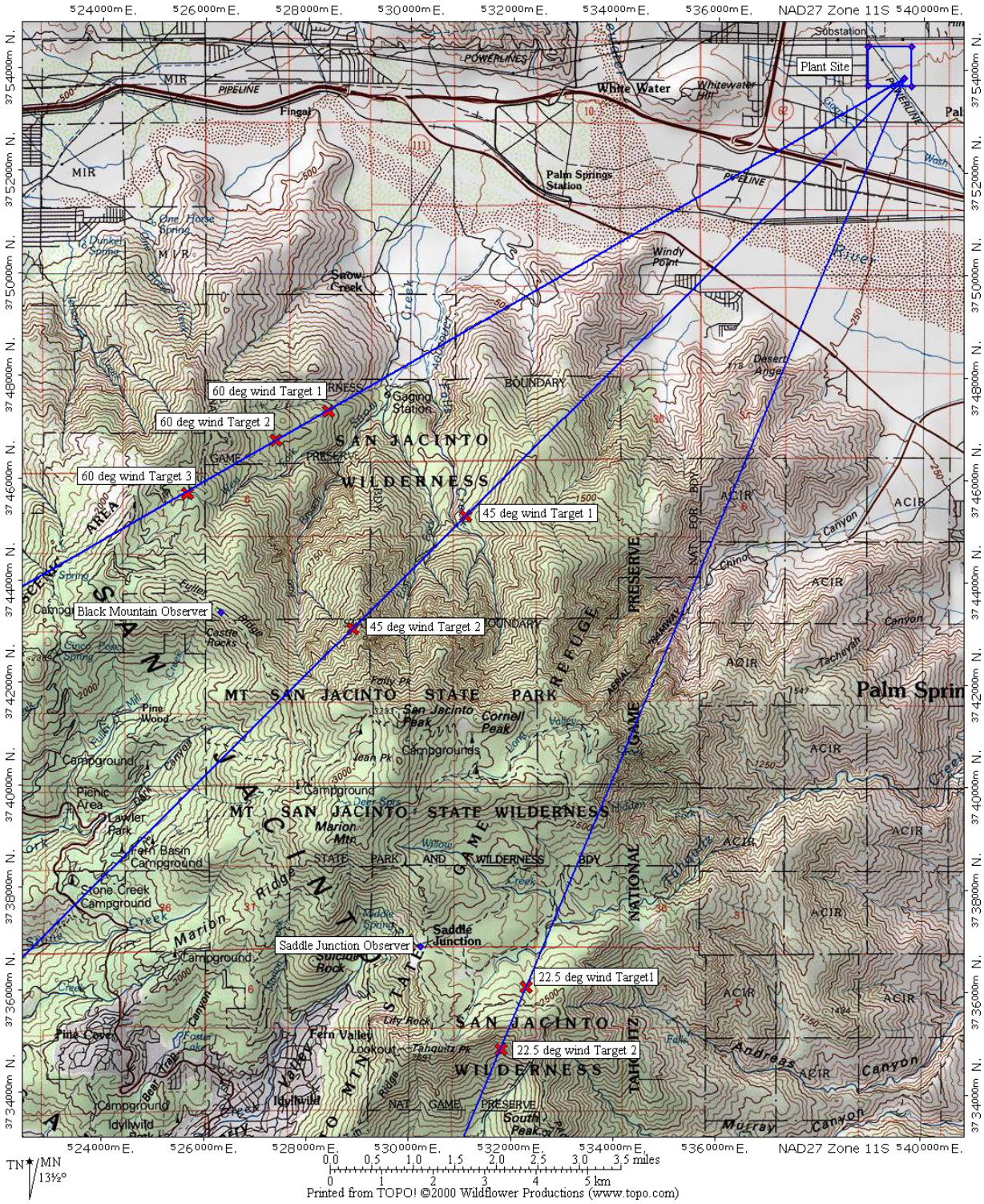
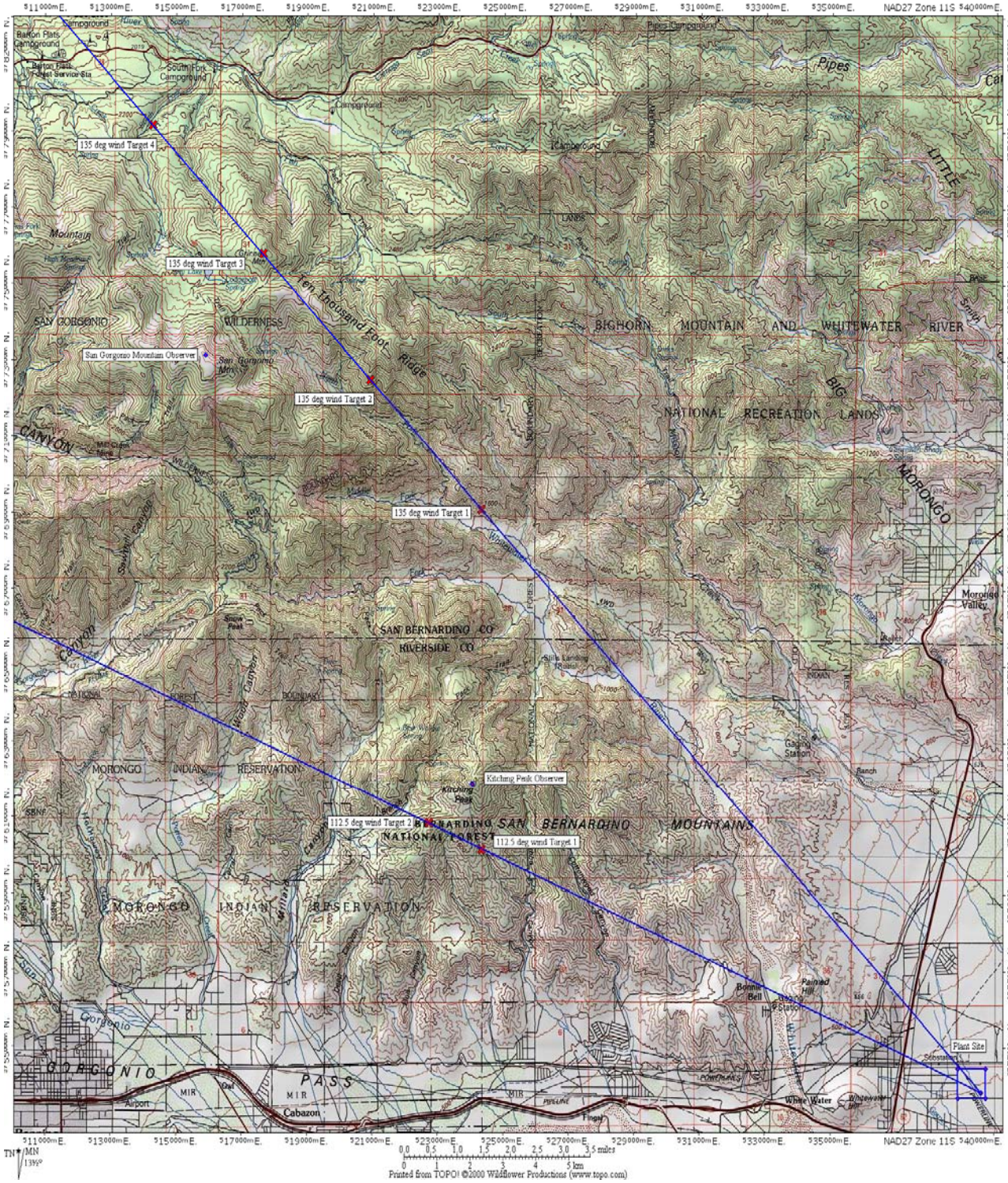


Figure 4-3 San Gorgonio Wilderness Area PLUVUE II Observer/Vista Locations



4.5 MODELING EMISSIONS INVENTORY

4.5.1 Operational Emissions

Operational emissions from the COEP will be dominated by the combustion turbine-generators. Conceptual plant design includes SCR for NO_x control and oxidation catalysts for CO control that will match recent BACT determinations for similar projects. Emissions of SO_2 and PM_{10} will be low, owing to the exclusive use of interstate pipeline quality natural gas as fuel for the gas turbine.

Table 4-3 Preliminary Estimated Emissions for Entire COEP

NO_x	CO	SO_2	ROC	PM_{10}	Pb
120	230	10	35	85	<0.6

Combustion turbine generator emissions will vary with ambient temperature and turbine load. Modeling will be conducted for a range of ambient temperatures (from low ambient temperature to high ambient temperature) and CTG loads (50, 75, and 100 percent). All combinations will be modeled to identify worst-case operating scenarios for each averaging period (i.e., 1-hour, 3-hour, 8-hour, 24-hour, and annual). Startup and shutdown scenarios will be addressed in the evaluation of normal worst-case operations. The modeling emission inventory for the proposed facility will include the maximum emission rate for each source for each appropriate averaging time. The modeling analyses conducted for the AFC, DOC, and Authority to Construct (ATC) permit applications will be based on the refined emissions estimates. Where applicable, emissions estimates will be provided in both parts per million (ppm) and pounds per hour values.

Emissions from different phases of the turbine commissioning process will be presented and the maximum short-term emissions will be selected as input into separate AERMOD modeling simulations.

The new cooling towers will incorporate drift eliminators. Drift emissions (as particulates) will be reduced by the drift eliminators. The PM_{10} emission rate from the cooling towers will incorporate this control measure. Emissions from the diesel black start generator and emergency firewater pump will also be estimated using vendor when provided or USEPA emission factors.

4.5.2 Construction Emissions

Temporary construction emissions will result from heavy equipment exhaust (primarily, CO, NO_x and diesel particulate emissions) and fugitive dust (PM_{10}) from earthmoving activities and vehicle traffic on paved and unpaved surfaces. Equipment-specific emissions factors will be used to estimate mass emissions for all criteria pollutants from diesel-fueled construction equipment and vehicles using SCAQMD OFFROAD Emission Factors. Fugitive dust emissions resulting from onsite soil disturbances and travel on unpaved roads will be estimated using SCAQMD CEQA Handbook (SCAQMD, 1993) emission factors. A dust control efficiency of 85 percent for the construction area activities will be achieved for these activities by frequent watering or other measures when required. Emissions from on-road delivery trucks and worker commute trips will be estimated using emission factors provided by

SCAQMD for Onroad Vehicles from the EMFAC2007 model. An ultra-low fuel sulfur content of 0.0015 percent by weight (15 ppm) will be used in all diesel construction equipment.

A detailed Excel Workbook will be created to estimate criteria pollutant emissions for the different non-overlapping phases of Project construction, based on information from the Project design engineers on the equipment use by month during the construction schedule and the areal extent of ground disturbance that will occur during different construction phases. Depending on the magnitude of emissions for different pollutants and the proximity of construction activities to the property boundary for each phase, one or more emission scenarios representing reasonable worst-case activity and ground disturbance for each averaging time will be selected for subsequent dispersion modeling to estimate the maximum off-site air quality impacts of these temporary activities. The emissions estimates for these scenarios will be modeled using AERMOD.

4.5.3 Air Toxic Emissions

Air toxics will also be emitted from the operational COEP due to combustion of natural gas in the turbines and diesel fuel in the black start engine and firewater pump engine. These emissions have not yet been estimated; however, because only natural gas will be used as fuel for the CTGs, only small quantities of TAC including benzene, formaldehyde, and polycyclic aromatic hydrocarbons may potentially be emitted. Diesel particulate matter is regulated as a TAC in California and will most likely dominate the predicted health risks attributable to diesel equipment. Emissions estimates for TAC will be based on emission factors and/or speciation profiles (for PM_{10} and ROC) available from SCAQMD, CARB, USEPA, and/or vendor data, if available.

4.5.4 Greenhouse Gas Emissions

Potential greenhouse gas emissions from the proposed project will be calculated using the California Climate Action Registry power/utility protocol. The estimated greenhouse gas emissions from the Project will be presented in a table.

4.6 BUILDING WAKE EFFECTS

The effect of building wakes (i.e., downwash) upon the stack plumes of emission sources at the COEP facility will be evaluated in accordance with USEPA guidance (USEPA, 1985). Wind direction-specific building data will be generated for stacks below good engineering practice (GEP) stack height using the most recent version of USEPA Building Parameter Input Program – Prime (BPIP-Prime). Appropriate information will be provided in the AFC and other permit applications that describe the input assumptions and output results from the BPIP-Prime model. The AERMOD model considers wind direction-specific downwash using both the Huber Snyder and Schulman-Scire algorithms as evaluated in the BPIP-Prime program.

4.7 RECEPTOR GRID

4.7.1 Normal Operations

The receptor grids that will be used in the AERMOD modeling analyses described in this protocol for operational sources will be as follows:

- 25-meter spacing along the fence line and extending from the fence line out to 100 meters beyond the property line;
- 100-meter spacing from 100 m to 1 km beyond the property line;
- 500-meter spacing within 1 to 5 km of the property line; and
- 1,000-meter spacing within 5 to 10 km of the property line.

During the refined modeling analysis for operational Project emissions, if a maximum predicted concentration for a particular pollutant and averaging time is located within the portion of the receptor grid with spacing greater than 25 meters, a supplemental dense receptor grid will be placed around the original maximum concentration point and the model will be rerun. The dense grid will use 25-meter spacing and will extend to the next grid point in all directions from the original point of maximum concentration.

Due to the large computation time required to run AERMOD, this receptor grid, with the additional dense nested grid points, was determined to best balance the need to predict maximum pollutant concentrations and allow the all operational modeling runs to be completed in less than one week.

A detailed project map and a 7 ½- minute U.S Geological Survey (USGS) map will be provided in the AFC. Actual Universal Transverse Mercator (UTM) coordinates will be used. The CAAQS and NAAQS apply to all locations offsite of the applicant's facility, i.e. where public access is not under the control of the applicant. The CAAQS and NAAQS are not evaluated on the property controlled by the applicant. In other words, the air within a facility's property is not considered ambient air relative to that facility's emissions.

4.7.2 Construction

Because construction emission sources release pollutants to the atmosphere from small stacks or from soil disturbances at ground level, maximum predicted construction impacts for all pollutants and averaging times will occur within the first kilometer from the COEP site boundary. Accordingly, only the portion of the above grid out to a distance of 1 km will be used for the construction modeling.

4.7.3 HRA Receptors

For the HRA modeling, receptors will be placed around the fence line with 25-meter spacing, and 100-meter grid spacing will be used out to 10 kilometers. All receptors that HARP creates inside the fence will be excluded. HARP will also include the census receptors out to 10 km. These census receptors will include the populated areas near the proposed COEP facility location. Discrete receptors will also be placed at all sensitive locations (e.g., schools, hospitals, residences, etc.) out to 3 miles.

4.8 METEOROLOGICAL DATA

The COEP is located at the eastern end of the San Gorgonio Pass, in an area surrounded by complex terrain which influences localized wind flows. The winds are consistently strong and predominantly from the west as shown in Figure 4-4. Due to these strong winds, many wind energy facilities surround the COEP site. Immediately adjacent to the COEP is the Wintec Wind Energy facility, where meteorological data were collected to support their wind energy business. The following meteorological parameters were collected: wind speed wind directions, and the horizontal standard deviation of the wind directions (sigma theta), at 50-foot and 100-foot heights above local grade. In addition, temperature was measured at the 50-foot height.

The Wintec Energy data can be considered "onsite" since they were collected next door to the proposed COEP site, and meet the USEPA criteria (USEPA, 1995) for representativeness, as follows:

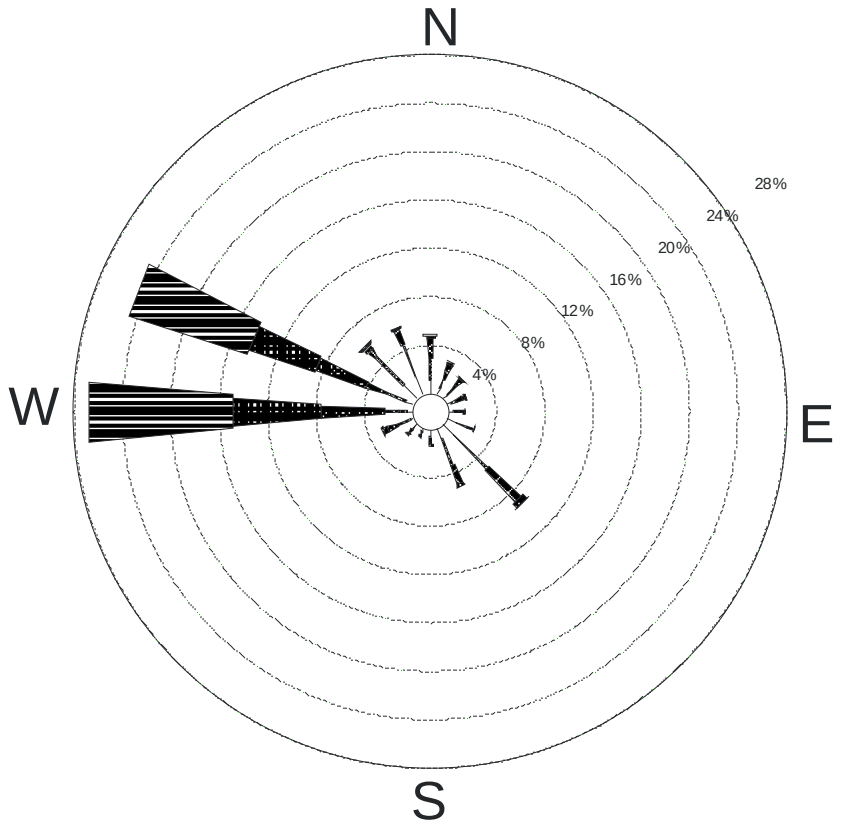
- *Proximity*: The data were collected within the boundary of the project site, and thus meet the criteria for proximity.
- *Complexity of Terrain and Exposure of Meteorological Monitoring Site*: Both the COEP site and the Wintec Energy monitoring station are located at the eastern end of the San Gorgonio Pass and are the same distances from prominent terrain features in the surrounding area.
- *Period of Data Collection*: The 1988 through 1991 data set represents data collection over four full years. Although only one year of onsite data is required, a four-year data set will be used to better represent project site conditions, as well as to capture worst-case meteorological conditions.
- *Data Quality:* The quality of the Wintec Energy monitoring equipment was good and the site was maintained on a regular basis. In addition, the data recovery rate was greater than 90 percent for the years 1988-1991.

The Wintec data will be processed according to the onsite data procedures set forth in the USEPA *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (1987). To create the meteorological data input files for AERMOD, the onsite data must be processed with National Weather Service (NWS) surface data and upper air data in AERMET.

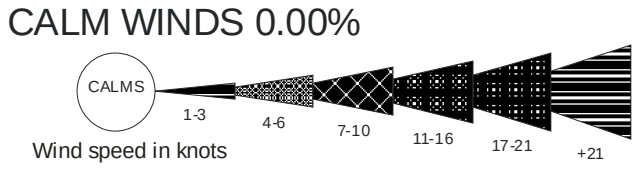
The most representative NWS surface station with adequate data collection to support the required modeling effort, was determined to be the Dagget-Barstow station. The Palm Springs Airport station is nearer, but had insufficient data collection.

Upper air data will be obtained from the Desert Rock station in Nevada for 1988-1991. Although Edwards Air Force Base upper air monitoring station is the closest upper air station, data were collected less than 50% of the time during the years for which Wintec data are available, and thus this station was determined to have insufficient data for the air quality analysis. The Desert Rock station is located in a desert environment similar to the COEP site and thus was determined to be the most representative data available for use in this modeling analysis.

Figure 4-4 Annual Windrose based 1988-1991 Wintec Wind Data



NOTE: Frequencies indicate direction from which the wind is blowing.



The land use characteristics for the entire 360 degrees out to a distance of 3 kilometers surrounding both the Wintec Energy facility and the COEP site are entirely rural desert. The land-use parameter values show in Table 4-4 are proposed to be used in AERMET for purposes of processing the Wintec meteorological data.

Table 4-4 COEP Land Use Characteristics

Land Use Characteristic	Spring	Summer	Autumn	Winter
Albedo	0.3	0.28	0.28	0.28
Bowen Ratio	3.0	4.0	6.0	6.0
Surface Roughness (meters)	0.3	0.3	0.3	0.3

To create a meteorological input data set for the HARP/ISC modeling, the same 1988-1991 Wintec data, Daggett-Barstow and Desert Rock data will be processed with PCRAMMET. Annual average values for surface roughness, albedo and Bowen ratio will be input into PCRAMMET.

4.9 AIR QUALITY MONITORING DATA

Available SCAQMD/CARB air quality data recorded from 2002 through 2006 will be used to determine baseline air pollutant concentrations. Data from the SCAQMD's Palm Springs-Fire Station, Banning Airport, Indio-Jackson Street Station, and Riverside-Rubidoux monitoring stations will be evaluated for potential representativeness of the proposed project site conditions.

The Palm Springs-Fire Station monitoring station records CO, NO_2, PM_{10}, $PM_{2.5}$, and O_3 and is located approximately 8.5 miles southeast of the COEP site It is by far the closest station that monitors all the criteria pollutants, except SO_2. The Riverside-Rubidoux station is the closest station that monitors ambient SO_2. Use of the monitoring data from the Palm Springs-Fire Station, and Riverside-Rubidoux stations to characterize conditions at the Project Site will almost certainly overestimate pollutant levels at COEP site, because of the lower population and level of development of the COEP area compared with those of the urban monitoring stations.

The data collected at the air monitoring stations identified above will be used to represent the background air quality for purposes of the AAQS analyses. The AFC will include an analysis supporting the representativeness and use of the background data sets selected to represent background conditions for the AAQS evaluations. The highest reported concentration that has occurred at the selected stations within the last five years will be used for each pollutant and averaging time corresponding to the AAQS.

The maximum monitored pollutant concentrations (Table 4-5) will be added to the modeled maximum impacts from the proposed facility and the total will then be compared with the applicable AAQS. This is a conservative approach because it assumes that the highest recorded value and the modeled maximum impact both occur at the same time and at the same location.

Table 4-5 Highest Monitored Concentrations Near COEP (2002 – 2006)

Pollutant	Averaging Time	Highest Monitoring Concentration	Monitoring Station Address	Year
CO	8-hour	1.29 ppm (1433 μg/m³)	Palm Springs - Fire Station	2003
	1-hour	3.3 ppm (3771 μg/m³)	Palm Springs - Fire Station	2003
NO_2	Annual	0.016 ppm (30.19 μg/m³)	Palm Springs - Fire Station	2002
	1-hour	0.0.93 ppm (174.84 μg/m³)	Palm Springs - Fire Station	2002
SO_2	Annual	0.004 ppm (10.7 μg/m³)	Riverside-Rubidoux	2005
	24-hour	0.015 ppm (39.38 μg/m³)	Riverside-Rubidoux	2004
	3-hour	0.016 ppm (41.6 μg/m³)	Riverside-Rubidoux	2004
	1-hour	0.024 ppm (62.88 μg/m³)	Riverside-Rubidoux	2005
PM_{10} (Non-attainment area)	Annual	26.5 μg/m³	Palm Springs - Fire Station	2003
	24-hour	108 μg/m³	Palm Springs - Fire Station	2003
$PM_{2.5}$ (Non-attainment area)	Annual	10 μg/m³	Palm Springs - Fire Station	2002
	24-hour	42.3 μg/m³	Indio-Jackson Street Station	2005

SECTION 5 PRESENTATION OF MODELING RESULTS

5.1 NAAQS AND CAAQS ANALYSIS

The results of the AAQS analyses for the COEP facility will be presented in summary tables. A figure indicating the location of the maximum pollutant concentrations during project operations will be provided. For CO, NO_2, SO_2, and PM_{10}, the highest short-term and highest annual concentrations over the four years modeled will be reported. The highest annual $PM_{2.5}$ concentration over the four years modeled will be presented. The 24-hour $PM_{2.5}$ NAAQS, is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. This is equivalent to the highest eighth high (H8H) 24-hour concentration over the four year period modeled. Background concentrations will be added to yield the total concentrations suitable for comparison with the NAAQS and CAAQS.

5.2 VISIBILITY ANALYSIS

The results of the visibility analysis to evaluate the operational impacts of the COEP facility will be presented in summary tables and compared with all relevant significance thresholds.

5.3 HEALTH RISK ASSESSMENT ANALYSIS

Maps at a scale of 1:24,000 will depict the following data:

- A map depicting elevated terrain within a 10-km radius of the project;
- A map indicating the locations of sensitive receptors, including schools, pre-schools, hospitals, etc., within a 3-mile radius of the project;
- A map depicting current and future residential land uses;
- Isopleths for any areas where predicted exposures to air toxics result in estimated chronic non-cancer impacts and acute impacts equal to or exceeding a hazard index of 0.5; and
- Isopleths for any areas where exposures to air toxics lead to an estimated carcinogenic risk equal to or exceeding one in one million.

Health risk assessment modeling results will be summarized to include maximum annual (chronic, carcinogenic, and non-carcinogenic) and hourly (acute) adverse health effects from the toxic air contaminant emissions from the COEP. Cancer burden will be presented if the maximum predicted cancer risk is greater than one in a million at any receptors. Health risk values will be calculated and presented in a summary table for the points of maximum impact and the sensitive receptors with the maximum risk values.

5.4 DATA SUBMITTAL

Electronic copies of the modeling input and output files will be provided to SCAQMD and the CEC.

SECTION 6 REFERENCES

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APPENDIX I-6
VISCREEN AND PLUVUE 2 MODELING INPUTS

Sentinel Energy Project Level II Visibility Modeling
VISCREEN LEVEL II MODELING SUMMARY

Emissions:	24-hour NOx	10.3	g/s
	24-hour PM10	6.05	g/s

These emission rates are for 8 turbines.

Ozone: 0.065 ppm
Primary Particulates Density= 1.5
Primary Particulates Diameter = 1.0

Class I Area	Wind Direction	Met Data	Worst Met Condition	Worst Met Adjusted for Terrain Influences	Distance to Class I Area Closest (km)	Farthest (km) *	Background Visible Range (km)	File Name	Met Condition w/ Cumulative Frequency >1.0 (Stability Class and Wind Speed (m/s)) Hr 1-6	Hr 7-12	Hr 13-18	Hr 19-24		VISCREEN Level II Results Inside Class I Area Sky 10	Sky 140	Ter 10	Ter 140
													Delta E Threshold	2.00	2.00	2.00	2.00
													Contrast Threshold	0.05	0.05	0.05	0.05
Joshua Tree	WNW	1987-1991	D 3.5	D 3.5	32.3	50	180	jtlv2wnw	--	--	D 3.5	D 4.5	Delta E	0.505	0.157	0.907	0.053
													Contrast	0.009	-0.005	0.006	0.001
Joshua Tree	W	1987-1991	--	--	14.4	50	180	< 1% stable winds	--	--	--	--	Delta E				
													Contrast				
Joshua Tree	WSW	1987-1991	D 3.5	D 3.5	11.6	50	180	jtlv2wsw	D 3.5	--	--	D 5.5	Delta E	1.405	0.303	3.382	0.157
													Contrast	0.021	-0.011	0.013	0.001
Joshua Tree	SW	1987-1991	E 2.5	E 2.5	13.1	35.9	180	jtlv2sw	E 2.5	--	--	E 3.5	Delta E	4.453	1.260	9.408	1.300
													Contrast	0.074	-0.039	0.086	0.025
San Gorgonic	SE	1987-1991	F 1.5	E 1.5	16.4	42.8	192	sglv2se	F 1.5	--	--	F 1.5	Delta E	6.535	1.665	12.090	1.765
													Contrast	0.111	-0.054	0.117	0.036
San Gorgonic	ESE	1987-1991	F 1.5	E 1.5	14.3	43.2	192	sglv2ese	F 1.5	D 4.5	--	F 1.5	Delta E	7.751	1.892	13.135	2.053
													Contrast	0.129	-0.064	0.131	0.044
San Jacinto	N	1987-1991	--	--	20.9	24.9	171	< 1% stable winds	--	--	--	--	Delta E				
													Contrast				
San Jacinto	NNE	1987-1991	--	--	10.5	24.9	171	< 1% stable winds	--	--	--	--	Delta E				
													Contrast				
San Jacinto	NE	1987-1991	--	--	9.0	21.2	171	< 1% stable winds	--	--	--	--	Delta E				
													Contrast				
San Jacinto	ENE	1987-1991	D 3.5	C 3.5	12.5	16.4	171	sjlv2ene	D 4.5	--	--	D 3.5	Delta E	0.157	0.076	0.750	0.036
													Contrast	0.003	-0.002	0.003	0.000

*Note: If farthest distance is greater than 50 km, 50 km is used.

Process Description:

1 The values (stability class and wind speed) corresponding to the first occurrence for a met condition with a cumulative frequency >1.0 are shown for each Class I area.
2 Worst-case met adjusted for terrain influences is the meteorological condition used in the Level II Visibility analysis.
3 Background visual range provide in SCAQMD Rule 1303
4 All other inputs in the model use default values.
5 Contrast threshold is an absolute value.

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
Joshua Tree National Park

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

x= 32.1 distance to class I area (km)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.268414195	4106.58457	5000	2.05E+07	4.11E+07	6.16E+07	8.21E+07	1.03E+08	1.23E+08	1.44E+08	1.64E+08
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.210412679	3188.708139	4913.679582	1.57E+07	3.13E+07	4.70E+07	6.27E+07	7.83E+07	9.40E+07	1.10E+08	1.25E+08
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.15243467	2293.678214	1459.679019	3.35E+06	6.70E+06	1.00E+07	1.34E+07	1.67E+07	2.01E+07	2.34E+07	2.68E+07
D	44.053 [4]	0.51179 [4]	8.333	0.72382	0.101616085	1522.395389	260.0097895	3.96E+05	7.92E+05	1.19E+06	1.58E+06	1.98E+06	2.38E+06	2.77E+06	3.17E+06
E	35.420 [5]	0.37615 [5]	6.25	0.54287	0.076216124	1140.132955	130.5931582	1.49E+05	2.98E+05	4.47E+05	5.96E+05	7.44E+05	8.93E+05	1.04E+06	1.19E+06
F	27.074 [6]	0.27436 [6]	4.1667	0.36191	0.050811533	759.2815598	70.12568964	5.32E+04	1.06E+05	1.60E+05	2.13E+05	2.66E+05	3.19E+05	3.73E+05	4.26E+05
							Travel Time (hours)[7]	17.8	5.9	3.6	2.5	2.0	1.6	1.4	1.2

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" > 30.00 kilometers.
[5] for "x" 20.01 - 40.00 kilometers.
[6] for "x" 30.01 - 60.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **WNW**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	5.3245E+04	17.8	0.000%		0.000%		0.000%		0.000%		F	0-1
2	F	1 - 2	2	1.0649E+05	5.9	0.240%	0.240%	0.000%	0.000%	0.050%	0.050%	0.160%	0.160%	F	1-2
3	E	0 - 1	1	1.4889E+05	17.8	0.000%		0.000%		0.000%		0.000%		E	0-1
4	F	2 - 3	3	1.5974E+05	3.6	0.040%	0.280%	0.000%	0.000%	0.010%	0.060%	0.050%	0.210%	F	2-3
5	E	1 - 2	2	2.9779E+05	5.9	0.140%	0.420%	0.000%	0.000%	0.250%	0.310%	0.100%	0.310%	E	1-2
6	D	0 - 1	1	3.9584E+05	17.8	0.000%		0.000%		0.000%		0.000%		D	0-1
7	E	2 - 3	3	4.4668E+05	3.6	0.100%	0.520%	0.000%	0.000%	0.160%	0.470%	0.210%	0.520%	E	2-3
8	E	3 - 4	4	5.9557E+05	2.5	0.070%	0.590%	0.000%	0.000%	0.050%	0.520%	0.080%	0.600%	E	3-4
9	E	4 - 5	5	7.4447E+05	2.0	0.040%	0.630%	0.000%	0.000%	0.030%	0.550%	0.060%	0.660%	E	4-5
10	D	1 - 2	2	7.9168E+05	5.9	0.010%	0.640%	0.210%	0.210%	0.120%	0.670%	0.010%	0.670%	D	1-2
11	D	2 - 3	3	1.1875E+06	3.6	0.030%	0.670%	0.340%	0.550%	0.280%	0.950%	0.060%	0.730%	D	2-3
12	D	3 - 4	4	1.5834E+06	2.5	0.130%	0.800%	0.100%	0.650%	0.260%	1.210%	0.220%	0.950%	D	3-4
13	D	4 - 5	5	1.9792E+06	2.0	0.070%	0.870%	0.080%	0.730%	0.260%	1.470%	0.050%	1.000%	D	4-5
14	D	5 - 6	6	2.3750E+06	2.5	0.020%	0.890%	0.090%	0.820%	0.080%	1.550%	0.100%	1.100%	D	5-6
15	D	6 - 7	7	2.7709E+06	1.4	0.000%	0.890%	0.000%	0.820%	0.000%	1.550%	0.000%	1.100%	D	6-7
16	D	7 - 8	8	3.1667E+06	1.2	0.000%	0.890%	0.000%	0.820%	0.000%	1.550%	0.000%	1.100%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
Joshua Tree National Park

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

x= 13.8 distance to class I area (km)

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.305740933	2025.954165	5000	1.01E+07	2.03E+07	3.04E+07	4.05E+07	5.06E+07	6.08E+07	7.09E+07	8.10E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.237075055	1550.855572	1946.173289	3.02E+06	6.04E+06	9.05E+06	1.21E+07	1.51E+07	1.81E+07	2.11E+07	2.41E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.168431212	1091.433924	674.4083581	7.36E+05	1.47E+06	2.21E+06	2.94E+06	3.68E+06	4.42E+06	5.15E+06	5.89E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.112280741	723.7295889	161.852777	1.17E+05	2.34E+05	3.51E+05	4.69E+05	5.86E+05	7.03E+05	8.20E+05	9.37E+05
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.08421469	541.8222947	91.90786213	4.98E+04	9.96E+04	1.49E+05	1.99E+05	2.49E+05	2.99E+05	3.49E+05	3.98E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.056143861	360.7443655	53.018456	1.91E+04	3.83E+04	5.74E+04	7.65E+04	9.56E+04	1.15E+05	1.34E+05	1.53E+05
							Travel Time (hours)[7]	7.7	2.6	1.5	1.1	0.9	0.7	0.6	0.5

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **W**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	1.9126E+04	7.7	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	3.8252E+04	2.6	0.150%	0.150%	0.000%	0.000%	0.030%	0.030%	0.210%	0.210%	F	1-2
3	E	0 - 1	1	4.9798E+04	7.7	0.000%	0.150%	0.000%	0.000%	0.000%	0.030%	0.000%	0.210%	E	0-1
4	F	2 - 3	3	5.7378E+04	1.5	0.060%	0.210%	0.000%	0.000%	0.000%	0.030%	0.050%	0.260%	F	2-3
5	E	1 - 2	2	9.9595E+04	2.6	0.130%	0.340%	0.000%	0.000%	0.080%	0.110%	0.100%	0.360%	E	1-2
6	D	0 - 1	1	1.1714E+05	7.7	0.000%	0.340%	0.000%	0.000%	0.000%	0.110%	0.000%	0.360%	D	0-1
7	E	2 - 3	3	1.4939E+05	1.5	0.170%	0.510%	0.000%	0.000%	0.070%	0.180%	0.160%	0.520%	E	2-3
8	E	3 - 4	4	1.9919E+05	1.1	0.030%	0.540%	0.000%	0.000%	0.040%	0.220%	0.100%	0.620%	E	3-4
9	D	1 - 2	2	2.3428E+05	2.6	0.050%	0.590%	0.180%	0.180%	0.050%	0.270%	0.000%	0.620%	D	1-2
10	E	4 - 5	5	2.4899E+05	0.9	0.030%	0.620%	0.000%	0.180%	0.030%	0.300%	0.050%	0.670%	E	4-5
11	D	2 - 3	3	3.5141E+05	1.5	0.080%	0.700%	0.160%	0.340%	0.070%	0.370%	0.020%	0.690%	D	2-3
12	D	3 - 4	4	4.6855E+05	1.1	0.130%	0.830%	0.050%	0.390%	0.060%	0.430%	0.130%	0.820%	D	3-4
13	D	4 - 5	5	5.8569E+05	0.9	0.050%	0.880%	0.060%	0.450%	0.080%	0.510%	0.060%	0.880%	D	4-5
14	D	5 - 6	6	7.0283E+05	1.1	0.080%	0.960%	0.050%	0.500%	0.090%	0.600%	0.040%	0.920%	D	5-6
15	D	6 - 7	7	8.1996E+05	0.6	0.000%	0.960%	0.000%	0.500%	0.000%	0.600%	0.000%	0.920%	D	6-7
16	D	7 - 8	8	9.3710E+05	0.5	0.000%	0.960%	0.000%	0.500%	0.000%	0.600%	0.000%	0.920%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
Joshua Tree National Park

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

x= 12.0 distance to class I area (km)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.311920671	1799.701744	5000	9.00E+06	1.80E+07	2.70E+07	3.60E+07	4.50E+07	5.40E+07	6.30E+07	7.20E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.241489224	1374.673604	1669.513392	2.30E+06	4.59E+06	6.89E+06	9.18E+06	1.15E+07	1.38E+07	1.61E+07	1.84E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.171079566	964.2887776	593.479421	5.72E+05	1.14E+06	1.72E+06	2.29E+06	2.86E+06	3.43E+06	4.01E+06	4.58E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.114046359	639.3119786	149.5449853	9.56E+04	1.91E+05	2.87E+05	3.82E+05	4.78E+05	5.74E+05	6.69E+05	7.65E+05
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.085538916	478.5943544	86.09915356	4.12E+04	8.24E+04	1.24E+05	1.65E+05	2.06E+05	2.47E+05	2.88E+05	3.30E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.05702667	318.633871	50.03031341	1.59E+04	3.19E+04	4.78E+04	6.38E+04	7.97E+04	9.56E+04	1.12E+05	1.28E+05
							Travel Time (hours)[7]	6.7	2.2	1.3	1.0	0.7	0.6	0.5	0.4

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **WSW**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	1.5941E+04	6.7	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	3.1883E+04	2.2	0.330%	0.330%	0.000%	0.000%	0.050%	0.050%	0.240%	0.240%	F	1-2
3	E	0 - 1	1	4.1207E+04	6.7	0.000%	0.330%	0.000%	0.000%	0.000%	0.050%	0.000%	0.240%	E	0-1
4	F	2 - 3	3	4.7824E+04	1.3	0.050%	0.380%	0.000%	0.000%	0.000%	0.050%	0.050%	0.290%	F	2-3
5	E	1 - 2	2	8.2413E+04	2.2	0.170%	0.550%	0.000%	0.000%	0.090%	0.140%	0.160%	0.450%	E	1-2
6	D	0 - 1	1	9.5606E+04	6.7	0.000%	0.550%	0.000%	0.000%	0.000%	0.140%	0.000%	0.450%	D	0-1
7	E	2 - 3	3	1.2362E+05	1.3	0.160%	0.710%	0.000%	0.000%	0.050%	0.190%	0.150%	0.600%	E	2-3
8	E	3 - 4	4	1.6483E+05	1.0	0.050%	0.760%	0.000%	0.000%	0.030%	0.220%	0.080%	0.680%	E	3-4
9	D	1 - 2	2	1.9121E+05	2.2	0.060%	0.820%	0.240%	0.240%	0.030%	0.250%	0.010%	0.690%	D	1-2
10	E	4 - 5	5	2.0603E+05	0.7	0.080%	0.900%	0.000%	0.240%	0.060%	0.310%	0.060%	0.750%	E	4-5
11	D	2 - 3	3	2.8682E+05	1.3	0.050%	0.950%	0.160%	0.400%	0.030%	0.340%	0.050%	0.800%	D	2-3
12	D	3 - 4	4	3.8242E+05	1.0	0.100%	1.050%	0.050%	0.450%	0.050%	0.390%	0.100%	0.900%	D	3-4
13	D	4 - 5	5	4.7803E+05	0.7	0.090%	1.140%	0.040%	0.490%	0.160%	0.550%	0.060%	0.960%	D	4-5
14	D	5 - 6	6	5.7364E+05	1.0	0.100%	1.240%	0.070%	0.560%	0.160%	0.710%	0.160%	1.120%	D	5-6
15	D	6 - 7	7	6.6924E+05	0.5	0.000%	1.240%	0.000%	0.560%	0.000%	0.710%	0.000%	1.120%	D	6-7
16	D	7 - 8	8	7.6485E+05	0.4	0.000%	1.240%	0.000%	0.560%	0.000%	0.710%	0.000%	1.120%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
Joshua Tree National Park

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

x= 14.0 distance to class I area (km)

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.305104718	2050.761204	5000	1.03E+07	2.05E+07	3.08E+07	4.10E+07	5.13E+07	6.15E+07	7.18E+07	8.20E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.236620609	1570.200142	1977.139123	3.10E+06	6.21E+06	9.31E+06	1.24E+07	1.55E+07	1.86E+07	2.17E+07	2.48E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.168158559	1105.425143	683.3426782	7.55E+05	1.51E+06	2.27E+06	3.02E+06	3.78E+06	4.53E+06	5.29E+06	6.04E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.112098967	733.019758	163.1760339	1.20E+05	2.39E+05	3.59E+05	4.78E+05	5.98E+05	7.18E+05	8.37E+05	9.57E+05
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.084078358	548.7807368	92.52769337	5.08E+04	1.02E+05	1.52E+05	2.03E+05	2.54E+05	3.05E+05	3.55E+05	4.06E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.056052974	365.3788576	53.33604732	1.95E+04	3.90E+04	5.85E+04	7.80E+04	9.74E+04	1.17E+05	1.36E+05	1.56E+05
							Travel Time (hours)[7]	7.8	2.6	1.6	1.1	0.9	0.7	0.6	0.5

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **SW**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	1.9488E+04	7.8	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	3.8976E+04	2.6	0.470%	0.470%	0.000%	0.000%	0.040%	0.040%	0.330%	0.330%	F	1-2
3	E	0 - 1	1	5.0777E+04	7.8	0.000%	0.470%	0.000%	0.000%	0.000%	0.040%	0.000%	0.330%	E	0-1
4	F	2 - 3	3	5.8464E+04	1.6	0.110%	0.580%	0.000%	0.000%	0.030%	0.070%	0.050%	0.380%	F	2-3
5	E	1 - 2	2	1.0155E+05	2.6	0.280%	0.860%	0.000%	0.000%	0.090%	0.160%	0.370%	0.750%	E	1-2
6	D	0 - 1	1	1.1961E+05	7.8	0.000%	0.860%	0.000%	0.000%	0.000%	0.160%	0.000%	0.750%	D	0-1
7	E	2 - 3	3	1.5233E+05	1.6	0.260%	1.120%	0.000%	0.000%	0.030%	0.190%	0.190%	0.940%	E	2-3
8	E	3 - 4	4	2.0311E+05	1.1	0.070%	1.190%	0.000%	0.000%	0.050%	0.240%	0.120%	1.060%	E	3-4
9	D	1 - 2	2	2.3922E+05	2.6	0.150%	1.340%	0.250%	0.250%	0.010%	0.250%	0.000%	1.060%	D	1-2
10	E	4 - 5	5	2.5389E+05	0.9	0.090%	1.430%	0.000%	0.250%	0.070%	0.320%	0.120%	1.180%	E	4-5
11	D	2 - 3	3	3.5883E+05	1.6	0.120%	1.550%	0.210%	0.460%	0.040%	0.360%	0.020%	1.200%	D	2-3
12	D	3 - 4	4	4.7845E+05	1.1	0.090%	1.640%	0.070%	0.530%	0.080%	0.440%	0.110%	1.310%	D	3-4
13	D	4 - 5	5	5.9806E+05	0.9	0.100%	1.740%	0.050%	0.580%	0.140%	0.580%	0.050%	1.360%	D	4-5
14	D	5 - 6	6	7.1767E+05	1.1	0.130%	1.870%	0.160%	0.740%	0.300%	0.880%	0.150%	1.510%	D	5-6
15	D	6 - 7	7	8.3728E+05	0.6	0.000%	1.870%	0.000%	0.740%	0.000%	0.880%	0.000%	1.510%	D	6-7
16	D	7 - 8	8	9.5689E+05	0.5	0.000%	1.870%	0.000%	0.740%	0.000%	0.880%	0.000%	1.510%	D	7-8

	1-6	7-12	13-18	19-24
Cumulative frequencies for stability classes E,F&D per time period:	311	151	42	179
Cumulative frequencies for stability classes A,B&C per time period:	0	97	26	0
Includes all stability classes:	311	248	68	179
hours in met year:	2190	2190	2190	2190

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
San Gorgonio Wilderness Area

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

x= 17.6 distance to class I area (km)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.294986219	2487.33979	5000	1.24E+07	2.49E+07	3.73E+07	4.97E+07	6.22E+07	7.46E+07	8.71E+07	9.95E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.229392996	1911.467824	2541.394641	4.86E+06	9.72E+06	1.46E+07	1.94E+07	2.43E+07	2.91E+07	3.40E+07	3.89E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.163822231	1353.183574	842.443336	1.14E+06	2.28E+06	3.42E+06	4.56E+06	5.70E+06	6.84E+06	7.98E+06	9.12E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.109208002	897.5528113	185.7364509	1.67E+05	3.33E+05	5.00E+05	6.67E+05	8.34E+05	1.00E+06	1.17E+06	1.33E+06
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.081910114	672.0236085	102.9668149	6.92E+04	1.38E+05	2.08E+05	2.77E+05	3.46E+05	4.15E+05	4.84E+05	5.54E+05
F	22.651 [6]	0.32681 [6]	4.1667	0.36191	0.054607492	447.4643312	57.82736122	2.59E+04	5.18E+04	7.76E+04	1.04E+05	1.29E+05	1.55E+05	1.81E+05	2.07E+05
							Travel Time (hours)[7]	9.8	3.3	2.0	1.4	1.1	0.9	0.8	0.7

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 15.01 - 30.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **SE**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	2.5876E+04	9.8	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	5.1751E+04	3.3	1.380%	1.380%	0.000%	0.000%	0.020%	0.020%	1.100%	1.100%	F	1-2
3	E	0 - 1	1	6.9196E+04	9.8		1.380%	0.000%	0.000%	0.000%	0.020%	0.000%	1.100%	E	0-1
4	F	2 - 3	3	7.7627E+04	2.0		1.380%	0.000%	0.000%	0.000%	0.020%	0.550%	1.650%	F	2-3
5	E	1 - 2	2	1.3839E+05	3.3		1.380%	0.000%	0.000%	0.110%	0.130%	1.030%	2.680%	E	1-2
6	D	0 - 1	1	1.6671E+05	9.8		1.380%	0.000%	0.000%	0.000%	0.130%		2.680%	D	0-1
7	E	2 - 3	3	2.0759E+05	2.0		1.380%	0.000%	0.000%	0.000%	0.130%		2.680%	E	2-3
8	E	3 - 4	4	2.7678E+05	1.4		1.380%	0.000%	0.000%	0.000%	0.130%		2.680%	E	3-4
9	D	1 - 2	2	3.3342E+05	3.3		1.380%	0.320%	0.320%	0.040%	0.170%		2.680%	D	1-2
10	E	4 - 5	5	3.4598E+05	1.1		1.380%	0.000%	0.320%	0.010%	0.180%		2.680%	E	4-5
11	D	2 - 3	3	5.0012E+05	2.0		1.380%	0.200%	0.520%	0.010%	0.190%		2.680%	D	2-3
12	D	3 - 4	4	6.6683E+05	1.4		1.380%	0.050%	0.570%	0.010%	0.200%		2.680%	D	3-4
13	D	4 - 5	5	8.3354E+05	1.1		1.380%	0.030%	0.600%	0.000%	0.200%		2.680%	D	4-5
14	D	5 - 6	6	1.0002E+06	1.4		1.380%	0.010%	0.610%	0.000%	0.200%		2.680%	D	5-6
15	D	6 - 7	7	1.1670E+06	0.8		1.380%	0.000%	0.610%	0.000%	0.200%		2.680%	D	6-7
16	D	7 - 8	8	1.3337E+06	0.7		1.380%	0.000%	0.610%	0.000%	0.200%		2.680%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
San Gorgonio Wilderness Area

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

x= 15.0 distance to class I area (km)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.302054117	2173.872264	5000	1.09E+07	2.17E+07	3.26E+07	4.35E+07	5.43E+07	6.52E+07	7.61E+07	8.70E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.234441574	1666.279157	2132.602344	3.55E+06	7.11E+06	1.07E+07	1.42E+07	1.78E+07	2.13E+07	2.49E+07	2.84E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.16685121	1175.002262	727.8542257	8.55E+05	1.71E+06	2.57E+06	3.42E+06	4.28E+06	5.13E+06	5.99E+06	6.84E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.111227377	779.2209972	169.6728136	1.32E+05	2.64E+05	3.97E+05	5.29E+05	6.61E+05	7.93E+05	9.25E+05	1.06E+06
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.08342466	583.3865337	95.55830909	5.57E+04	1.11E+05	1.67E+05	2.23E+05	2.79E+05	3.34E+05	3.90E+05	4.46E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.055617179	388.4274191	54.88550476	2.13E+04	4.26E+04	6.40E+04	8.53E+04	1.07E+05	1.28E+05	1.49E+05	1.71E+05
							Travel Time (hours)[7]	8.3	2.8	1.7	1.2	0.9	0.8	0.6	0.6

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **ESE**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	2.1319E+04	8.3	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	4.2638E+04	2.8	1.290%	1.290%	0.000%	0.000%	0.020%	0.020%	1.020%	1.020%	F	1-2
3	E	0 - 1	1	5.5747E+04	8.3		1.290%	0.000%	0.000%	0.000%	0.020%		1.020%	E	0-1
4	F	2 - 3	3	6.3957E+04	1.7		1.290%	0.000%	0.000%	0.000%	0.020%		1.020%	F	2-3
5	E	1 - 2	2	1.1149E+05	2.8		1.290%	0.000%	0.000%	0.070%	0.090%		1.020%	E	1-2
6	D	0 - 1	1	1.3221E+05	8.3		1.290%	0.000%	0.000%	0.000%	0.090%		1.020%	D	0-1
7	E	2 - 3	3	1.6724E+05	1.7		1.290%	0.000%	0.000%	0.030%	0.120%		1.020%	E	2-3
8	E	3 - 4	4	2.2299E+05	1.2		1.290%	0.000%	0.000%	0.040%	0.160%		1.020%	E	3-4
9	D	1 - 2	2	2.6443E+05	2.8		1.290%	0.300%	0.300%	0.030%	0.190%		1.020%	D	1-2
10	E	4 - 5	5	2.7874E+05	0.9		1.290%	0.000%	0.300%	0.020%	0.210%		1.020%	E	4-5
11	D	2 - 3	3	3.9664E+05	1.7		1.290%	0.200%	0.500%	0.050%	0.260%		1.020%	D	2-3
12	D	3 - 4	4	5.2885E+05	1.2		1.290%	0.230%	0.730%	0.040%	0.300%		1.020%	D	3-4
13	D	4 - 5	5	6.6106E+05	0.9		1.290%	0.330%	1.060%	0.040%	0.340%		1.020%	D	4-5
14	D	5 - 6	6	7.9328E+05	1.2		1.290%	0.250%	1.310%	0.050%	0.390%		1.020%	D	5-6
15	D	6 - 7	7	9.2549E+05	0.6		1.290%	0.000%	1.310%	0.000%	0.390%		1.020%	D	6-7
16	D	7 - 8	8	1.0577E+06	0.6		1.290%	0.000%	1.310%	0.000%	0.390%		1.020%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
San Jacinto Wilderness Area

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

x= 15.7 distance to class I area (km)

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.300037395	2259.173216	5000	1.13E+07	2.26E+07	3.39E+07	4.52E+07	5.65E+07	6.78E+07	7.91E+07	9.04E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.233001035	1732.923352	2242.031296	3.89E+06	7.77E+06	1.17E+07	1.55E+07	1.94E+07	2.33E+07	2.72E+07	3.11E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.165986935	1223.34641	758.8608618	9.28E+05	1.86E+06	2.79E+06	3.71E+06	4.64E+06	5.57E+06	6.50E+06	7.43E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.110651178	811.3248341	174.1091652	1.41E+05	2.83E+05	4.24E+05	5.65E+05	7.06E+05	8.48E+05	9.89E+05	1.13E+06
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.082992506	607.4335616	97.61612215	5.93E+04	1.19E+05	1.78E+05	2.37E+05	2.96E+05	3.56E+05	4.15E+05	4.74E+05
F	22.651 [6]	0.32681 [6]	4.1667	0.36191	0.055329079	404.4437464	55.70822814	2.25E+04	4.51E+04	6.76E+04	9.01E+04	1.13E+05	1.35E+05	1.58E+05	1.80E+05
							Travel Time (hours)[7]	8.7	2.9	1.7	1.2	1.0	0.8	0.7	0.6

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 15.01 - 30.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **N**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	2.2531E+04	8.7	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	4.5062E+04	2.9	0.150%	0.150%	0.000%	0.000%	0.040%	0.040%	0.180%	0.180%	F	1-2
3	E	0 - 1	1	5.9295E+04	8.7	0.000%	0.150%	0.000%	0.000%	0.000%	0.040%	0.000%	0.180%	E	0-1
4	F	2 - 3	3	6.7593E+04	1.7	0.020%	0.170%	0.000%	0.000%	0.010%	0.050%	0.010%	0.190%	F	2-3
5	E	1 - 2	2	1.1859E+05	2.9	0.070%	0.240%	0.000%	0.000%	0.160%	0.210%	0.130%	0.320%	E	1-2
6	D	0 - 1	1	1.4126E+05	8.7	0.000%	0.240%	0.000%	0.000%	0.000%	0.210%	0.000%	0.320%	D	0-1
7	E	2 - 3	3	1.7789E+05	1.7	0.040%	0.280%	0.000%	0.000%	0.010%	0.220%	0.030%	0.350%	E	2-3
8	E	3 - 4	4	2.3718E+05	1.2	0.010%	0.290%	0.000%	0.000%	0.000%	0.220%	0.010%	0.360%	E	3-4
9	D	1 - 2	2	2.8252E+05	2.9	0.050%	0.340%	0.100%	0.100%	0.150%	0.370%	0.020%	0.380%	D	1-2
10	E	4 - 5	5	2.9648E+05	1.0	0.000%	0.340%	0.000%	0.100%	0.000%	0.370%	0.040%	0.420%	E	4-5
11	D	2 - 3	3	4.2378E+05	1.7	0.010%	0.350%	0.010%	0.110%	0.070%	0.440%	0.030%	0.450%	D	2-3
12	D	3 - 4	4	5.6504E+05	1.2	0.050%	0.400%	0.040%	0.150%	0.050%	0.490%	0.020%	0.470%	D	3-4
13	D	4 - 5	5	7.0630E+05	1.0	0.010%	0.410%	0.020%	0.170%	0.040%	0.530%	0.020%	0.490%	D	4-5
14	D	5 - 6	6	8.4755E+05	1.2	0.020%	0.430%	0.010%	0.180%	0.050%	0.580%	0.010%	0.500%	D	5-6
15	D	6 - 7	7	9.8881E+05	0.7	0.000%	0.430%	0.000%	0.180%	0.000%	0.580%	0.000%	0.500%	D	6-7
16	D	7 - 8	8	1.1301E+06	0.6	0.000%	0.430%	0.000%	0.180%	0.000%	0.580%	0.000%	0.500%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
San Jacinto Wilderness Area

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

x= 9.7 distance to class I area (km)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.321329022	1501.76316	5000	7.51E+06	1.50E+07	2.25E+07	3.00E+07	3.75E+07	4.51E+07	5.26E+07	6.01E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.24820958	1143.407293	1321.926874	1.51E+06	3.02E+06	4.53E+06	6.05E+06	7.56E+06	9.07E+06	1.06E+07	1.21E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.175111558	798.2137441	488.5210753	3.90E+05	7.80E+05	1.17E+06	1.56E+06	1.95E+06	2.34E+06	2.73E+06	3.12E+06
D	33.504 [4]	0.60486 [4]	8.333	0.72382	0.116734428	529.0676772	132.4205573	7.01E+04	1.40E+05	2.10E+05	2.80E+05	3.50E+05	4.20E+05	4.90E+05	5.60E+05
E	24.703 [5]	0.50527 [5]	6.25	0.54287	0.087554986	396.0280025	77.8638462	3.08E+04	6.17E+04	9.25E+04	1.23E+05	1.54E+05	1.85E+05	2.16E+05	2.47E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.058370704	263.6463944	45.8011948	1.21E+04	2.42E+04	3.62E+04	4.83E+04	6.04E+04	7.25E+04	8.45E+04	9.66E+04
							Travel Time (hours)[7]	5.4	1.8	1.1	0.8	0.6	0.5	0.4	0.4

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 3.01 - 10.00 kilometers.
[5] for "x" 4.01 - 10.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **NE**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	1.2075E+04	5.4	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	2.4151E+04	1.8	0.060%	0.060%	0.000%	0.000%	0.010%	0.010%	0.070%	0.070%	F	1-2
3	E	0 - 1	1	3.0836E+04	5.4	0.000%	0.060%	0.000%	0.000%	0.000%	0.010%	0.000%	0.070%	E	0-1
4	F	2 - 3	3	3.6226E+04	1.1	0.000%	0.060%	0.000%	0.000%	0.000%	0.010%	0.010%	0.080%	F	2-3
5	E	1 - 2	2	6.1673E+04	1.8	0.040%	0.100%	0.000%	0.000%	0.050%	0.060%	0.040%	0.120%	E	1-2
6	D	0 - 1	1	7.0059E+04	5.4	0.000%	0.100%	0.000%	0.000%	0.000%	0.060%	0.000%	0.120%	D	0-1
7	E	2 - 3	3	9.2509E+04	1.1	0.040%	0.140%	0.000%	0.000%	0.020%	0.080%	0.050%	0.170%	E	2-3
8	E	3 - 4	4	1.2335E+05	0.8	0.000%	0.140%	0.000%	0.000%	0.000%	0.080%	0.010%	0.180%	E	3-4
9	D	1 - 2	2	1.4012E+05	1.8	0.030%	0.170%	0.050%	0.050%	0.050%	0.130%	0.010%	0.190%	D	1-2
10	E	4 - 5	5	1.5418E+05	0.6	0.010%	0.180%	0.000%	0.050%	0.000%	0.130%	0.020%	0.210%	E	4-5
11	D	2 - 3	3	2.1018E+05	1.1	0.000%	0.180%	0.040%	0.090%	0.030%	0.160%	0.020%	0.230%	D	2-3
12	D	3 - 4	4	2.8024E+05	0.8	0.020%	0.200%	0.020%	0.110%	0.020%	0.180%	0.060%	0.290%	D	3-4
13	D	4 - 5	5	3.5030E+05	0.6	0.020%	0.220%	0.000%	0.110%	0.020%	0.200%	0.030%	0.320%	D	4-5
14	D	5 - 6	6	4.2036E+05	0.8	0.010%	0.230%	0.020%	0.130%	0.000%	0.200%	0.010%	0.330%	D	5-6
15	D	6 - 7	7	4.9042E+05	0.4	0.000%	0.230%	0.000%	0.130%	0.000%	0.200%	0.000%	0.330%	D	6-7
16	D	7 - 8	8	5.6048E+05	0.4	0.000%	0.230%	0.000%	0.130%	0.000%	0.200%	0.000%	0.330%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
San Jacinto Wilderness Area

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

x= 8.0 distance to class I area (km)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.329848786	1273.882501	5000	6.37E+06	1.27E+07	1.91E+07	2.55E+07	3.18E+07	3.82E+07	4.46E+07	5.10E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.254295222	967.1525283	1070.040429	1.03E+06	2.07E+06	3.10E+06	4.14E+06	5.17E+06	6.21E+06	7.24E+06	8.28E+06
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.178762741	672.3407938	409.584765	2.75E+05	5.51E+05	8.26E+05	1.10E+06	1.38E+06	1.65E+06	1.93E+06	2.20E+06
D	33.504 [4]	0.60486 [4]	8.333	0.72382	0.119168617	445.5291205	117.8527361	5.25E+04	1.05E+05	1.58E+05	2.10E+05	2.63E+05	3.15E+05	3.68E+05	4.20E+05
E	24.703 [5]	0.50527 [5]	6.25	0.54287	0.089380645	333.4676302	70.64053441	2.36E+04	4.71E+04	7.07E+04	9.42E+04	1.18E+05	1.41E+05	1.65E+05	1.88E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.059587799	221.9848405	42.28078331	9.39E+03	1.88E+04	2.82E+04	3.75E+04	4.69E+04	5.63E+04	6.57E+04	7.51E+04
							Travel Time (hours)[7]	4.4	1.5	0.9	0.6	0.5	0.4	0.3	0.3

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 3.01 - 10.00 kilometers.
[5] for "x" 4.01 - 10.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **NE**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	9.3857E+03	4.4	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	1.8771E+04	1.5	0.100%	0.100%	0.000%	0.000%	0.000%	0.000%	0.150%	0.150%	F	1-2
3	E	0 - 1	1	2.3556E+04	4.4	0.000%	0.100%	0.000%	0.000%	0.000%	0.000%	0.000%	0.150%	E	0-1
4	F	2 - 3	3	2.8157E+04	0.9	0.000%	0.100%	0.000%	0.000%	0.000%	0.000%	0.000%	0.150%	F	2-3
5	E	1 - 2	2	4.7113E+04	1.5	0.030%	0.130%	0.000%	0.000%	0.040%	0.040%	0.090%	0.240%	E	1-2
6	D	0 - 1	1	5.2507E+04	4.4	0.000%	0.130%	0.000%	0.000%	0.000%	0.040%	0.000%	0.240%	D	0-1
7	E	2 - 3	3	7.0669E+04	0.9	0.120%	0.250%	0.000%	0.000%	0.050%	0.090%	0.090%	0.330%	E	2-3
8	E	3 - 4	4	9.4225E+04	0.6	0.010%	0.260%	0.000%	0.000%	0.010%	0.100%	0.030%	0.360%	E	3-4
9	D	1 - 2	2	1.0501E+05	1.5	0.040%	0.300%	0.160%	0.160%	0.010%	0.110%	0.040%	0.400%	D	1-2
10	E	4 - 5	5	1.1778E+05	0.5	0.010%	0.310%	0.000%	0.160%	0.000%	0.110%	0.000%	0.400%	E	4-5
11	D	2 - 3	3	1.5752E+05	0.9	0.010%	0.320%	0.090%	0.250%	0.010%	0.120%	0.000%	0.400%	D	2-3
12	D	3 - 4	4	2.1003E+05	0.6	0.060%	0.380%	0.090%	0.340%	0.040%	0.160%	0.090%	0.490%	D	3-4
13	D	4 - 5	5	2.6253E+05	0.5	0.040%	0.420%	0.050%	0.390%	0.040%	0.200%	0.050%	0.540%	D	4-5
14	D	5 - 6	6	3.1504E+05	0.6	0.060%	0.480%	0.040%	0.430%	0.020%	0.220%	0.090%	0.630%	D	5-6
15	D	6 - 7	7	3.6755E+05	0.3	0.000%	0.480%	0.000%	0.430%	0.000%	0.220%	0.000%	0.630%	D	6-7
16	D	7 - 8	8	4.2005E+05	0.3	0.000%	0.480%	0.000%	0.430%	0.000%	0.220%	0.000%	0.630%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project Level II Visibility Modeling
Class I Areas
San Jacinto Wilderness Area

Formulas:

σ_y (meters) =465.11628(x)tan(TH)

TH =0.017453293[c-d ln(x)]

σ_z (meters) =ax^b

x= 10.3 distance to class I area (km)

Shaded areas below represent wind speed/stability conditions not needed for this analysis.
(see page 45 in "Workbook for Plume Visual Impact Screening and Analysis, EPA-450/4-88-019; updated 10-92)

Stability Class	a (meters)	b	c[8]	d[8]	TH	σ_y	σ_z	$\sigma_y\sigma_z u$ for various wind speeds (meters/second) 1	2	3	4	5	6	7	8
A	** [1]	** [1]	24.167	2.5334	0.318675255	1580.54613	5000	7.90E+06	1.58E+07	2.37E+07	3.16E+07	3.95E+07	4.74E+07	5.53E+07	6.32E+07
B	109.300 [2]	1.09710 [2]	18.333	1.8096	0.246314003	1204.473729	1411.899815	1.70E+06	3.40E+06	5.10E+06	6.80E+06	8.50E+06	1.02E+07	1.19E+07	1.36E+07
C	61.141 [3]	0.91465 [3]	12.5	1.0857	0.173974274	841.9699906	516.088409	4.35E+05	8.69E+05	1.30E+06	1.74E+06	2.17E+06	2.61E+06	3.04E+06	3.48E+06
D	36.650 [4]	0.56589 [4]	8.333	0.72382	0.115976218	558.1115333	137.1603031	7.66E+04	1.53E+05	2.30E+05	3.06E+05	3.83E+05	4.59E+05	5.36E+05	6.12E+05
E	26.970 [5]	0.46713 [5]	6.25	0.54287	0.086986323	417.779434	80.16920912	3.35E+04	6.70E+04	1.00E+05	1.34E+05	1.67E+05	2.01E+05	2.34E+05	2.68E+05
F	17.836 [6]	0.41507 [6]	4.1667	0.36191	0.057991599	278.1320794	46.95650996	1.31E+04	2.61E+04	3.92E+04	5.22E+04	6.53E+04	7.84E+04	9.14E+04	1.04E+05
							Travel Time (hours)[7]	5.7	1.9	1.1	0.8	0.6	0.5	0.4	0.4

[1] If x is >3.11 km, then σz = 5,000 meters
[2] for "x" > 0.4 kilometers.
[3] all distances
[4] for "x" 10.01 - 30.00 kilometers.
[5] for "x" 10.01 - 20.00 kilometers.
[6] for "x" 7.01 - 15.00 kilometers.
[7] wind speed used to calculate travel time are the average ws within a ws category. (1-2 uses 1.5 m/s; ws category of 3-4 uses 3.5 m/s)
[8] Table 1-1 in ISC2 Volume II Users Guide

Sector of Interest **ENE**

Condition No.	5 year Meteorological Data Stability Class	Wind Speed	Flag	$\sigma_y\sigma_z u$	Travel Time (hours)	Frequency of Occurance Hour of day 1-6 f	1-6 cf	7-12 f	7-12 cf	13-18 f	13-18 cf	19-24 f	19-24 cf	5 year Meteorological Data Stability Class	Wind Speed
1	F	0 - 1	1	1.3060E+04	5.7	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	F	0-1
2	F	1 - 2	2	2.6120E+04	1.9	0.140%	0.140%	0.000%	0.000%	0.010%	0.010%	0.270%	0.270%	F	1-2
3	E	0 - 1	1	3.3493E+04	5.7	0.000%	0.140%	0.000%	0.000%	0.000%	0.010%	0.000%	0.270%	E	0-1
4	F	2 - 3	3	3.9180E+04	1.1	0.050%	0.190%	0.000%	0.000%	0.010%	0.020%	0.070%	0.340%	F	2-3
5	E	1 - 2	2	6.6986E+04	1.9	0.160%	0.350%	0.000%	0.000%	0.020%	0.040%	0.200%	0.540%	E	1-2
6	D	0 - 1	1	7.6551E+04	5.7	0.000%	0.350%	0.000%	0.000%	0.000%	0.040%	0.000%	0.540%	D	0-1
7	E	2 - 3	3	1.0048E+05	1.1	0.160%	0.510%	0.000%	0.000%	0.000%	0.040%	0.100%	0.640%	E	2-3
8	E	3 - 4	4	1.3397E+05	0.8	0.050%	0.560%	0.000%	0.000%	0.000%	0.040%	0.130%	0.770%	E	3-4
9	D	1 - 2	2	1.5310E+05	1.9	0.060%	0.620%	0.160%	0.160%	0.050%	0.090%	0.000%	0.770%	D	1-2
10	E	4 - 5	5	1.6747E+05	0.6	0.050%	0.670%	0.000%	0.160%	0.030%	0.120%	0.090%	0.860%	E	4-5
11	D	2 - 3	3	2.2965E+05	1.1	0.050%	0.720%	0.130%	0.290%	0.060%	0.180%	0.060%	0.920%	D	2-3
12	D	3 - 4	4	3.0620E+05	0.8	0.150%	0.870%	0.230%	0.520%	0.050%	0.230%	0.140%	1.060%	D	3-4
13	D	4 - 5	5	3.8275E+05	0.6	0.160%	1.030%	0.240%	0.760%	0.130%	0.360%	0.090%	1.150%	D	4-5
14	D	5 - 6	6	4.5930E+05	0.8	0.160%	1.190%	0.170%	0.930%	0.060%	0.420%	0.220%	1.370%	D	5-6
15	D	6 - 7	7	5.3586E+05	0.4	0.000%	1.190%	0.000%	0.930%	0.000%	0.420%	0.000%	1.370%	D	6-7
16	D	7 - 8	8	6.1241E+05	0.4	0.000%	1.190%	0.000%	0.930%	0.000%	0.420%	0.000%	1.370%	D	7-8
					Cumulative frequencies for stability classes E,F&D per time period:	311		151		42		179			
					Cumulative frequencies for stability classes A,B&C per time period:	0		97		26		0			
					Includes all stability classes:	311		248		68		179			
					hours in met year:	2190		2190		2190		2190			

Sentinel Energy Project - Meteorological statistics regarding wind speed varying with time and season

				Wind speeds (m/s)						
			Wind Direction	**0-1**	**1-2**	**2-3**	**3-6**	**6-10**	**>10**	
WINTER	**0 - 6**	**Stability F**	Joshua Tree	0.00%	0.30%	0.04%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	1.01%	0.42%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.18%	0.11%	0.00%	0.00%	0.00%	
			All Others	0.00%	4.97%	3.09%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.19%	0.48%	0.37%	0.02%	0.00%	
			San Jacinto	0.00%	0.51%	0.76%	0.79%	0.00%	0.00%	
			San Gorgonio	0.00%	0.04%	0.37%	0.12%	0.00%	0.00%	
			All Others	0.00%	4.58%	4.32%	6.10%	0.05%	0.00%	
		Stability D	Joshua Tree	0.00%	0.02%	0.12%	0.78%	1.27%	0.93%	
			San Jacinto	0.00%	0.02%	0.12%	1.16%	0.51%	0.12%	
			San Gorgonio	0.00%	0.02%	0.09%	0.35%	0.11%	0.00%	
			All Others	0.00%	0.93%	1.46%	3.61%	3.14%	3.33%	
	6 - 12	**Stability F**	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability F
			All Others							
		Stability E	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability E
			All Others							
		Stability D	Joshua Tree	0.00%	0.49%	0.14%	0.71%	1.60%	1.43%	
			San Jacinto	0.00%	0.83%	0.72%	0.97%	1.11%	0.35%	
			San Gorgonio	0.00%	0.56%	0.63%	0.71%	0.30%	0.00%	
			All Others	0.00%	2.82%	1.68%	3.42%	2.43%	2.22%	
	12 - 18	**Stability F**	Joshua Tree	0.00%	0.04%	0.02%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	0.14%	0.04%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.04%	0.04%	0.00%	0.00%	0.00%	
			All Others	0.00%	0.49%	0.11%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.12%	0.04%	0.05%	0.00%	0.00%	
			San Jacinto	0.00%	0.42%	0.11%	0.35%	0.00%	0.00%	
			San Gorgonio	0.00%	0.88%	0.39%	0.23%	0.00%	0.00%	
			All Others	0.00%	1.66%	0.56%	0.42%	0.00%	0.00%	
		Stability D	Joshua Tree	0.00%	0.14%	0.16%	0.58%	2.65%	2.98%	
			San Jacinto	0.00%	0.09%	0.07%	1.16%	1.78%	0.39%	
			San Gorgonio	0.00%	0.72%	1.71%	2.79%	0.11%	0.00%	
			All Others	0.00%	1.09%	1.08%	1.96%	2.08%	2.08%	
	All Daytime Hours									
	0 - 18	**Stability F**	Joshua Tree	0.00%	0.34%	0.05%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	1.15%	0.46%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.21%	0.14%	0.00%	0.00%	0.00%	
			All Others	0.00%	5.47%	3.19%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.32%	0.51%	0.42%	0.02%	0.00%	
			San Jacinto	0.00%	0.93%	0.86%	1.15%	0.00%	0.00%	
			San Gorgonio	0.00%	0.92%	0.76%	0.35%	0.00%	0.00%	
			All Others	0.00%	6.24%	4.88%	6.52%	0.05%	0.00%	
		Stability D	Joshua Tree	0.00%	0.65%	0.42%	2.06%	5.52%	5.34%	
			San Jacinto	0.00%	0.93%	0.92%	3.30%	3.40%	0.86%	
			San Gorgonio	0.00%	1.30%	2.43%	3.84%	0.51%	0.00%	
			All Others	0.00%	4.85%	4.21%	8.99%	7.65%	7.64%	

				Wind speeds (m/s)						
			Wind Direction	0-1	1-2	2-3	3-6	6-10	>10	
SPRING	0 - 6	Stability F	Joshua Tree	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	0.24%	0.06%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	
			All Others	0.00%	1.12%	0.98%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.05%	0.21%	0.08%	0.00%	0.00%	
			San Jacinto	0.00%	0.14%	0.08%	0.16%	0.00%	0.00%	
			San Gorgonio	0.00%	0.00%	0.05%	0.05%	0.00%	0.00%	
			All Others	0.00%	1.19%	1.76%	1.79%	0.00%	0.00%	
		Stability D	Joshua Tree	0.00%	0.06%	0.05%	0.59%	2.69%	5.68%	
			San Jacinto	0.00%	0.06%	0.05%	0.24%	0.16%	0.02%	
			San Gorgonio	0.00%	0.02%	0.02%	0.03%	0.02%	0.00%	
			All Others	0.00%	0.62%	1.11%	3.42%	6.47%	12.19%	
	6 - 12	Stability F	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability F
			All Others							
		Stability E	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability E
			All Others							
		Stability D	Joshua Tree	0.00%	0.09%	0.19%	1.03%	5.79%	9.24%	
			San Jacinto	0.00%	0.09%	0.09%	0.17%	0.92%	0.24%	
			San Gorgonio	0.00%	0.05%	0.02%	0.33%	0.17%	0.02%	
			All Others	0.00%	0.36%	0.51%	0.85%	1.96%	6.20%	
	12 - 18	Stability F	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability F
			All Others							
		Stability E	Joshua Tree	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	
			San Jacinto	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	
			San Gorgonio	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	
			All Others	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	
		Stability D	Joshua Tree	0.00%	0.51%	0.66%	2.12%	8.10%	10.75%	
			San Jacinto	0.00%	0.00%	0.00%	0.00%	0.00%	1.19%	
			San Gorgonio	0.00%	0.09%	0.14%	0.27%	0.43%	0.30%	
			All Others	0.00%	0.00%	0.00%	0.00%	0.28%	5.06%	
	All Daytime Hours									
	0 - 18	Stability F	Joshua Tree	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	0.24%	0.06%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	
			All Others	0.00%	1.12%	0.98%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.05%	0.21%	0.08%	0.02%	0.00%	
			San Jacinto	0.00%	0.14%	0.08%	0.16%	0.00%	0.03%	
			San Gorgonio	0.00%	0.00%	0.05%	0.05%	0.00%	0.09%	
			All Others	0.00%	1.19%	1.76%	1.79%	0.02%	0.00%	
		Stability D	Joshua Tree	0.00%	0.66%	0.90%	3.73%	16.57%	25.67%	
			San Jacinto	0.00%	0.16%	0.14%	0.41%	1.08%	1.44%	
			San Gorgonio	0.00%	0.16%	0.17%	0.63%	0.62%	0.32%	
			All Others	0.00%	0.98%	1.61%	4.27%	8.71%	23.45%	

				Wind speeds (m/s)						
			Wind Direction	0-1	1-2	2-3	3-6	6-10	>10	
SUMMER	0 - 6	Stability F	Joshua Tree	0.00%	0.07%	0.05%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	0.13%	0.02%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	
			All Others	0.00%	0.12%	0.12%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.10%	0.30%	0.38%	0.00%	0.00%	
			San Jacinto	0.00%	0.15%	0.15%	0.02%	0.00%	0.00%	
			San Gorgonio	0.00%	0.03%	0.03%	0.05%	0.00%	0.00%	
			All Others	0.00%	0.66%	0.91%	0.86%	0.00%	0.00%	
		Stability D	Joshua Tree	0.00%	0.18%	0.15%	1.18%	6.63%	5.93%	
			San Jacinto	0.00%	0.23%	0.22%	0.07%	0.00%	0.00%	
			San Gorgonio	0.00%	0.05%	0.00%	0.07%	0.00%	0.00%	
			All Others	0.00%	0.83%	0.93%	3.29%	7.92%	9.17%	
	6 - 12	Stability F	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability F
			All Others							
		Stability E	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability E
			All Others							
		Stability D	Joshua Tree	0.00%	0.05%	0.17%	1.23%	10.20%	7.91%	
			San Jacinto	0.00%	0.17%	0.05%	0.08%	0.10%	0.00%	
			San Gorgonio	0.00%	0.05%	0.17%	0.78%	0.08%	0.00%	
			All Others	0.00%	0.20%	0.18%	0.91%	1.48%	2.29%	
	12 - 18	Stability F	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability F
			All Others							
		Stability E	Joshua Tree							
			San Jacinto							*no readings
			San Gorgonio							with stability E
			All Others							
		Stability D	Joshua Tree	0.00%	0.00%	0.00%	0.20%	7.48%	18.75%	
			San Jacinto	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	
			San Gorgonio	0.00%	0.03%	0.02%	1.21%	0.65%	0.00%	
			All Others	0.00%	0.07%	0.13%	0.33%	0.47%	2.61%	
	All Daytime Hours									
	0 - 18	Stability F	Joshua Tree	0.00%	0.07%	0.05%	0.00%	0.00%	0.00%	
			San Jacinto	0.00%	0.13%	0.02%	0.00%	0.00%	0.00%	
			San Gorgonio	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	
			All Others	0.00%	0.12%	0.12%	0.00%	0.00%	0.00%	
		Stability E	Joshua Tree	0.00%	0.10%	0.30%	0.38%	0.00%	0.00%	
			San Jacinto	0.00%	0.15%	0.15%	0.02%	0.00%	0.00%	
			San Gorgonio	0.00%	0.03%	0.03%	0.05%	0.00%	0.00%	
			All Others	0.00%	0.66%	0.91%	0.86%	0.00%	0.00%	
		Stability D	Joshua Tree	0.00%	0.23%	0.32%	2.61%	24.30%	32.59%	
			San Jacinto	0.00%	0.40%	0.27%	0.15%	0.13%	0.00%	
			San Gorgonio	0.00%	0.13%	0.18%	2.06%	0.73%	0.00%	
			All Others	0.00%	1.10%	1.25%	4.53%	9.87%	14.07%	

				Wind speeds (m/s)					
			Wind Direction	0-1	1-2	2-3	3-6	6-10	>10
FALL	0 - 6	Stability F	Joshua Tree	0.00%	0.23%	0.05%	0.00%	0.00%	0.00%
			San Jacinto	0.00%	0.46%	0.18%	0.00%	0.00%	0.00%
			San Gorgonio	0.00%	0.11%	0.00%	0.00%	0.00%	0.00%
			All Others	0.00%	3.88%	2.59%	0.00%	0.00%	0.00%
		Stability E	Joshua Tree	0.00%	0.18%	0.21%	0.37%	0.04%	0.00%
			San Jacinto	0.00%	0.37%	0.41%	0.53%	0.02%	0.00%
			San Gorgonio	0.00%	0.02%	0.12%	0.07%	0.00%	0.00%
			All Others	0.00%	2.89%	4.04%	4.10%	0.04%	0.00%
		Stability D	Joshua Tree	0.00%	0.04%	0.05%	1.03%	3.00%	2.29%
			San Jacinto	0.00%	0.20%	0.16%	0.43%	0.23%	0.07%
			San Gorgonio	0.00%	0.05%	0.07%	0.18%	0.05%	0.00%
			All Others	0.00%	1.08%	2.48%	4.68%	4.36%	4.75%
	6 - 12	Stability F	Joshua Tree						
			San Jacinto						*no readings
			San Gorgonio						with stability F
			All Others						
		Stability E	Joshua Tree						
			San Jacinto						*no readings
			San Gorgonio						with stability E
			All Others						
		Stability D	Joshua Tree	0.00%	0.32%	0.32%	1.28%	4.59%	3.96%
			San Jacinto	0.00%	0.25%	0.23%	0.69%	0.83%	0.05%
			San Gorgonio	0.00%	0.27%	0.35%	1.26%	0.12%	0.00%
			All Others	0.00%	1.28%	1.17%	2.15%	2.16%	2.20%
	12 - 18	Stability F	Joshua Tree	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%
			San Jacinto	0.00%	0.12%	0.02%	0.00%	0.00%	0.00%
			San Gorgonio	0.00%	0.07%	0.07%	0.00%	0.00%	0.00%
			All Others	0.00%	0.16%	0.05%	0.00%	0.00%	0.00%
		Stability E	Joshua Tree	0.00%	0.04%	0.04%	0.20%	0.00%	0.00%
			San Jacinto	0.00%	0.18%	0.11%	0.27%	0.00%	0.00%
			San Gorgonio	0.00%	0.37%	0.43%	0.27%	0.00%	0.00%
			All Others	0.00%	0.76%	0.37%	0.25%	0.00%	0.00%
		Stability D	Joshua Tree	0.00%	0.05%	0.09%	0.59%	6.30%	7.45%
			San Jacinto	0.00%	0.04%	0.05%	1.22%	0.78%	0.16%
			San Gorgonio	0.00%	0.20%	0.73%	2.91%	0.28%	0.00%
			All Others	0.00%	0.34%	0.60%	1.33%	1.15%	2.32%
	All Daytime Hours								
	0 - 18	Stability F	Joshua Tree	0.00%	0.28%	0.05%	0.00%	0.00%	0.00%
			San Jacinto	0.00%	0.59%	0.20%	0.00%	0.00%	0.00%
			San Gorgonio	0.00%	0.18%	0.07%	0.00%	0.00%	0.00%
			All Others	0.00%	4.04%	2.64%	0.00%	0.00%	0.00%
		Stability E	Joshua Tree	0.00%	0.21%	0.25%	0.57%	0.04%	0.00%
			San Jacinto	0.00%	0.55%	0.51%	0.80%	0.02%	0.00%
			San Gorgonio	0.00%	0.39%	0.55%	0.34%	0.00%	0.00%
			All Others	0.00%	3.65%	4.42%	4.35%	0.04%	0.00%
		Stability D	Joshua Tree	0.00%	0.41%	0.46%	2.89%	13.89%	13.69%
			San Jacinto	0.00%	0.48%	0.44%	2.34%	1.84%	0.28%
			San Gorgonio	0.00%	0.51%	1.15%	4.35%	0.46%	0.00%
			All Others	0.00%	2.70%	4.26%	8.16%	7.68%	9.28%

				Wind speeds (m/s)					
			Wind Direction	0-1	1-2	2-3	3-6	6-10	>10
All Seasons	0 - 6	Stability F	Joshua Tree	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%
			San Jacinto	0.00%	0.45%	0.16%	0.00%	0.00%	0.00%
			San Gorgonio	0.00%	0.09%	0.03%	0.00%	0.00%	0.00%
			All Others	0.00%	2.45%	1.65%	0.00%	0.00%	0.00%
		Stability E	Joshua Tree	0.00%	0.13%	0.30%	0.30%	0.01%	0.00%
			San Jacinto	0.00%	0.29%	0.34%	0.36%	0.00%	0.00%
			San Gorgonio	0.00%	0.02%	0.14%	0.07%	0.00%	0.00%
			All Others	0.00%	2.27%	2.70%	3.14%	0.02%	0.00%
		Stability D	Joshua Tree	0.00%	0.08%	0.09%	0.89%	3.42%	3.80%
			San Jacinto	0.00%	0.13%	0.14%	0.46%	0.22%	0.05%
			San Gorgonio	0.00%	0.03%	0.04%	0.15%	0.04%	0.00%
			All Others	0.00%	0.86%	1.48%	3.73%	5.54%	7.53%
	6 - 12	Stability F	Joshua Tree						
			San Jacinto						*no readings
			San Gorgonio						with stability F
			All Others						
		Stability E	Joshua Tree						
			San Jacinto						*no readings
			San Gorgonio						with stability E
			All Others						
		Stability D	Joshua Tree	0.00%	0.23%	0.20%	1.06%	5.62%	5.77%
			San Jacinto	0.00%	0.33%	0.27%	0.47%	0.74%	0.16%
			San Gorgonio	0.00%	0.22%	0.28%	0.76%	0.17%	0.00%
			All Others	0.00%	1.13%	0.86%	1.79%	2.00%	3.30%
	12 - 18	Stability F	Joshua Tree	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
			San Jacinto	0.00%	0.06%	0.01%	0.00%	0.00%	0.00%
			San Gorgonio	0.00%	0.03%	0.03%	0.00%	0.00%	0.00%
			All Others	0.00%	0.16%	0.04%	0.00%	0.00%	0.00%
		Stability E	Joshua Tree	0.00%	0.04%	0.02%	0.06%	0.00%	0.00%
			San Jacinto	0.00%	0.14%	0.05%	0.15%	0.00%	0.01%
			San Gorgonio	0.00%	0.30%	0.19%	0.12%	0.00%	0.03%
			All Others	0.00%	0.58%	0.22%	0.16%	0.00%	0.00%
		Stability D	Joshua Tree	0.00%	0.18%	0.24%	0.90%	6.20%	10.14%
			San Jacinto	0.00%	0.03%	0.03%	0.57%	0.62%	0.45%
			San Gorgonio	0.00%	0.25%	0.63%	1.74%	0.37%	0.08%
			All Others	0.00%	0.36%	0.44%	0.87%	0.97%	3.07%
	All Daytime Hours								
	0 - 18	Stability F	Joshua Tree	0.00%	0.17%	0.04%	0.00%	0.00%	0.00%
			San Jacinto	0.00%	0.51%	0.18%	0.00%	0.00%	0.00%
			San Gorgonio	0.00%	0.12%	0.05%	0.00%	0.00%	0.00%
			All Others	0.00%	2.60%	1.69%	0.00%	0.00%	0.00%
		Stability E	Joshua Tree	0.00%	0.16%	0.31%	0.36%	0.02%	0.00%
			San Jacinto	0.00%	0.43%	0.39%	0.51%	0.00%	0.01%
			San Gorgonio	0.00%	0.32%	0.33%	0.19%	0.00%	0.03%
			All Others	0.00%	2.85%	2.93%	3.30%	0.03%	0.00%
		Stability D	Joshua Tree	0.00%	0.49%	0.53%	2.85%	15.25%	19.70%
			San Jacinto	0.00%	0.48%	0.43%	1.50%	1.58%	0.66%
			San Gorgonio	0.00%	0.51%	0.95%	2.65%	0.58%	0.08%
			All Others	0.00%	2.35%	2.77%	6.40%	8.51%	13.89%

APPENDIX I-7
BACT ANALYSIS

A BACT assessment was conducted for the proposed Competitive Power Ventures (CPV) Sentinel Energy Project (CPVS) which considered all NO_x and CO control technologies currently proposed or in use on natural gas-fired combustion turbines with more than 50 MMBtu per hour fuel energy input. To identify feasible emission limits for comparable turbine units, several information sources were consulted, including the following:

- USEPA RACT/BACT/LAER Clearinghouse (USEPA 1985) and updates
- CARB BACT Clearinghouse database and CARB BACT Guidelines for Power Plants (Adopted 7/22/99)
- Recent California Energy Commission (CEC) Applications for Certification

Table 1, Summary of Recent NO_x BACT Determinations for Combustion Turbine Generators Rated at Greater than 40 MW in Peaking Service, lists selected recent NO_x BACT proposals and determinations for natural gas-fired advanced technology combustion turbines in California. Nearly all recent simple-cycle turbine projects in California had a NO_x BACT level of 2.5 ppm dry volume (ppmvd) (at 15 percent oxygen [O_2]), to be achieved by means of dry low-NO_x burners and SCR with ammonia injection. However, in some cases, SCR in conjunction with water or steam injection has been selected. The combustion turbines of the CPVS will achieve the BACT concentration of 2.5 ppmvd at 15 percent O_2 using steam or water injection, rather than dry low-NO_x combustor technology, and SCR, except during maintenance, startup, and shutdown events.

TABLE 1
SUMMARY OF RECENT NO_X BACT DETERMINATIONS FOR COMBUSTION TURBINE GENERATORS RATED AT GREATER THAN 40 MW IN PEAKING SERVICE

Name	Location	Rating	Vendor, Model	Emission Limit	Control(s)	Permit Date
Kings River Conservation District Peaking Plant	CA	40+ each, 2 turbines, 97 MW total	GE LM6000 Sprint PC	3.0 ppm	Water injection and SCR	5/04
Modesto Electric Generation Project	CA	40+ each, 2 turbines, 95 MW total	GE LM6000 Sprint	2.5 ppm	Water injection and SCR	2/04
Riverside Energy Resource Center	CA	40+ each, 2 turbines, 96 MW total	GE LM6000 Sprint PC NxGen	2.5 ppm	Water injection and SCR	12/04
San Francisco Electric Reliability Project	CA	40+ each, 3 turbines, 145 MW total	GE LM6000	2.5 ppm	Water injection and SCR	Tentative 4/06

GE = General Electric
MW = megawatt
ppm = Parts per million by volume, dry basis, at 15 percent oxygen
SCR = Selective catalytic reduction

Similarly, most recent simple-cycle turbine projects have been approved with a CO emissions limit of 6 ppmvd and a VOC emissions limit of 2 ppmvd (both at 15 percent O_2), based on the use of an oxidation catalyst. The CPVS natural gas turbines will achieve these same BACT concentrations for CO and VOC by application of oxidation catalysts. Exclusive use of natural gas fuel has been determined to be BACT for SO_x and PM_{10} in all other comparable projects for several years.

ASSESSMENT OF NO_X CONTROL TECHNOLOGIES

Based on a review of the materials described above, the following NO_x control technologies were evaluated to determine whether they are able to achieve BACT NO_x levels in practice:

- DLE and Goal Line EMx™
- Water injection and SCR

EMx™

EMx™ is a NO_x reduction system produced by Goal Line Environmental Technologies (now distributed by EmeraChem) for natural gas turbine applications within an exhaust temperature range significantly below the design operating parameters of the simple-cycle LMS100 turbines that will be employed at the CPVS. This system uses a coated catalyst to oxidize both NO_x and CO and thereby reduce plant emissions. As demonstrated by an initial installation on several gas turbines in co-generation applications, EMx™ is capable of achieving NO_x emission concentrations of 2 ppm based on a maximum inlet concentration of 25 ppm, and 90 percent CO reduction based on a maximum inlet concentration of 50 ppm. CO emissions are reduced in EMx™ by the oxidation of CO to CO_2. A two-step process reduces NO_x emissions. First, NO_x emissions are oxidized to NO_2 and then adsorbed onto the catalyst. In the second step, a proprietary regenerative natural gas is passed through the catalyst periodically. This natural gas de-desorbs the NO_2 from the catalyst and reduces it to N_2. The system does not use ammonia as a reagent; rather, it uses natural gas as the basis for a proprietary catalyst regeneration process.

However, the EMx™ technology has not been sufficiently demonstrated on higher exhaust temperature simple-cycle peaking natural gas turbines such as those proposed for the Project. The system consists of a catalyst that is installed in the flue gas at a point where the temperature is between 280°F and 650°F. The CPVS CTGs operate between 741 to 817 °F; therefore, the EMx™ application is not appropriate for this high temperature technology.

Potential advantages of the EMx™ process include:

- **No Ammonia.** The EMx™ process does not use ammonia. This eliminates any ammonia storage and transportation safety issues and the potential for ammonia slip or ammonia-based particulate formation.
- **Carbon Monoxide Reduction.** EMx™ will reduce CO emissions as well as NO_x emissions.

Potential disadvantages of the EMx™ process include:

- **High Capital and Operating Cost.** EMx™ is significantly more expensive than SCR with ammonia injection, primarily due to the higher cost of initial and replacement catalyst. The EMx™ catalyst is a precious metal catalyst, which is very expensive.
- **Not Suitable for Exhaust Temperatures of Simple-Cycle Natural Gas Turbine Peaking Applications**. EMx™ has been primarily installed on small co-generation systems. The CPVS facility will be a simple-cycle peaking operation. Peaking units require more rapid startup and more frequent load changes than typical co-generation systems. The main concerns are the damper systems that would be required with EMx™ for the units and assuring proper regeneration gas distribution. The effectiveness and longevity of these damper systems have not been demonstrated on simple-cycle natural gas turbines, and their cost of replacement would be substantial. In addition, steam is required to produce the EMx™ regeneration gas. The CPVS facility will have no steam production.
- **Catalyst "Washing."** A proprietary catalyst washing system must be used and an on-line catalyst washing system design has not yet been fully developed. If an on-line catalyst washing system is not used, then the facility must be shut down for cleaning.

Because the low NO_x emission rates attainable on natural gas turbines in co-generation systems with EMx™ have not been sufficiently demonstrated as "achieved in practice" on simple-cycle natural gas turbine applications and the other factors discussed above, EMx™ does not represent current, technically feasible BACT for the CPVS facility. Accordingly, a comparative cost analysis with the proposed NOx control technologies is not required. However, SCAQMD staff has agreed with previous BACT evaluations that determined the use of EMx™ for simple-cycle CTGs is not a cost effective option. These findings reinforce the elimination of EMx™ on grounds of technical infeasibility.

SCR with Water Injection

SCR is a technology that achieves post-combustion reduction of NO_x from flue gas within a catalytic reactor. The SCR process involves the injection of ammonia (NH_3) into the exhaust gas upstream of a specialized catalyst module, promoting conversion of NO_x to molecular nitrogen. SCR with ammonia injection systems for reduction of NO_x emissions have been widely used in simple-cycle natural gas turbine applications for many years, and are considered a proven technology. SCR systems are commercially available from several vendors, unlike EMx™, which is available from a single vendor. The SCR process involves the injection of ammonia into the flue gas stream by means of an ammonia injection grid upstream of the catalyst. The ammonia reacts with NO_x natural gases in the presence of the catalyst. The catalyst is not regenerated and requires periodic replacement. SCR vendors typically offer a 3-year guarantee on catalyst life. SCR with ammonia injection systems have been used in numerous simple-cycle applications in California and throughout the world.

Water or steam injection has been a proven NO_x control technique for many years. Injection of water or steam into the primary combustion zone of advanced combustors of

a CTG reduces the formation of thermal NO_x by decreasing the peak combustion temperature. Water injection decreases the peak flame temperature by diluting the combustion gas stream and acting as a heat sink by absorbing heat necessary to: (a) vaporize the water (latent heat of vaporization), and (b) raise the vaporized water temperature to the combustion temperature. High purity water must be employed to prevent turbine corrosion and deposition of solids on the turbine blades. The use of water or steam injection in diffusion flame combustors firing natural gas can typically achieve NO_x exhaust concentrations of 25 ppmvd, corrected to 15 percent O_2.

The Project will use water injection and SCR with ammonia injection designed to achieve a NO_x emission limit of 2.5 ppm (at 15 percent O_2). As noted in Table 1, water injection and SCR have recently been permitted at a NO_x emission level of 2.5 ppmvd (at 15 percent O_2) for numerous California turbines that are similar in capacity to the proposed CPVS turbines. Accordingly, water injection with SCR with ammonia injection is considered to be BACT for the CPVS facility.

OTHER TECHNOLOGIES

Technologies that cannot achieve a NO_x emissions limit of 2.5 ppmvd (at 15 percent O_2) in practice were not considered as BACT candidates for the CPVS facility. These technologies include SCR without DLE, DLE without SCR, and water/steam injection without SCR.

ASSESSMENT OF CO CONTROL TECHNOLOGIES

The CPVS facility CTGs are guaranteed to emit no more than 6 ppm of CO (at 15 percent O_2), with natural gas fuel and use of a CO oxidation catalyst (except during startup and shutdown). In discussions with the applicant, SCAQMD has already confirmed that the use of a CO oxidation catalyst to achieve a stack concentration of 6 ppmvd @15% O_2 will result in emissions of CO that will conform to current SCAQMD BACT requirements.

The following CO control technologies are evaluated:

- Combustion design/control
- Oxidizing catalyst

Combustion Design/Control

Natural gas turbine combustion technology has significantly improved over recent years with regard to lowering CO emissions. CPVS proposes to operate eight LMS100 turbines at the CPVS facility. For other installations, turbines have been guaranteed by the manufacturer to achieve a CO rate of 9 ppm (at 15 percent O_2) without post-combustion control technologies under a wide range of operating conditions (50 percent to 100 percent load) and ambient conditions (15°F to 115°F).

Oxidizing Catalyst

CO oxidizing catalysts have been used with natural gas-fired turbines for over a decade when uncontrolled CO emission levels are unacceptably high. CO catalysts operate at

elevated temperatures within the exhaust stream. CO-oxidizing catalysts can be considered technically feasible for use in simple-cycle peaking applications. Thus, installation of a CO-oxidizing catalyst on the natural gas turbines is considered to be BACT for the CPVS facility.

ASSESSMENT OF VOC CONTROL TECHNOLOGIES

The proposed BACT level of 2 ppmvd (at 15 percent O_2) for VOC control with water injection, SCR, and an oxidation catalyst is consistent with the most stringent level found among recent BACT determinations for simple-cycle natural gas turbines, and is therefore considered to be BACT for the CPVS facility.

ASSESSMENT OF SO_2 AND PM_{10} CONTROL TECHNOLOGIES

Sulfur dioxide and PM_{10} emissions will be controlled through the exclusive use of clean-burning pipeline quality natural gas. This control technology has been widely and uniformly implemented for control of SO_2 and PM_{10} emissions from combustion turbines in California and throughout the United States, and is considered to be BACT for the CPVS facility.

ASSESSMENT OF AMMONIA SLIP CONTROL TECHNOLOGIES

Ammonia emissions will be limited to 5 ppmvd (at 15 percent O_2). This proposed BACT is consistent with SCAQMD policy to control NO_x.

SUMMARY OF PROPOSED BACT

Table 2, Summary of Proposed BACT, presents the proposed BACT emission levels for the CPVS facility, based on the assessment described in the preceding subsections.

TABLE 2
SUMMARY OF PROPOSED BACT

Pollutant	Control Technology	Concentration
Combustion Turbines		
NO_x	Water injection and SCR with ammonia injection	2.5 ppmvd at 15 percent O_2 (1-hour average)
CO	Catalytic oxidation	6.0 ppmvd at 15 percent O_2 (1-hour average)
VOC	Catalytic oxidation	2.0 ppmvd at 15 percent O_2 (1-hour average)
SO_2	Pipeline quality natural gas	NA
PM_{10}	Pipeline quality natural gas	NA
Ammonia slip	Operational limitation	5.0 ppmvd at 15 percent O_2
Emergency Firewater Pump Engine (240 horsepower)		
NO_x	EPA Tier II	3.9 g/brake horsepower (bhp)-hour
CO	EPA Tier II	0.59 g/bhp-hour

TABLE 2 SUMMARY OF PROPOSED BACT		
Pollutant	**Control Technology**	**Concentration**
ROC	EPA Tier II	1.00 g/bhp-hour
SO_2	EPA Tier II	Diesel fuel with sulfur content no greater than 0.0015% by weight
PM_{10}	EPA Tier II	0.14 g/bhp-hour
Black Start Engine (2,206 horsepower)		
NO_x	EPA Tier II	5.4 g/kilowatt (kW)-hour
CO	EPA Tier II	3.5 g/kW-hour
ROC	EPA Tier II	1.0 g/kW-hour
SO_2	EPA Tier II	Diesel fuel with sulfur content no greater than 0.0015% by weight
PM_{10}	EPA Tier II	0.20 g/kW-hour

Notes:
BACT = Best Available Control Technology
CO = carbon monoxide
NA = not applicable
NO_x = nitrogen oxides
O_2 = oxygen
PM_{10} = particulate matter less than or equal to 10 microns in diameter
ppm = parts per million
SCR = Selective catalytic reduction
VOC = volatile organic compounds
SO_2 = sulfur dioxide