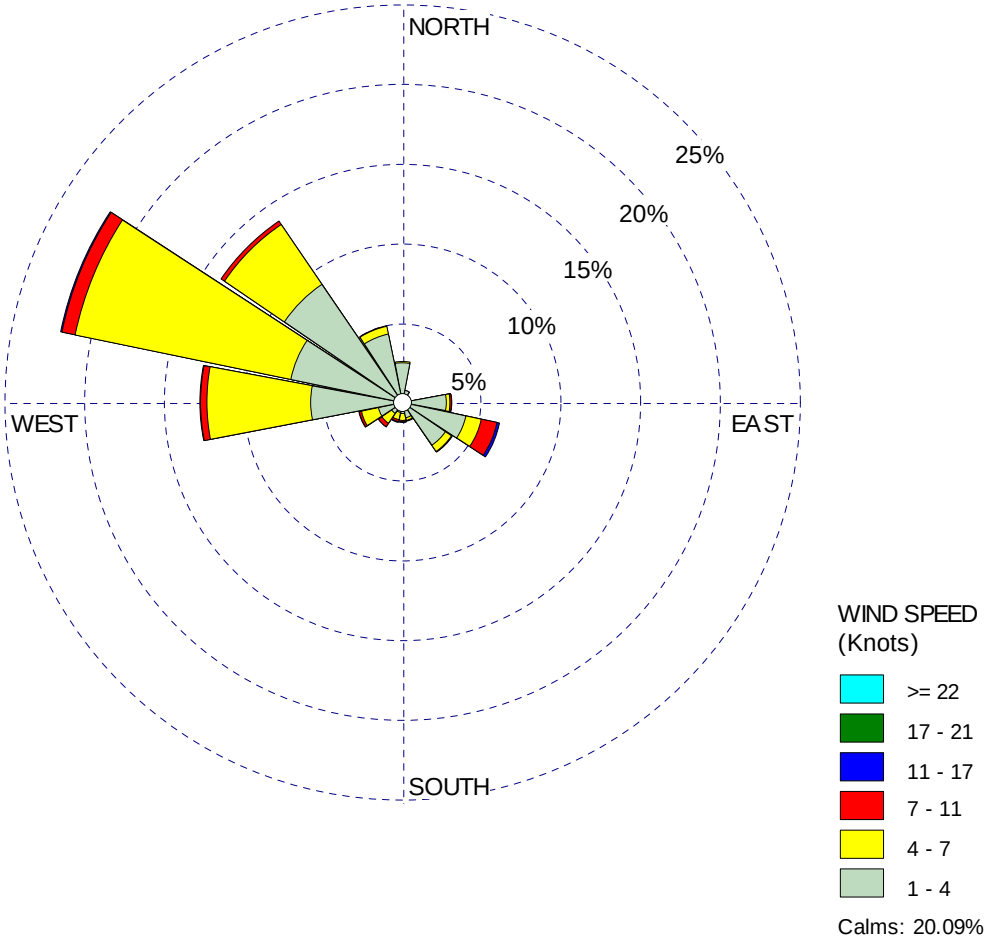
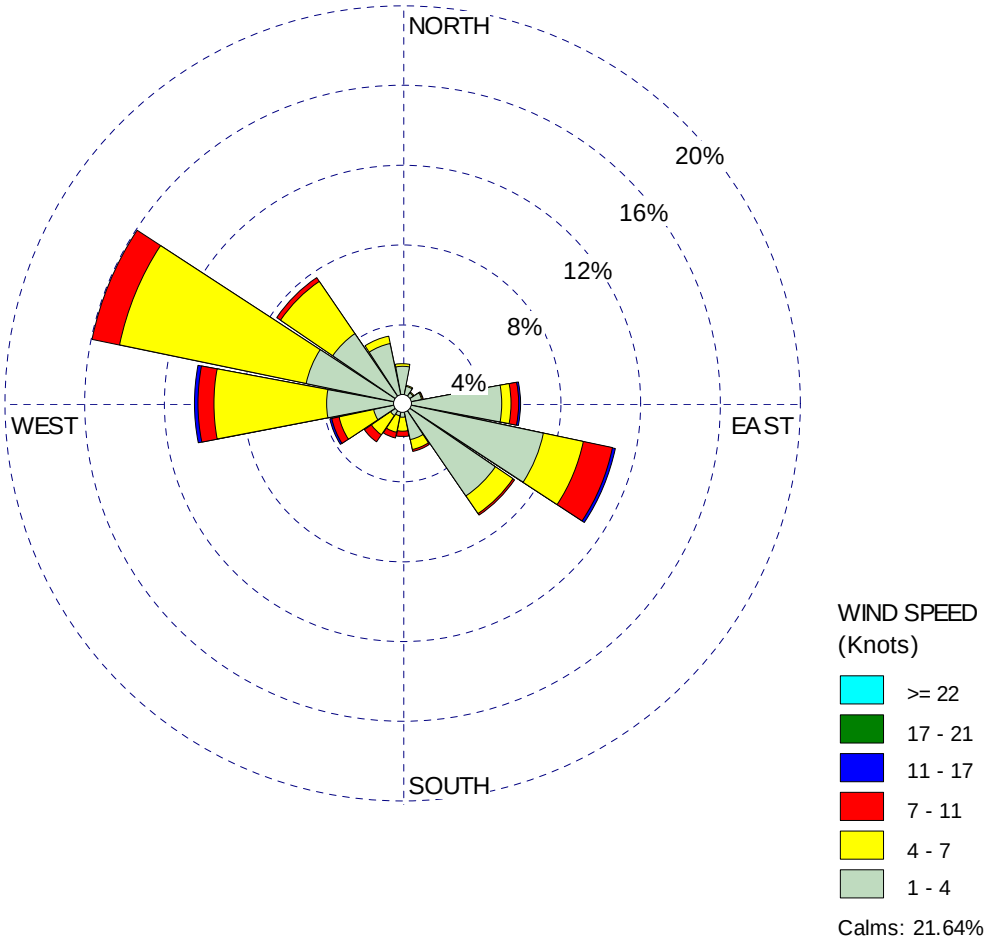
APPENDIX G-1

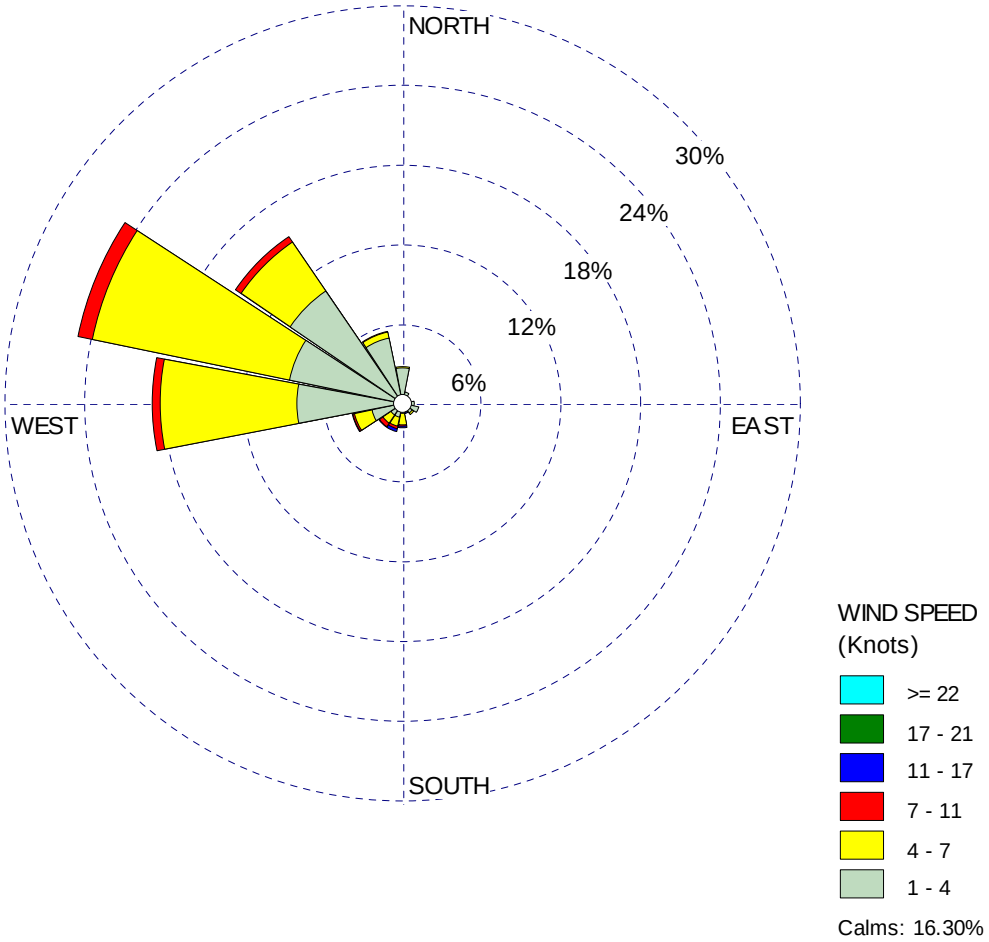
Wind Roses and Wind Frequency Distributions



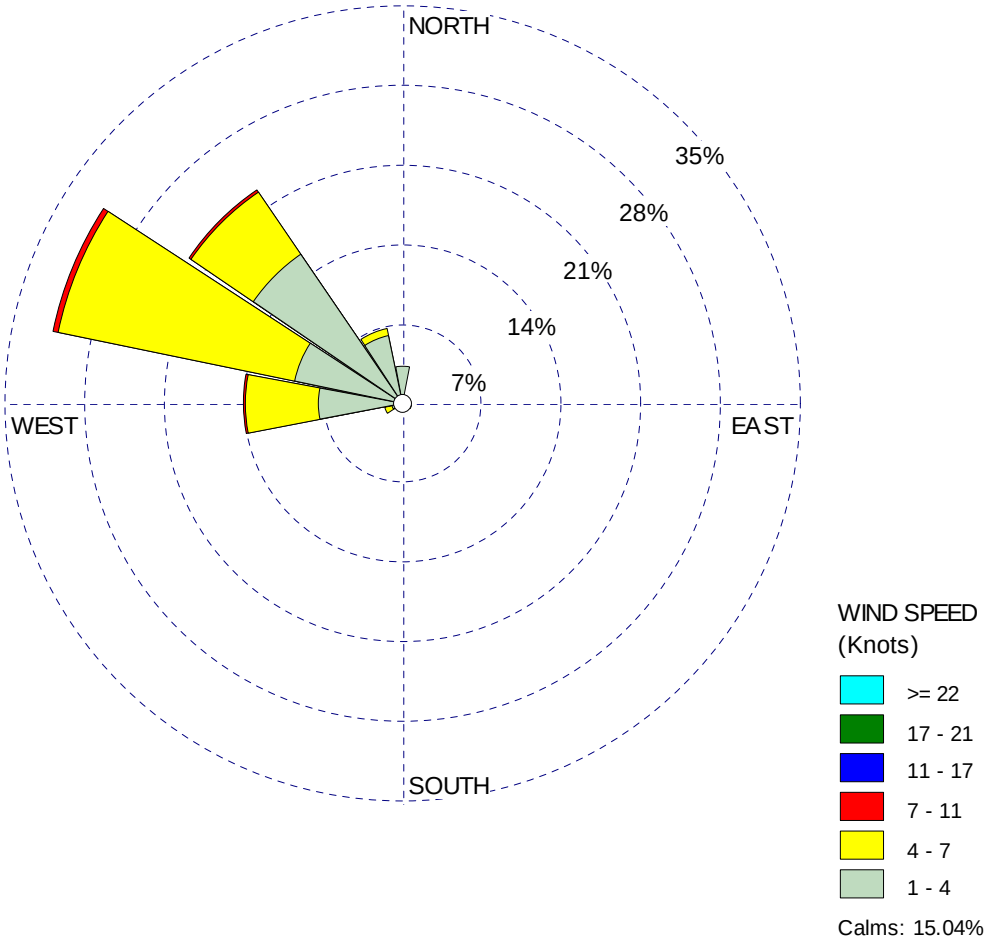
Otay Mesa - 2006



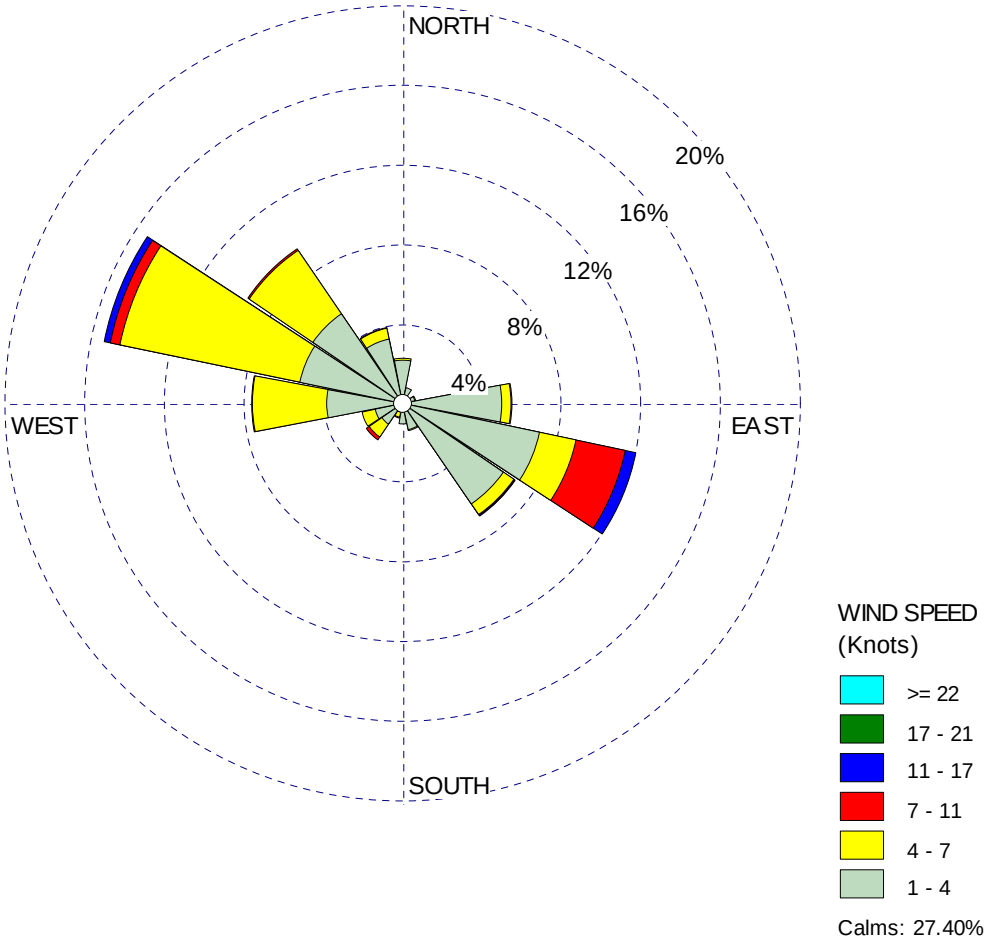
Otay Mesa – First Quarter 2006



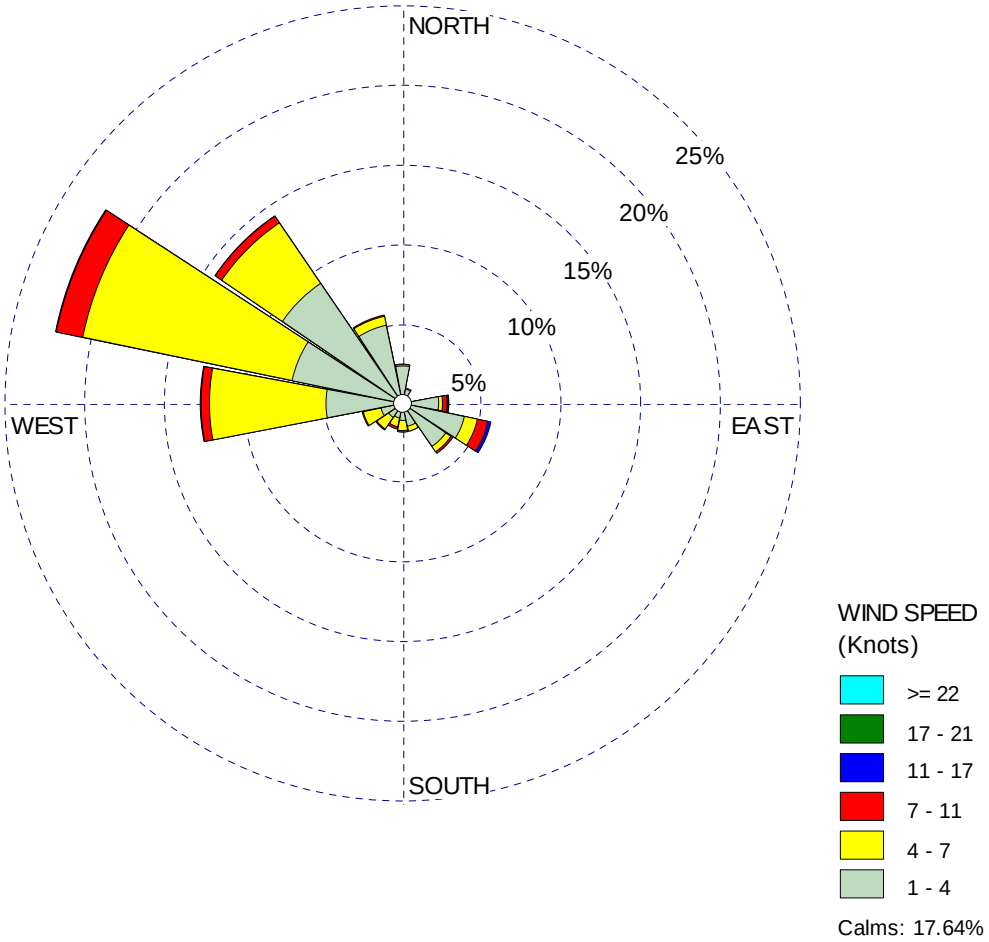
Otay Mesa – Second Quarter 2006



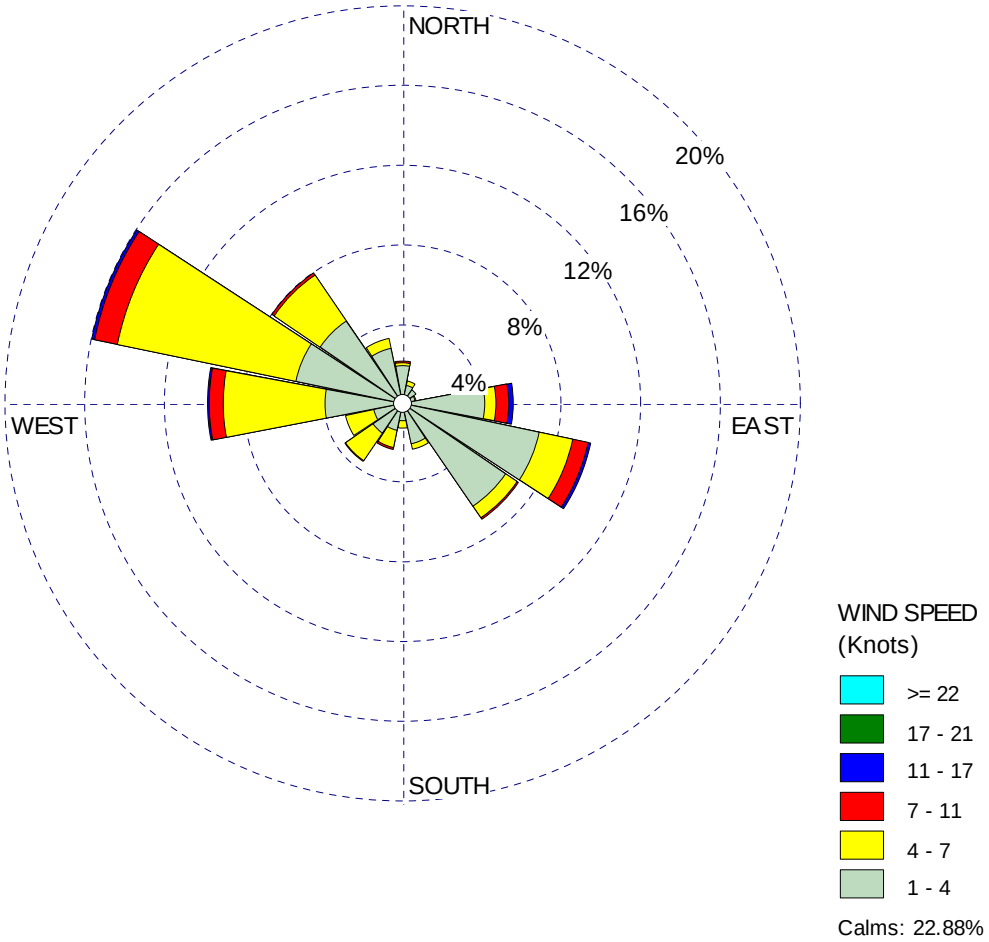
Otay Mesa – Third Quarter 2006



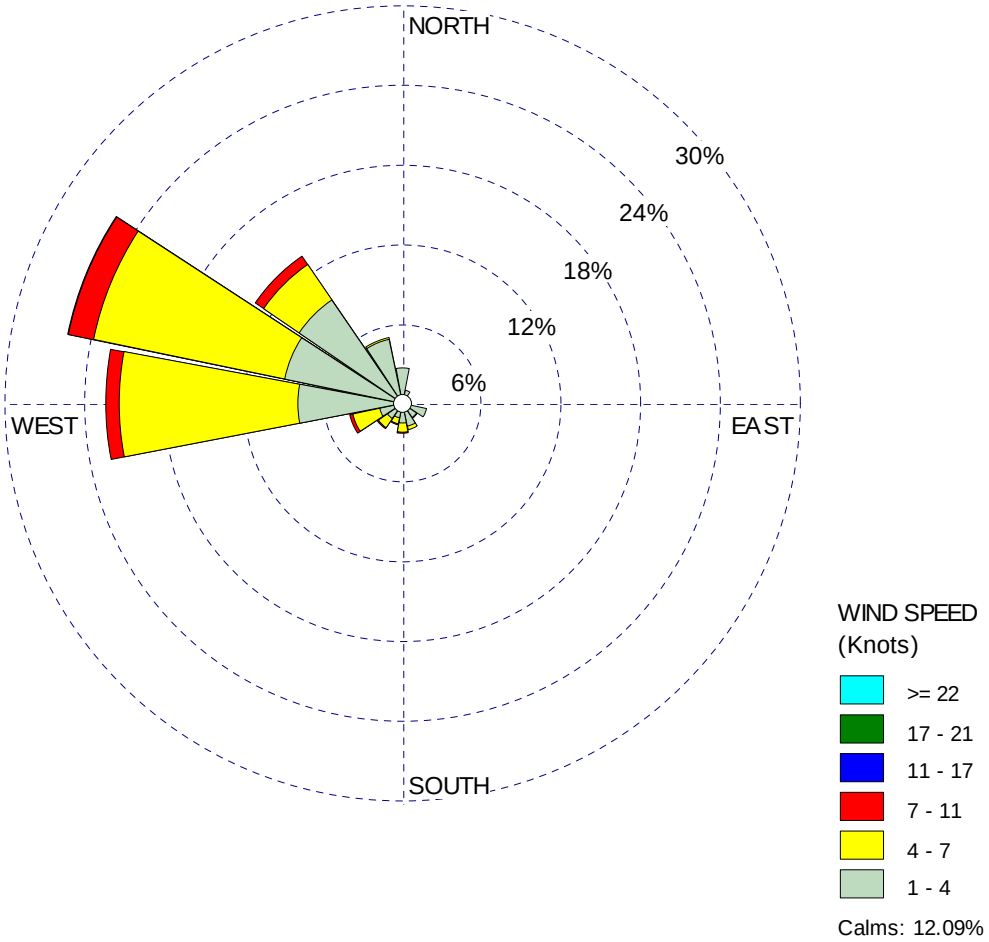
Otay Mesa – Fourth Quarter 2006



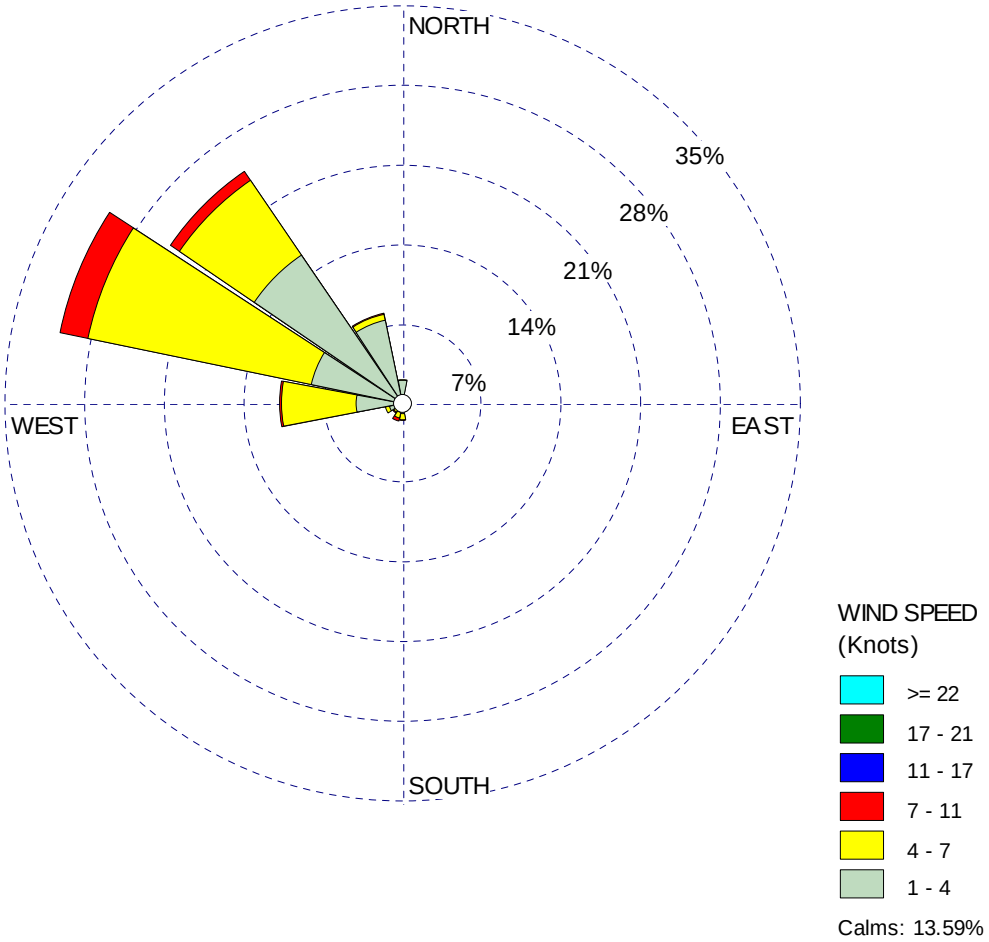
Otay Mesa – 2007



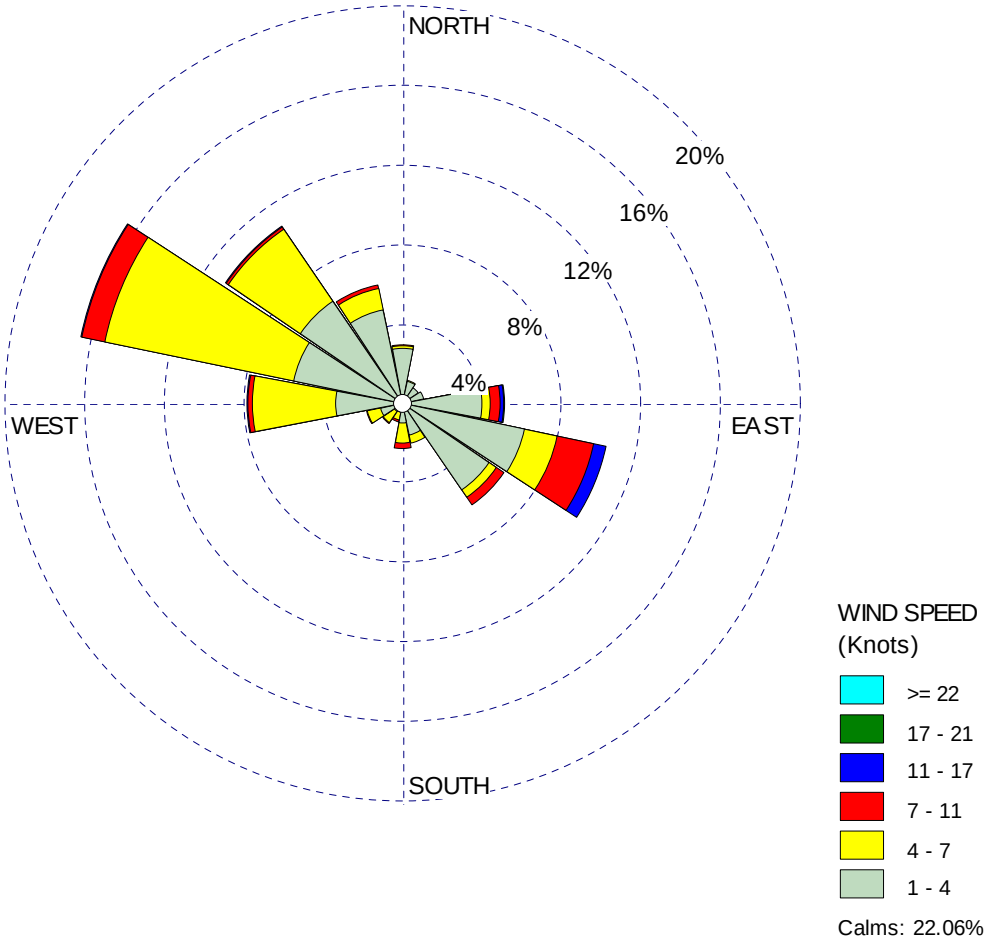
Otay Mesa – First Quarter 2007



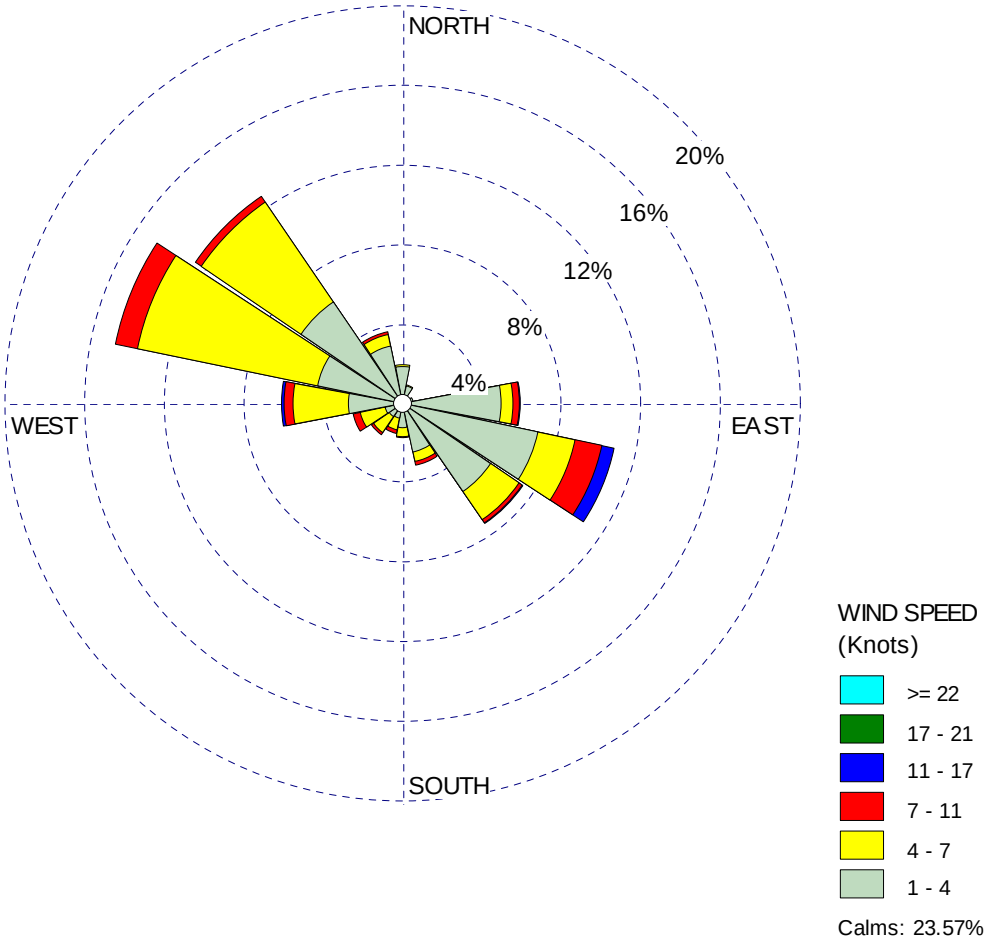
Otay Mesa – Second Quarter 2007



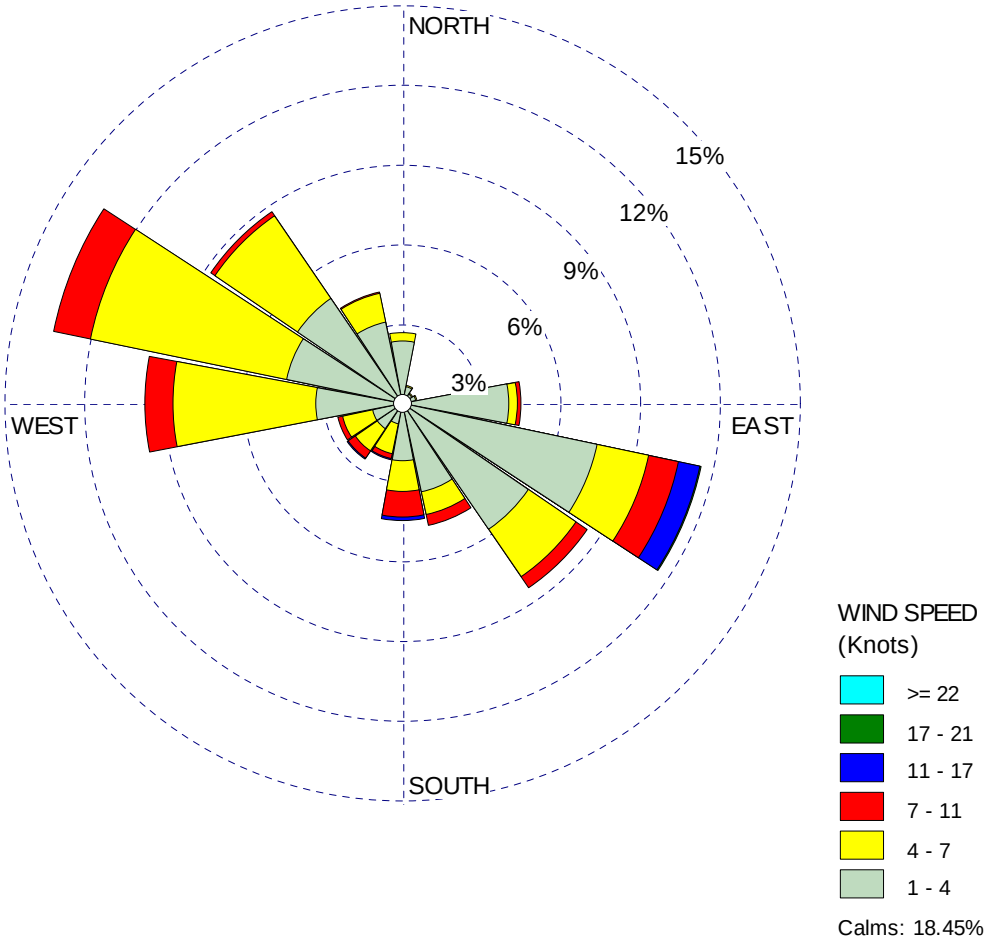
Otay Mesa – Third Quarter 2007



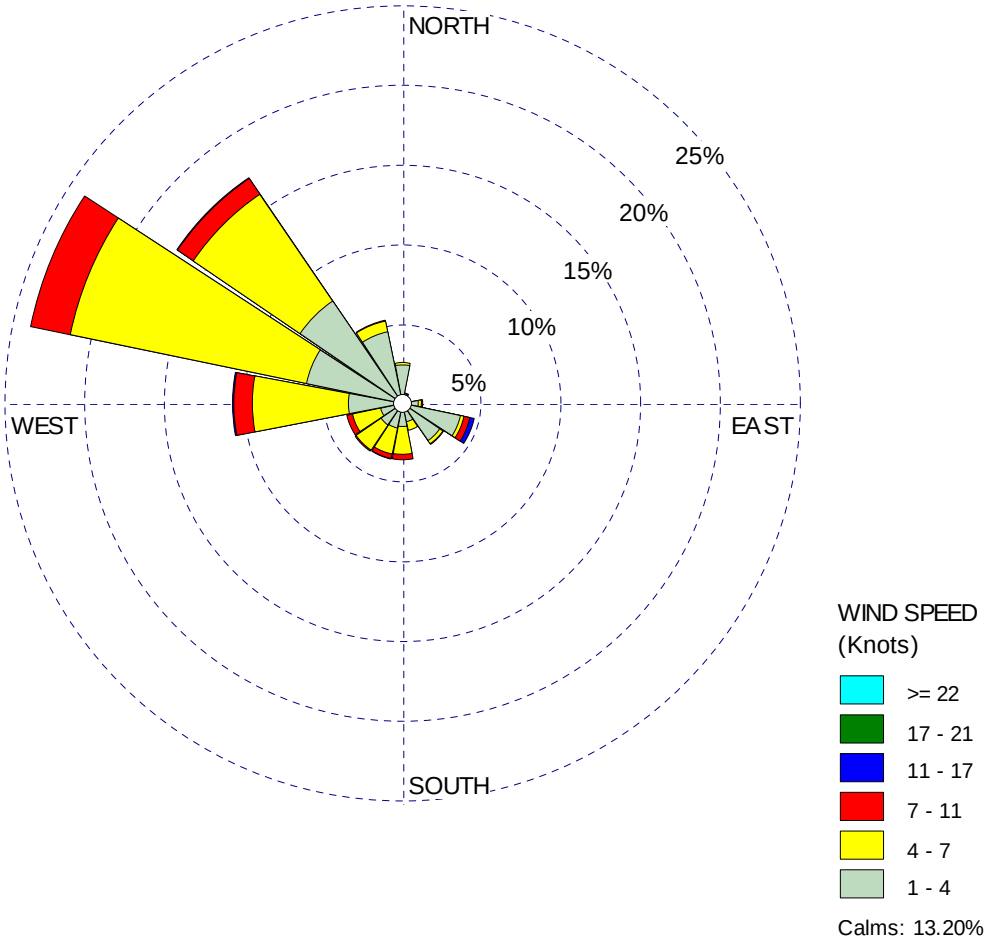
Otay Mesa – Fourth Quarter 2007



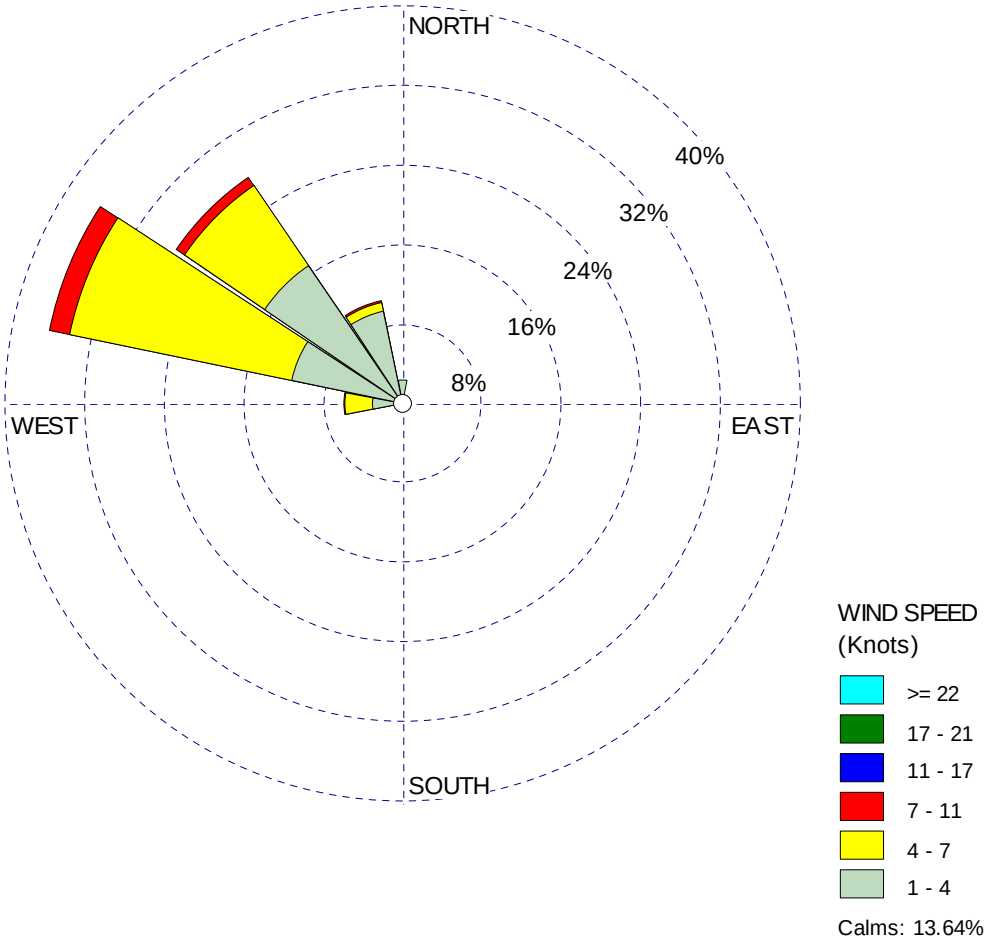
Otay Mesa – 2008



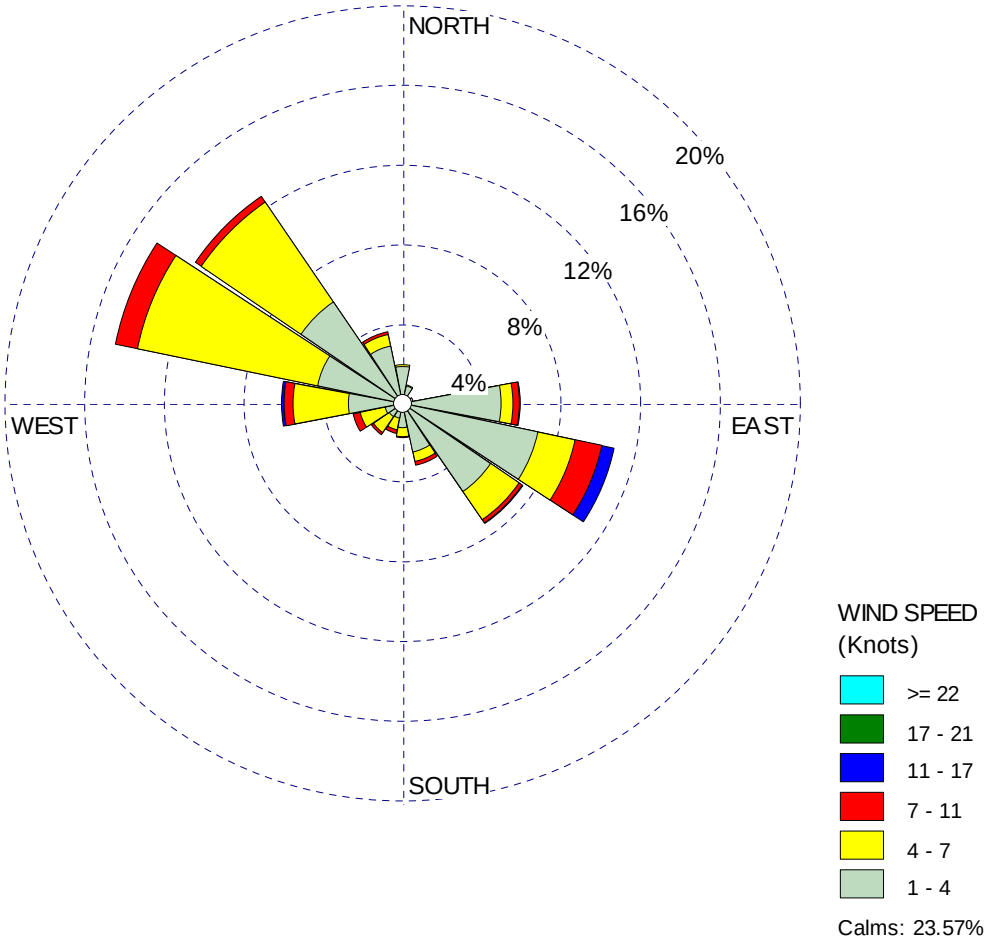
Otay Mesa – First Quarter 2008



Otay Mesa – Second Quarter 2008



Otay Mesa – Third Quarter 2008



Otay Mesa – Fourth Quarter 2008

PIO PICO ENERGY CENTER
METEOROLOGICAL DATA:
2006, 2007, AND 2008
WIND FREQUENCY DISTRIBUTIONS

2006

WIND SPEEDS AT 10 METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	146	78	7	0	0	0	0	0	231
NNE	54	20	1	0	0	0	0	0	75
NE	29	11	1	0	0	0	0	0	41
ENE	35	10	2	1	0	0	0	0	48
E	199	46	8	12	8	3	0	0	276
ESE	208	153	40	48	71	22	7	0	549
SE	124	166	29	13	2	0	1	0	335
SSE	42	50	11	3	3	0	1	1	111
S	25	41	31	7	7	2	1	1	115
SSW	28	34	32	8	10	2	2	2	118
SW	34	45	38	30	18	1	1	0	167
WSW	61	80	63	33	8	5	1	0	251
W	124	384	372	196	33	5	1	0	1115
WNW	200	430	658	547	75	0	5	2	1917
NW	260	529	251	145	22	1	0	0	1208
NNW	200	188	35	9	2	0	0	0	434
Sub-Total:	1769	2265	1579	1052	259	41	20	6	6991
Calms									1758
Missing/Incomplete									11
Total									8760

Average Wind Speed: 1.59m/s

2006 First Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	19	22	3	0	0	0	0	0	44
NNE	13	7	1	0	0	0	0	0	21
NE	12	3	1	0	0	0	0	0	16
ENE	17	5	1	1	0	0	0	0	24
E	85	23	5	5	7	3	0	0	128
ESE	79	77	24	23	23	8	1	0	235
SE	50	72	17	7	1	0	0	0	147
SSE	19	22	8	3	2	0	0	0	54
S	7	9	11	4	6	0	0	0	37
SSW	6	9	14	4	6	0	0	0	39
SW	6	11	11	15	7	1	0	0	51
WSW	17	16	22	16	5	5	0	0	81
W	19	64	79	42	17	3	1	0	225
WNW	31	76	106	99	30	0	0	0	342
NW	24	68	45	23	4	1	0	0	165
NNW	35	32	8	0	0	0	0	0	75
Sub-Total:	439	516	356	242	108	21	2	0	1684
Calms									465
Missing/Incomplete									11
Total									2160

Average Wind Speed: 1.61m/s

2006 Second Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	41	19	2	0	0	0	0	0	62
NNE	15	6	0	0	0	0	0	0	21
NE	6	2	0	0	0	0	0	0	8
ENE	4	2	0	0	0	0	0	0	6
E	20	1	0	0	0	0	0	0	21
ESE	21	8	0	0	0	0	0	0	29
SE	7	14	3	0	0	0	0	0	24
SSE	6	8	2	0	1	0	1	1	19
S	7	11	16	3	1	2	1	1	42
SSW	12	13	13	2	3	2	2	2	49
SW	11	14	11	7	5	0	1	0	49
WSW	21	32	20	9	3	0	1	0	86
W	47	128	144	80	11	2	0	0	412
WNW	59	132	190	140	24	0	0	0	545
NW	70	155	56	41	11	0	0	0	333
NNW	53	58	7	3	1	0	0	0	122
Sub-Total:	400	603	464	285	60	6	6	4	1828
Calms									356
Missing/Incomplete									0
Total									2184

Average Wind Speed: 1.70m/s

2006 Third Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	49	25	0	0	0	0	0	0	74
NNE	9	5	0	0	0	0	0	0	14
NE	8	3	0	0	0	0	0	0	11
ENE	2	0	0	0	0	0	0	0	2
E	5	0	0	0	0	0	0	0	5
ESE	13	7	0	0	0	0	0	0	20
SE	6	5	1	0	0	0	0	0	12
SSE	3	3	0	0	0	0	0	0	6
S	6	2	4	0	0	0	0	0	12
SSW	7	4	1	0	0	0	0	0	12
SW	6	2	5	2	2	0	0	0	17
WSW	14	9	8	6	0	0	0	0	37
W	40	125	86	55	4	0	0	0	310
WNW	71	144	224	243	10	0	0	0	692
NW	129	222	89	57	5	0	0	0	502
NNW	71	65	11	3	0	0	0	0	150
Sub-Total:	439	621	429	366	21	0	0	0	1876
Calms									332
Missing/Incomplete									0
Total									2208

Average Wind Speed: 1.67m/s

2006 Fourth Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	37	12	2	0	0	0	0	0	51
NNE	17	2	0	0	0	0	0	0	19
NE	3	3	0	0	0	0	0	0	6
ENE	12	3	1	0	0	0	0	0	16
E	89	22	3	7	1	0	0	0	122
ESE	95	61	16	25	48	14	6	0	265
SE	61	75	8	6	1	0	1	0	152
SSE	14	17	1	0	0	0	0	0	32
S	5	19	0	0	0	0	0	0	24
SSW	3	8	4	2	1	0	0	0	18
SW	11	18	11	6	4	0	0	0	50
WSW	9	23	13	2	0	0	0	0	47
W	18	67	63	19	1	0	0	0	168
WNW	39	78	138	65	11	0	5	2	338
NW	37	84	61	24	2	0	0	0	208
NNW	41	33	9	3	1	0	0	0	87
Sub-Total:	491	525	330	159	70	14	12	2	1603
Calms									605
Missing/Incomplete									0
Total									2208

Average Wind Speed: 1.37m/s

2007

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	121	90	5	2	3	0	0	0	221
NNE	58	28	4	2	0	0	0	0	92
NE	35	16	0	0	0	0	0	0	51
ENE	36	11	1	0	0	0	0	0	48
E	141	63	10	11	21	8	4	2	260
ESE	199	153	44	30	44	19	6	6	501
SE	125	168	28	5	10	2	0	0	338
SSE	64	70	19	9	1	0	0	0	163
S	44	55	39	18	8	1	0	0	165
SSW	40	48	31	18	11	1	0	0	149
SW	38	61	56	21	6	0	0	0	182
WSW	53	74	71	28	6	0	0	0	232
W	117	308	365	274	42	5	1	1	1113
WNW	203	421	554	617	139	12	2	0	1948
NW	292	511	245	156	44	1	0	0	1249
NNW	217	227	43	7	5	1	0	0	500
Sub-Total:	1783	2304	1515	1198	340	50	13	9	7212
Calms									1545
Missing/Incomplete									3
Total									8760

Average Wind Speed: 1.67m/s

2007 First Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	25	17	1	2	2	0	0	0	47
NNE	14	7	3	2	0	0	0	0	26
NE	14	5	0	0	0	0	0	0	19
ENE	9	6	1	0	0	0	0	0	16
E	67	23	5	7	11	5	3	0	121
ESE	96	56	20	17	15	2	3	0	209
SE	53	83	12	3	2	0	0	0	153
SSE	23	23	2	4	0	0	0	0	52
S	8	12	6	2	0	0	0	0	28
SSW	13	18	10	9	2	0	0	0	52
SW	15	25	28	8	1	0	0	0	77
WSW	16	17	22	9	0	0	0	0	64
W	22	63	72	38	13	2	1	1	212
WNW	42	77	114	83	25	1	2	0	344
NW	50	59	43	17	3	0	0	0	172
NNW	29	33	9	2	0	0	0	0	73
Sub-Total:	496	524	348	203	74	10	9	1	1665
Calms									494
Missing/Incomplete									1
Total									2160

Average Wind Speed: 1.48m/s

2007 Second Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	39	21	0	0	0	0	0	0	60
NNE	20	4	0	0	0	0	0	0	24
NE	6	1	0	0	0	0	0	0	7
ENE	6	0	0	0	0	0	0	0	6
E	13	3	0	0	0	0	0	0	16
ESE	29	13	0	0	0	0	0	0	42
SE	11	19	0	1	0	0	0	0	31
SSE	16	24	6	0	0	0	0	0	46
S	11	23	12	3	2	0	0	0	51
SSW	6	20	5	5	2	0	0	0	38
SW	10	22	13	5	2	0	0	0	52
WSW	8	32	31	14	5	0	0	0	90
W	42	131	154	139	21	1	0	0	488
WNW	65	134	132	188	35	8	0	0	562
NW	84	123	40	30	17	0	0	0	294
NNW	65	44	2	1	0	0	0	0	112
Sub-Total:	431	614	395	386	84	9	0	0	1919
Calms									264
Missing/Incomplete									1
Total									2184

Average Wind Speed: 1.82m/s

2007 Third Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	29	18	1	0	0	0	0	0	48
NNE	11	4	0	0	0	0	0	0	15
NE	2	1	0	0	0	0	0	0	3
ENE	1	0	0	0	0	0	0	0	1
E	9	0	0	0	0	0	0	0	9
ESE	16	3	0	0	0	0	0	0	19
SE	6	4	7	0	0	0	0	0	17
SSE	2	9	6	1	1	0	0	0	19
S	9	13	11	1	1	0	0	0	35
SSW	13	7	10	1	5	1	0	0	37
SW	7	8	2	6	2	0	0	0	25
WSW	12	16	6	2	0	0	0	0	36
W	30	62	78	66	4	0	0	0	240
WNW	57	125	186	255	54	1	0	0	678
NW	113	236	98	77	21	0	0	0	545
NNW	83	83	10	2	2	0	0	0	180
Sub-Total:	400	589	415	411	90	2	0	0	1907
Calms									300
Missing/Incomplete									1
Total									2208

Average Wind Speed: 1.82m/s

2007 Fourth Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	28	34	3	0	1	0	0	0	66
NNE	13	13	1	0	0	0	0	0	27
NE	13	9	0	0	0	0	0	0	22
ENE	20	5	0	0	0	0	0	0	25
E	52	37	5	4	10	3	1	2	114
ESE	58	81	24	13	29	17	3	6	231
SE	55	62	9	1	8	2	0	0	137
SSE	23	14	5	4	0	0	0	0	46
S	16	7	10	12	5	1	0	0	51
SSW	8	3	6	3	2	0	0	0	22
SW	6	6	13	2	1	0	0	0	28
WSW	17	9	12	3	1	0	0	0	42
W	23	52	61	31	4	2	0	0	173
WNW	39	85	122	91	25	2	0	0	364
NW	45	93	64	32	3	1	0	0	238
NNW	40	67	22	2	3	1	0	0	135
Sub-Total:	456	577	357	198	92	29	4	8	1721
Calms									487
Missing/Incomplete									0
Total									2208

Average Wind Speed: 1.57m/s

2008

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	114	88	9	3	0	0	0	0	214
NNE	48	23	2	0	1	0	0	0	74
NE	29	8	0	1	1	1	0	0	40
ENE	29	5	1	0	0	0	0	0	35
E	159	68	16	8	10	2	1	0	264
ESE	216	190	52	38	52	27	13	10	598
SE	152	161	63	27	16	0	1	0	420
SSE	50	109	32	10	12	1	0	0	214
S	39	77	51	22	26	4	2	0	221
SSW	25	51	48	26	12	4	0	0	166
SW	28	63	49	35	11	1	1	0	188
WSW	46	46	50	44	16	2	0	0	204
W	93	184	216	159	52	7	1	0	712
WNW	180	402	570	626	154	3	0	0	1935
NW	262	521	316	289	59	2	0	0	1449
NNW	212	234	54	18	8	1	0	0	527
Sub-Total:	1682	2230	1529	1306	430	55	19	10	7261
Calms									1511
Missing/Incomplete									12
Total									8784

Average Wind Speed: 1.75m/s

2008 First Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	23	29	5	2	0	0	0	0	59
NNE	9	6	1	0	0	0	0	0	16
NE	9	1	0	1	0	0	0	0	11
ENE	11	1	1	0	0	0	0	0	13
E	59	29	6	1	3	0	0	0	98
ESE	74	90	23	20	22	7	5	10	251
SE	57	69	30	17	11	0	0	0	184
SSE	20	55	11	8	8	1	0	0	103
S	20	28	12	13	18	4	2	0	97
SSW	5	13	13	12	3	2	0	0	48
SW	9	17	15	7	6	1	1	0	56
WSW	12	14	14	11	4	0	0	0	55
W	21	51	66	51	21	2	0	0	212
WNW	31	67	88	76	31	0	0	0	293
NW	27	78	46	36	4	0	0	0	191
NNW	34	35	19	5	1	0	0	0	94
Sub-Total:	421	583	350	260	132	17	8	10	1781
Calms									403
Missing/Incomplete									0
Total									2184

Average Wind Speed: 1.73m/s

2008 Second Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	35	19	3	0	0	0	0	0	57
NNE	9	6	0	0	1	0	0	0	16
NE	8	2	0	0	1	1	0	0	12
ENE	6	2	0	0	0	0	0	0	8
E	17	6	4	0	2	0	0	0	29
ESE	56	26	3	2	5	5	4	0	101
SE	29	34	5	0	1	0	0	0	69
SSE	9	18	11	1	0	0	0	0	39
S	8	25	31	7	7	0	0	0	78
SSW	12	24	27	9	6	1	0	0	79
SW	8	29	21	20	2	0	0	0	80
WSW	15	17	25	16	4	2	0	0	79
W	23	52	72	64	20	2	0	0	233
WNW	48	87	143	185	53	2	0	0	518
NW	53	117	81	95	25	2	0	0	373
NNW	41	60	10	5	1	0	0	0	117
Sub-Total:	377	524	436	404	128	15	4	0	1888
Calms									287
Missing/Incomplete									9
Total									2184

Average Wind Speed: 1.93m/s

2008 Third Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	39	15	0	0	0	0	0	0	54
NNE	19	1	0	0	0	0	0	0	20
NE	7	1	0	0	0	0	0	0	8
ENE	1	0	0	0	0	0	0	0	1
E	6	0	0	0	0	0	0	0	6
ESE	2	4	0	0	0	0	0	0	6
SE	4	1	0	0	0	0	0	0	5
SSE	0	1	0	0	0	0	0	0	1
S	4	3	0	0	0	0	0	0	7
SSW	3	1	0	0	0	0	0	0	4
SW	9	0	0	0	0	0	0	0	9
WSW	9	4	0	0	0	0	0	0	13
W	29	40	40	21	2	0	0	0	132
WNW	74	178	224	277	46	0	0	0	799
NW	144	227	104	110	22	0	0	0	607
NNW	110	100	16	4	4	0	0	0	234
Sub-Total:	460	576	384	412	74	0	0	0	1906
Calms									301
Missing/Incomplete									1
Total									2208

Average Wind Speed: 1.77m/s

2008 Fourth Quarter

WIND SPEEDS AT 10METERS HEIGHT (m/s)

SECTOR	0.5-1	1-2	2-3	3-4	4-5	5-6	6-7	>=7	Total
N	17	25	1	1	0	0	0	0	44
NNE	11	10	1	0	0	0	0	0	22
NE	5	4	0	0	0	0	0	0	9
ENE	11	2	0	0	0	0	0	0	13
E	77	33	6	7	5	2	1	0	131
ESE	84	70	26	16	25	15	4	0	240
SE	62	57	28	10	4	0	1	0	162
SSE	21	35	10	1	4	0	0	0	71
S	7	21	8	2	1	0	0	0	39
SSW	5	13	8	5	3	1	0	0	35
SW	2	17	13	8	3	0	0	0	43
WSW	10	11	11	17	8	0	0	0	57
W	20	41	38	23	9	3	1	0	135
WNW	27	70	115	88	24	1	0	0	325
NW	38	99	85	48	8	0	0	0	278
NNW	27	39	9	4	2	1	0	0	82
Sub-Total:	424	547	359	230	96	23	7	0	1686
Calms									520
Missing/Incomplete									2
Total									2208

Average Wind Speed: 1.56m/s

APPENDIX G-2

Construction Emissions and Impact Analysis

APPENDIX G-2

Construction Emissions and Impact Analysis

Emissions during the construction phase of the project have been estimated, and include an assessment of emissions from vehicle and equipment exhaust and the fugitive dust generated from material handling. A dispersion modeling analysis was conducted based on these emissions. The results of the analysis indicate that construction activities are not expected to cause or contribute to exceedances of state or federal standards for criteria pollutants. The best available emission control techniques will be used to minimize emissions during construction. The project construction impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

The primary emission sources during construction will include exhaust from heavy construction equipment and vehicles, and fugitive dust generated in areas disturbed by grading, excavating, and erection of facility structures. The projected construction schedule has a duration of 16 months, during which different areas within the proposed site and a nearby temporary laydown area will be disturbed. Estimated land disturbance for major construction activities is summarized in Section 3.0, Facility Description.

Construction equipment and vehicle exhaust emissions were estimated using equipment lists and construction scheduling information provided by the project design engineering firm. The California Air Resource Board (CARB) OFFROAD2007 model and EMFAC2007 model were used to generate equipment-specific emission factors for all criteria pollutants for diesel-fueled construction equipment, and for on-road vehicles, respectively. Assumptions used in calculating project construction emissions included a 16-month construction period; 5 construction days per week; and a single-shift, 8-hour workday. The list of fueled equipment needed during each month of the construction effort (see Table G-2.16) served as the basis for estimating pollutant emissions throughout the term of construction, and helped to identify the periods of expected maximum short-term emissions.

Combustion emissions during construction will result from:

- Exhaust from the diesel construction equipment used for site preparation, grading, excavation, trenching, and construction of onsite structures;
- Exhaust from water trucks used to control construction dust emissions;
- Exhaust from portable welding machines;
- Exhaust from pickup trucks and diesel trucks used to transport workers and materials around the construction site;
- Exhaust from diesel trucks used to deliver concrete, fuel, and construction supplies to the construction site including the heavy hauling of major components using truck and/or rail; and
- Exhaust from vehicles used by workers to commute to the construction site.

Fugitive dust emissions resulting from on-site soil disturbances were estimated using USEPA AP-42 emission factors activities including bulldozing and dirt-pushing, travel on paved and unpaved roads, material handling, and wind erosion to storage of aggregate materials. A combined dust control efficiency of 92 percent was assumed to be achieved for traveling on unpaved surfaces at the project site and temporary construction area activities by the mitigation measures of frequent watering and limiting speeds to 15 miles per hour.

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

- Dust entrained during site preparation and grading/excavation at the construction site;
- Dust entrained during onsite travel on paved and unpaved surfaces;
- Dust entrained during aggregate and soil loading and unloading operations; and
- Wind erosion of areas disturbed during construction activities.

To determine the potential worst-case daily construction impacts, exhaust and dust emission rates have been evaluated for each source of emissions. Maximum short-term impacts are calculated based on the equipment mix expected during the second month of the construction schedule. Annual emissions are based on the equipment mix during the peak 12-month period out of the overall construction period.

Available Mitigation Measures

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

- Unpaved roads and disturbed areas in the project construction site will be watered as frequently as necessary to prevent fugitive dust plumes. The frequency of watering can be reduced or eliminated during periods of precipitation.
- The vehicle speed limit will be 15 miles per hour within the construction site.
- The construction site entrances shall be posted with visible speed limit signs.
- Construction equipment vehicle tires will be inspected and washed as necessary to be cleaned free of dirt prior to entering paved roadways.
- Gravel ramps of at least 20 feet in length will be provided at the tire washing/cleaning station.
- Unpaved exits from the construction site will be graveled or treated to prevent track-out to public roadways.
- Construction vehicles will enter the construction site through the treated entrance roadways, unless an alternative route has been submitted to and approved by the Compliance Project Manager.
- Construction areas adjacent to any paved roadway will be provided with sandbags or other measures as specified in the Storm Water Pollution Prevention Plan (SWPPP) to prevent run-off to roadways.

- Paved roads within the construction site will be swept at least twice daily (or less during periods of precipitation) on days when construction activity occurs to prevent the accumulation of dirt and debris.
- At least the first 500 feet of any public roadway exiting from the construction site shall be swept at least twice daily (or less during periods of precipitation) on days when construction activity occurs or on any other day when dirt or runoff from the construction site is visible on public roadways.
- Soil storage piles and disturbed areas that remain inactive for longer than 10 days will be covered or treated with appropriate dust suppressant compounds.
- Vehicles used to transport solid bulk material on public roadways and having the potential to cause visible emissions will be provided with a cover, or the materials will be sufficiently wetted and loaded onto the trucks in a manner to provide at least one foot of freeboard.
- Wind erosion control techniques (such as windbreaks, water, chemical dust suppressants, and/or vegetation) will be used on all construction areas that may be disturbed. Any windbreaks installed to comply with this condition shall remain in place until the soil is stabilized or permanently covered with vegetation.

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

Estimates of Emissions with Mitigation Measures - Onsite Construction

Tables G-2.1 and G-2.2 show the estimated maximum daily and annual heavy equipment exhaust and fugitive dust emissions with recommended mitigation measures for onsite construction activities. Detailed emission calculations are included as Tables G-2.7 through G-2.16.

Analysis of Ambient Impacts from Onsite Construction

Ambient air quality impacts from emissions during the construction of the project were estimated using an air quality dispersion modeling analysis, in accordance with the procedures described in the modeling protocol (See Appendix G-8). The modeling analysis considers the construction site location, the surrounding topography, and the sources of emissions during construction, including vehicle and equipment exhaust emissions and fugitive dust.

Existing Ambient Levels

As with the modeling analysis of project operating impacts (Section 5.2), ambient monitoring data collected from monitoring stations in the project area were used to establish the ambient background levels for the construction impact modeling analysis. Table G-2.3 shows the maximum background concentrations of NOx, SO_2, CO, and PM_{10} recorded for 2006 through 2008.

Dispersion Model

The EPA guideline model AERMOD was used to estimate ambient impacts from construction activities.

Worst-case modeling was conducted for short-term averaging times using all combustion emissions from all construction equipment from Month 8 and dust emissions from activities in Month 2 (see Table G-2.4). Annual emissions were modeled for Months 2-13 of the construction schedule (See Table G-2.5). These periods were selected because they have a higher level of construction activity and exhaust and dust emissions than any other over the full 16 months of construction.

The emission sources for the construction site were grouped into three categories: exhaust emissions, construction dust emissions, and windblown dust emissions. The exhaust and construction dust emissions were modeled as three volume sources with a vertical dimension of 6 meters. Among the three volume sources, one was used to represent the construction dust and combustion exhaust sources from the facility site, while two were used to represent construction dust and combustion exhaust sources from the laydown area. Based on the width of the construction area, the horizontal dimension for the volume source at the facility site was set to 177.2 meters, with sigma-y = 18.6 meters; the horizontal dimension for each of the two volume sources at the laydown area were set to 102.7 meters, with sigma-y = 23.9 meters. The fugitive dust emissions from disturbed areas were represented for modeling purposes as area sources. To assess impacts from fugitive dust, the facility site and the laydown area were modeled as two separate area sources covering a combined disturbed area of 14.4 acres. The effective plume height for these two area sources was set at 0.5 meters in the modeling analysis.

The PVMRM option of AERMOD was used to account for the role of ambient ozone levels on the atmospheric conversion rate of NOx emissions (initially mostly in the form of nitric oxide) to NO_2 (the pollutant addressed by ambient standards). The record of hourly ozone measurements at the SDAPCD Chula Vista monitoring station during the same three years of the meteorological input data set were used to support the PVMRM calculations.

As with the refined modeling discussed in Section 5.2, the construction impact modeling was performed using the 2006 through 2008 Chula Vista monitoring station meteorological data set.

Modeling Results

The modeling analysis results are shown in Table G-2.3. Also included in the table are the maximum background levels that have occurred in the last 3 years and the resulting total ambient impacts. Construction impacts alone for all modeled pollutants are expected to be below the most stringent state and national standards.

Table G-2.3 shows that construction emissions will not cause new exceedances of any state or federal air quality standards. The table shows that the sum of the highest construction impact and the highest measured ambient background concentration exceed the federal 1-hour NO_2 standard. However, the federal NO_2 standard applies to a 3-year average of the 98th percentile 1-hour daily maximum values, not to individual maximum modeled values. As discussed above, the PPEC construction phase impacts would occur over a proposed schedule lasting about 16 months; peak emissions are expected to occur

over about a 6 month period. Construction impacts would be close to zero during the other two years of a compliance assessment with the new federal one-hour NO_2 and SO_2 standards. Because the federal one-hour NO_2 standard requires averaging the concentrations over three years, the NO_2 impacts during the single year of construction would not be likely to cause a new violation of the federal one-hour NO_2 standard. The table also shows that worst-case background concentrations of PM_{10} and $PM_{2.5}$ are already above the state standards, although they are below the federal standards. The project's modeled annual PM_{10} and $PM_{2.5}$ impacts are small relative to the background; the annual $PM_{2.5}$ impact is below the federal threshold for significance.

Table G-2.1
Maximum Daily Emissions During Construction, Pounds Per Day
Month 8 (combustion)
Month 2 (dust)

	NOx	CO	VOC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	40.7	24.3	4.1	0.0	1.6	1.6
Fugitive Dust	--	--	--	--	19.7	2.9
Offsite						
Worker Travel, Truck Deliveries	11.2	63.8	6.3	0.1	0.1	0.1
Total Emissions						
Total	51.9	88.1	10.4	0.1	21.4	4.6

Table G-2.2
Peak Annual Emissions During Project Construction, Tons Per Year

	NOx	CO	VOC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	4.7	2.3	0.4	0.0	0.2	0.2
Fugitive Dust	--	--	--	--	2.5	0.6
Offsite						
Worker Travel, Truck Deliveries	0.8	2.6	0.3	0.0	0.0	0.0
Total Emissions						
Total	5.5	4.9	0.7	0.0	0.5	1.9

Table G-2.3

Modeled Maximum Impacts During Construction

Pollutant	Averaging Period	Maximum Predicted Impact ($\mu g/m^3$)	Maximum Background Concentration ($\mu g/m^3$)	Total Concentration[1] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	CAAQS ($\mu g/m^3$)
NO_2	1-hr	79	154	233[2]	188	339
	Annual	6	32	38	100	57
SO_2	1-hr	0	45	45	196	655
	3-hr	0	34	34	1300	--
	24-hr	0	10	10	--	105
	Annual	0	8	8	80	--
CO	1-hr	63	4	67	40,000	23,000
	8-hr	34	2	36	10,000	20.000
PM_{10}	24-hr	21	57	78	150	50
	Annual	2.7	26.7	29.4	--	20
$PM_{2.5}$	24-hr	4.6	45.7	50.3	35	--
	Annual	0,2	12.5	12.7	15.0	12

Notes:

1. The federal 1-hour NO_2, 24-hour $PM_{2.5}$, and 1-hr SO_2 standards are based on 3-year averages of 98th percentile values, not on maximum values.

2. Construction is expected to last only 16 months; construction impacts would be much lower during the second year and zero during the third year. Because the federal one-hour NO_2 standard requires averaging the concentrations over three years, the NO_2 impacts during the single year of construction would not be likely to cause a new violation of the federal one-hour NO_2 standard.

Table G-2.4

Daily Construction Emissions (peak month) (lbs/day) Month 8 (combustion) Month 2 (fugitive dust)

	NOx	CO	VOC	SOx	PM2.5	PM10
	Onsite					
Construction Equipment	40.7	24.3	4.1	0.0	1.6	1.6
Fugitive Dust					2.9	19.7
Subtotal =	40.7	24.3	4.1	0.0	4.6	21.3
	Offsite					
Worker Travel (combustion)	6.1	61.2	5.8	0.1	0.1	0.1
Truck Deliveries (combustion)	5.1	2.5	0.4	0.0	0.0	0.0
Dust from travel on dirt roads					0.0	0.0
Subtotal =	11.2	63.8	6.3	0.1	0.1	0.1
Total =	51.9	88.1	10.4	0.1	4.6	21.4

Table G-2.5

Annual Construction Emissions (peak 12-month period)
(tons/yr)

Months 1-12 (combustion)
Months 2-13 (fugitive dust)

	NOx	CO	VOC	SOx	PM2.5	PM10
Onsite						
Construction Equipment (combustion)	4.7	2.3	0.4	0.0	0.2	0.2
Fugitive Dust					0.3	1.6
Subtotal =	4.7	2.3	0.4	0.0	0.5	1.8
Offsite						
Worker Travel	0.2	2.4	0.2	0.0	0.0	0.0
Truck Deliveries	0.5	0.3	0.0	0.0	0.0	0.0
Dust from travel on dirt roads					0.0	0.0
Subtotal =	0.8	2.6	0.3	0.0	0.0	0.0
Total =	5.5	4.9	0.7	0.0	0.5	1.9

Table G-2.6
Greenhouse Gas Emissions Calculations: Project Construction

Unit	Fuel	Fuel Use, gal/yr	Maximum Emissions, metric tonnes/yr				
			CO2	CH4	N2O	SF6	TOTAL
Offroad Fuel Use	Diesel	7,661	78	3.19E-03	6.38E-04	0.00	
Worker Travel	Gasoline	34,864	307	1.30E-02	2.60E-03	0.00	
Truck Deliveries	Diesel	8,020	81	3.34E-03	6.68E-04	0.00	
Total	--	50,545	466	1.95E-02	3.91E-03	0	
CO2eq			466	0	1	0	467

Natural Gas GHG Emission Rates (Note 1)

	Emission Factors, kg/gal			
	CO2 (2)	CH4	N2O	SF6
Diesel	10.140	4.17E-04	8.33E-05	n/a
Gasoline	8.800	3.73E-04	7.45E-05	
Global Warming	1	21	310	23,900

g/MMBTU		MMBtu/gal
CH4 (3)	N2O (3)	
3.00E+00	6.00E-01	1.39E-01
3.00E+00	6.00E-01	1.24E-01

Notes:
1. Calculation methods and emission factors from ARB, "Regulation for the Mandatory Reporting of Greenhouse Gas Emissions," December 2007
2. Appendix A, Table 3.
3. Appendix A, Table 6.
4. Appendix A, Table 2.

Table G-2.7
Delivery Truck Daily Emissions (Peak Month)

Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
3.18	50	159.09	0.0320	0.0160	0.0028	0.0000	0.0014	5.10	2.54	0.45	0.01	0.22
Idle exhaust (2)												0.01336

Notes:
(1) See notes for combustion emissions.
(2) 20 trucks per day times 1 hr idle time per visit times 0.0042 lb/hr.

Table G-2.8
Delivery Truck Annual Emissions

Number of Deliveries Per Year	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
652	50	32600.00	0.0320	0.0160	0.0028	0.0000	0.0014	0.52	0.26	0.05	0.00	0.02
Idle exhaust (2,3)												0.00137

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

Table G-2.9

Worker Travel Daily Emissions (Peak Month)

Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
284	1.5	189	40	7,573	0.0008	0.0081	0.0008	0.0000	0.0001	6.12	61.24	5.85	0.07	0.68

Notes:

(1) See notes for combustion emissions.

Table G-2.10

Worker Travel Annual Emissions

Average Number of Workers Per Day	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Days per Year	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
						NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
184	2	123	40	120	589,067	0.0008	0.0081	0.0008	0.0000	0.0001	0.24	2.38	0.23	0.00	0.03

Table G-2.11

Onsite Combustion Emissions																		
							Total Daily Fuel Use(5) (Gals/day)	Daily Emissic Lbs/day					Total Ar Fuel Us (Gals/yr)	Annual Emissio Lbs/yr				
	Adjusted factors lbs/1000 gallon (4)																	
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Hydro Crane 35-50 Ton RT	2	170.60	31.88	13.16	0.21	1.95	12.30	2.10	0.39	0.16	0.00	0.02	2,165	369.38	69.03	28.49	0.45	4.22
RT 760 - 60 ton Crane	2	184.89	35.93	7.12	0.21	1.95	30.76	5.69	1.11	0.22	0.01	0.06	6,090	1125.92	218.82	43.35	1.27	11.88
Hydro Crane 75-80 Ton RT	2	184.89	35.93	7.12	0.21	1.95	0.00	0.00	0.00	0.00	0.00	0.00	1,353	250.20	48.63	9.63	0.28	2.64
2250 Manitow oc 300 Ton (track mounted crane)	2	184.89	35.93	7.12	0.21	1.95	25.83	4.78	0.93	0.18	0.01	0.05	3,410	630.52	122.54	24.27	0.71	6.65
40' - 60' Manlift	2	168.09	197.65	27.34	0.21	11.71	41.50	6.98	8.20	1.13	0.01	0.49	4,565	767.29	902.25	124.80	0.95	53.45
90' Manlift	2	168.09	197.65	27.34	0.21	11.71	27.67	4.65	5.47	0.76	0.01	0.32	2,739	460.38	541.35	74.88	0.57	32.07
Forklift	2	169.60	137.47	14.65	0.21	7.55	9.75	1.65	1.34	0.14	0.00	0.07	1,931	327.43	265.41	28.27	0.40	14.58
Diesel Welder 400 Amp	2	160.21	125.59	17.47	0.21	8.79	6.90	1.10	0.87	0.12	0.00	0.06	1,315	210.63	165.11	22.97	0.27	11.55
185 CFM Compressor	2	170.61	89.05	11.12	0.21	12.17	10.81	1.84	0.96	0.12	0.00	0.13	2,734	466.47	243.48	30.41	0.57	33.28
Light Tow er 5 KW	2	160.21	125.59	17.47	0.21	8.79	9.58	1.53	1.20	0.17	0.00	0.08	2,388	382.55	299.87	41.71	0.50	20.99
Water Truck 4000 Gal	Onroad	173.70	86.54	15.22	0.21	7.61	7.83	1.36	0.68	0.12	0.00	0.06	2,066	358.83	178.77	31.44	0.43	15.72
Track 330 Excavator	2	164.48	56.00	15.00	0.21	5.69	0.00	0.00	0.00	0.00	0.00	0.00	2,478	407.56	138.75	37.18	0.51	14.09
RT Hoe 710 (Backhoe)	2	163.01	80.51	28.01	0.21	9.15	11.85	1.93	0.95	0.33	0.00	0.11	3,910	637.35	314.78	109.51	0.81	35.79
Roller	2	164.48	56.00	15.00	0.21	5.69	12.61	2.07	0.71	0.19	0.00	0.07	3,051	501.84	170.85	45.78	0.63	17.35
950/960 Loader	2	160.47	48.29	13.68	0.21	3.17	31.43	5.04	1.52	0.43	0.01	0.10	10,371	1664.26	500.89	141.87	2.16	32.91
Cat D6 Dozer	2	164.48	56.00	15.00	0.21	5.69	0.00	0.00	0.00	0.00	0.00	0.00	2,240	368.38	125.41	33.61	0.47	12.74
Dump Truck	Onroad	173.70	86.54	15.22	0.21	7.61	0.00	0.00	0.00	0.00	0.00	0.00	475	82.53	41.12	7.23	0.10	3.62
Grader	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	1,479	237.38	71.44	20.24	0.31	4.69
Fusion Machine	2	160.21	125.59	17.47	0.21	8.79	0.00	0.00	0.00	0.00	0.00	0.00	1,264	202.53	158.76	22.08	0.26	11.11
Asphalt Paver	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Paving Equipment	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00

(1) - Steady State Emission Factors from Table A4 of EPA July 2010 NR-009d Publication.
(2) - In use adjustment factors per Table A5 EPA July 2010 NR-009d Publication.
(3) - PM10 and SO2 adjustments due to Equation 3 and Equation 5 on pages 6 and 23, Respectively of EPA Report No. NR-009d
(4) - Calculation uses adjusted BSFC and assumed 7.1 lbs/gallon. The onroad emission factors are not adjusted.
(5) - Daily fuel use based on peak combustion month equipment schedule.
(6) - Annual fuel use based on average level during peak 12-month period.

Table G-2.12

Daily Fugitive Dust Emissions (peak month)	Month 2								
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Hydro Crane 35-50 Ton RT	0	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
RT 760 - 60 ton Crane	1	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
Hydro Crane 75-80 Ton RT	0	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
2250 Manitowoc 300 Ton (track mounted crane)	0	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
40' - 60' Manlift	0	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
90' Manlift	0	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
Forklift	1	7.2	7.2	vmt	1.71E-01	1.71E+00	92%	0.10	1.05
Diesel Welder 400 Amp	2	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
185 CFM Compressor	2	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
Light Tower 5 KW	3	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
Water Truck 4000 Gal	1	15.0	15.0	vmt	2.84E-01	2.84E+00	92%	0.36	3.62
Track 330 Excavator	1	434.7	434.7	tons	1.14E-05	3.63E-05	0%	0.00	0.02
RT Hoe 710 (Backhoe)	2	466.2	932.4	tons	5.30E-05	1.51E-03	0%	0.05	1.41
Roller	1	13.8	13.8	vmt	1.93E-02	2.75E-01	0%	0.27	3.80
950/960 Loader	2	4.3	8.6	vmt	1.93E-02	2.75E-01	0%	0.17	2.37
Cat D6 Dozer	1	5.2	5.2	hrs	2.31E-01	4.19E-01	0%	1.20	2.18
Dump Truck	1	13.8	13.8	vmt	1.43E-01	1.43E+00	92%	0.17	1.68
Grader	1	4.6	4.6	vmt	1.93E-02	2.75E-01	0%	0.09	1.27
Fusion Machine	3	0.0	0.0	none	0.00E+00	0.00E+00	0%	0.00	0.00
Asphalt Paver	0	14.1	0.0	vmt	1.93E-02	2.75E-01	0%	0.00	0.00
Paving Equipment	0	14.1	0.0	vmt	1.93E-02	2.75E-01	0%	0.00	0.00
0	0	0.0	0.0	0.0	0.00E+00	0.00E+00	0%	0.00	0.00
Windblown Dust (active construction area)	N/A	435600	435600	sq.ft.	6.73E-06	1.68E-05	92%	0.25	0.62
Windblown Dust (laydown area)	N/A	261360	261360	sq.ft.	6.73E-06	1.68E-05	92%	0.15	0.37
Worker Gravel Road Travel (onsite)	189.333	0.1	18.9333	vmt	7.71E-02	7.71E-01	92%	0.12	1.24
Delivery Truck Gravel Road Travel (onsite)	3.18182	0.1	0.31818	vmt	2.31E-01	2.31E+00	92%	0.01	0.06
Total onsite=								2.94	19.67

(1) Dust control efficiency for unpaved road travel and active excavation area is based on "Control of Open Fugitive Dust Sources", U.S. EPA, 9/88.

Table G-2.13

Annual Fugitive Dust Emissions

Activity	Average Daily PM2.5 Emissions(1) (lbs/day)	Average Daily PM10 Emissions(1) (lbs/day)	Days per Year	Annual PM2.5 Emissions (tons/yr)	Annual PM10 Emissions (tons/yr)
Construction Activities	1.94	13.72	240	0.23	1.65E+00
Windblown Dust	0.40	1.00	365	0.07	1.82E-01
Total =				0.31	1.83E+00

Notes:

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

Table G-2.14

Construction Equipment Daily Fuel Use (peak period)

Month 8

Equipment	Number of Units	Hrs/Day Per Unit	Gals/Hr Per Unit	Total Fuel Use (Gals/day)
Hydro Crane 35-50 Ton RT	1	3.4	3.6	12.3
RT 760 - 60 ton Crane	2	3.4	4.5	30.8
Hydro Crane 75-80 Ton RT	0	3.4	4.5	0.0
2250 Manitowoc 300 Ton (track mounted crane)	1	3.4	7.6	25.8
40' - 60' Manlift	9	4	1.2	41.5
90' Manlift	6	4	1.2	27.7
Forklift	2	2.4	2.0	9.8
Diesel Welder 400 Amp	3	3.6	0.6	6.9
185 CFM Compressor	2	3.8	1.4	10.8
Light Tower 5 KW	3	5	0.6	9.6
Water Truck 4000 Gal	1	5	1.6	7.8
Track 330 Excavator	0	4.6	4.9	0.0
RT Hoe 710 (Backhoe)	1	3.7	3.2	11.8
Roller	1	4.6	2.7	12.6
950/960 Loader	1	4.3	7.3	31.4
Cat D6 Dozer	0	5.2	6.5	0.0
Dump Truck	0	4.6	1.6	0.0
Grader	0	4.6	3.7	0.0
Fusion Machine	0	5	0.6	0.0
Asphalt Paver	0	4.7	2.2	0.0
Paving Equipment	0	4.7	2.2	0.0

Total = 238.8

Table G-2.15

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

Equipment	Average number of units per day: Total Construction Period	Average number of units per day: Peak Construction Year	Average Operating Hrs/Day Per Unit	Gals/Hr Per Unit	Average Operating Days per Year	12-Month Average Total Fuel Use (Gals/yr)	Peak 12-Month Average Total Fuel Use (Gals/yr)
Hydro Crane 35-50 Ton RT	0.22	0.67	3.40	3.6	264	722	2,165
RT 760 - 60 ton Crane	0.50	1.50	3.40	4.5	264	2,030	6,090
Hydro Crane 75-80 Ton RT	0.22	0.33	3.40	4.5	264	902	1,353
2250 Manitowoc 300 Ton (track mounted crane)	0.17	0.50	3.40	7.6	264	1,137	3,410
40' - 60' Manlift	1.25	3.75	4.00	1.2	264	1,522	4,565
90' Manlift	0.75	2.25	4.00	1.2	264	913	2,739
Forklift	0.61	1.50	2.40	2.0	264	787	1,931
Diesel Welder 400 Amp	0.89	2.17	3.60	0.6	264	539	1,315
185 CFM Compressor	0.67	1.92	3.80	1.4	264	951	2,734
Light Tower 5 KW	1.06	2.83	5.00	0.6	264	890	2,388
Water Truck 4000 Gal	0.44	1.00	5.00	1.6	264	918	2,066
Track 330 Excavator	0.14	0.42	4.60	4.9	264	826	2,478
RT Hoe 710 (Backhoe)	0.42	1.25	3.70	3.2	264	1,303	3,910
Roller	0.39	0.92	4.60	2.7	264	1,294	3,051
950/960 Loader	0.47	1.25	4.30	7.3	264	3,918	10,371
Cat D6 Dozer	0.08	0.25	5.20	6.5	264	747	2,240
Dump Truck	0.08	0.25	4.60	1.6	264	158	475
Grader	0.17	0.33	4.60	3.7	264	740	1,479
Fusion Machine	0.50	1.50	5.00	0.6	264	421	1,264
Asphalt Paver	0.03	0.00	4.70	2.2	264	76	0
Paving Equipment	0.03	0.00	4.70	2.2	264	76	0
Total =						20,869	54,760

Table G-2.16
Equipment Schedule

Duration of Construction Period:	16	Months	Avg const. day/year			264											
Month		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Construction Workers		50	90	118	164	181	216	242	284	283	236	188	124	83	54	32	29
Major Construction Equipment	HP																
Hydro Crane 35-50 Ton RT	200					1	1	1	1	1	1	1	1				
RT 760 - 60 ton Crane	250		1	1	1	2	2	2	2	2	2	2	1				
Hydro Crane 75-80 Ton RT	250									1	1	1	1	1	1	1	1
2250 Manitowoc 300 Ton (track mounted crane)	420					1	1	1	1	1	1						
40' - 60' Manlift	85					3	5	8	9	8	6	4	2				
90' Manlift	85					2	3	4	6	4	4	2	2				
Forklift	100	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1
Diesel Welder 400 Amp	22		2	2	2	2	2	2	3	3	3	3	2	2	2	1	1
185 CFM Compressor	49	2	2	2	2	2	2	2	2	2	2	2	1	1			
Light Tower 5 KW	22	2	3	3	3	3	3	3	3	3	3	3	2	1	1	1	1
Water Truck 4000 Gal	225	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Track 330 Excavator	268	1	1	1	1	1											
RT Hoe 710 (Backhoe)	150		2	2	2	2	1	1	1	1	1	1	1				
Roller	100		1	1	1	1	1	1	1	1	1	1	1	1	1		1
950/960 Loader	280		2	2	2	2	1	1	1	1	1	1	1	1	1		
Cat D6 Dozer	250	1	1	1													
Dump Truck	250	1	1	1													
Grader	200	1	1	1									1	1	1		
Fusion Machine	22	3	3	3	3	3	3										
Asphalt Paver	120																1
Paving Equipment	120																1
Pickup trucks		27	28	28	39	39	42	37	37	36	36	31	30	24	18	17	
Concrete Deliveries			6	6	6	6	6	3	1	1	1						
Light/Medium Deliveries		3	3	6	12	15	21	21	21	21	21	21	21	21	15	15	
HD Truck Delivery						1	1	1	1	1							

Note:

1. Construction schedule is provided by the applicant.
- Total month construction 16 months
- Days per week 5 days
- Days per month 22 days

- Hours per day 8 hours

2. Construction phases are provided by the applicant and listed as follows:

- Clearing and grubbing month 1
- Underground water line relocation month 2
- Access road widening work month 1-2
- Site grading month 2-3
- Underground gas and waste water linear month 2-3
- Relocation of the reclaimed/recycled water line month 2-3
- Facilities building month 4-15
- Lateral construction month 10-11
- Solar field month 15-16
- Asphalt paving month 16

3. Deliveries trip per day, distance, and origins are based on the information provided by the applicant and assumptions.

4. Worker passenger vehicles will park in the laydown area so there's no on-site travelling.

5. It is assumed the numbers of worker passenger vehicles are the numbers of workers divided by 1.5

Table G-2.17
Onsite Equipment Combustion Emission Factors

	Offroad Combustion Factors																				
					Base Factors g/bhp, if Tier 1 >50 hp (1)					**Adjustment (2)**						**Adjustment (3)**	**Adjusted Factors (g/bhp)**				
Dust Process Units per Hour per unit	Road dust suppression Abatement Factor	HP Cat.	Tier	BSFC lb/hp	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fuel S	BSFC	NOx	CO	VOC	SOx	PM10
0	0.000	175-300	2	0.367	4	0.7475	0.3085	0.00499	0.1316	None	1	1	1	1	1	-0.08585669	0.367	4	0.7475	0.3085	0.00487	0.04574
0	0.000	300-600	2	0.367	4.3351	0.8425	0.1669	0.00499	0.1316	None	1	1	1	1	1	-0.08585669	0.367	4.3351	0.8425	0.1669	0.00488	0.04574
0	0.000	300-600	2	0.367	4.3351	0.8425	0.1669	0.00499	0.1316	None	1	1	1	1	1	-0.08585669	0.367	4.3351	0.8425	0.1669	0.00488	0.04574
0	0.000	300-600	2	0.367	4.3351	0.8425	0.1669	0.00499	0.1316	None	1	1	1	1	1	-0.08585669	0.367	4.3351	0.8425	0.1669	0.00488	0.04574
0	0.000	50-100	2	0.408	4.7	2.3655	0.3672	0.00555	0.24	LoLF	1.1	2.57	2.29	1.18	1.97	-0.112629	0.48144	5.17	6.07934	0.84089	0.00638	0.36017
0	0.000	50-100	2	0.408	4.7	2.3655	0.3672	0.00555	0.24	LoLF	1.1	2.57	2.29	1.18	1.97	-0.112629	0.48144	5.17	6.07934	0.84089	0.00638	0.36017
3	0.915	50-100	2	0.408	4.7	2.3655	0.3672	0.00555	0.24	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.09640279	0.41208	4.465	3.61922	0.38556	0.00547	0.1988
0	0.000	16-25	2	0.408	4.4399	2.161	0.438	0.00555	0.2665	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.09640279	0.41208	4.21791	3.30633	0.4599	0.00547	0.23139
0	0.000	26-50	2	0.408	4.728	1.5323	0.2789	0.00555	0.3389	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.09640279	0.41208	4.4916	2.34442	0.29285	0.00547	0.32044
0	0.000	16-25	2	0.408	4.4399	2.161	0.438	0.00555	0.2665	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.09640279	0.41208	4.21791	3.30633	0.4599	0.00547	0.23139
3	0.915	Onroad	Onroad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94.5	0.000	100-175	2	0.367	4.1	0.8667	0.3384	0.00499	0.18	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.895	1.32605	0.35532	0.00492	0.13468
126	0.000	100-175	2	0.367	4.1	0.8667	0.3384	0.00499	0.18	LoLF	1.1	2.57	2.29	1.18	1.97	-0.10131089	0.43306	4.51	2.22742	0.77494	0.00574	0.25329
3	0.000	100-175	2	0.367	4.1	0.8667	0.3384	0.00499	0.18	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.895	1.32605	0.35532	0.00492	0.13468
1	0.000	175-300	2	0.367	4	0.7475	0.3085	0.00499	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.8	1.14368	0.32393	0.00492	0.07515
1	0.000	100-175	2	0.367	4.1	0.8667	0.3384	0.00499	0.18	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.895	1.32605	0.35532	0.00492	0.13468
3	0.915	Onroad	Onroad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.000	175-300	2	0.367	4	0.7475	0.3085	0.00499	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.8	1.14368	0.32393	0.00492	0.07515
0	0.000	16-25	2	0.408	4.4399	2.161	0.438	0.00555	0.2665	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.09640279	0.41208	4.21791	3.30633	0.4599	0.00547	0.23139
3	0.000	175-300	2	0.367	4	0.7475	0.3085	0.00499	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.8	1.14368	0.32393	0.00492	0.07515
3	0.000	175-300	2	0.367	4	0.7475	0.3085	0.00499	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.08671526	0.37067	3.8	1.14368	0.32393	0.00492	0.07515

(1) - Steady State Emission Factors from Table A4 of EPA July 2010 NR-009d Publication.

(2) - In use adjustment factors per Table A5 EPA July 2010 NR-009d Publication.

(3) - PM10 and SO2 adjustments due to Equation 3 and Equation 5 on pages 6 and 23, Respectively of EPA Report No. NR-009d

(4) - PM2.5 = PM10 * 0.97 per page 25 of EPA Report No. NR-009d

Table G-2.18
Adjusted Emission Factors

							Total Daily Fuel Use(5) (Gals/day)	Daily Emissions	Lbs/day				Total Annual Fuel Use(6) (Gals/yr)	Annual Emissions	Lbs/yr			
	Adjusted factors lbs/1000 gallon (4)																	
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Hydro Crane 35-50 Ton RT	2	170.60	31.88	13.16	0.21	1.95	12.30	2.10	0.39	0.16	0.00	0.02	2,165	369.38	69.03	28.49	0.45	4.22
RT 760 - 60 ton Crane	2	184.89	35.93	7.12	0.21	1.95	30.76	5.69	1.11	0.22	0.01	0.06	6,090	1125.92	218.82	43.35	1.27	11.88
Hydro Crane 75-80 Ton RT	2	184.89	35.93	7.12	0.21	1.95	0.00	0.00	0.00	0.00	0.00	0.00	1,353	250.20	48.63	9.63	0.28	2.64
2250 Manitowoc 300 Ton (track mounted crane)	2	184.89	35.93	7.12	0.21	1.95	25.83	4.78	0.93	0.18	0.01	0.05	3,410	630.52	122.54	24.27	0.71	6.65
40' - 60' Manlift	2	168.09	197.65	27.34	0.21	11.71	41.50	6.98	8.20	1.13	0.01	0.49	4,565	767.29	902.25	124.80	0.95	53.45
90' Manlift	2	168.09	197.65	27.34	0.21	11.71	27.67	4.65	5.47	0.76	0.01	0.32	2,739	460.38	541.35	74.88	0.57	32.07
Forklift	2	169.60	137.47	14.65	0.21	7.55	9.75	1.65	1.34	0.14	0.00	0.07	1,931	327.43	265.41	28.27	0.40	14.58
Diesel Welder 400 Amp	2	160.21	125.59	17.47	0.21	8.79	6.90	1.10	0.87	0.12	0.00	0.06	1,315	210.63	165.11	22.97	0.27	11.55
185 CFM Compressor	2	170.61	89.05	11.12	0.21	12.17	10.81	1.84	0.96	0.12	0.00	0.13	2,734	466.47	243.48	30.41	0.57	33.28
Light Tower 5 KW	2	160.21	125.59	17.47	0.21	8.79	9.58	1.53	1.20	0.17	0.00	0.08	2,388	382.55	299.87	41.71	0.50	20.99
Water Truck 4000 Gal	Onroad	173.70	86.54	15.22	0.21	7.61	7.83	1.36	0.68	0.12	0.00	0.06	2,066	358.83	178.77	31.44	0.43	15.72
Track 330 Excavator	2	164.48	56.00	15.00	0.21	5.69	0.00	0.00	0.00	0.00	0.00	0.00	2,478	407.56	138.75	37.18	0.51	14.09
RT Hoe 710 (Backhoe)	2	163.01	80.51	28.01	0.21	9.15	11.85	1.93	0.95	0.33	0.00	0.11	3,910	637.35	314.78	109.51	0.81	35.79
Roller	2	164.48	56.00	15.00	0.21	5.69	12.61	2.07	0.71	0.19	0.00	0.07	3,051	501.84	170.85	45.78	0.63	17.35
950/960 Loader	2	160.47	48.29	13.68	0.21	3.17	31.43	5.04	1.52	0.43	0.01	0.10	10,371	1664.26	500.89	141.87	2.16	32.91
Cat D6 Dozer	2	164.48	56.00	15.00	0.21	5.69	0.00	0.00	0.00	0.00	0.00	0.00	2,240	368.38	125.41	33.61	0.47	12.74
Dump Truck	Onroad	173.70	86.54	15.22	0.21	7.61	0.00	0.00	0.00	0.00	0.00	0.00	475	82.53	41.12	7.23	0.10	3.62
Grader	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	1,479	237.38	71.44	20.24	0.31	4.69
Fusion Machine	2	160.21	125.59	17.47	0.21	8.79	0.00	0.00	0.00	0.00	0.00	0.00	1,264	202.53	158.76	22.08	0.26	11.11
Asphalt Paver	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Paving Equipment	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00

(1) - Steady State Emission Factors from Table A4 of EPA July 2010 NR-009d Publication.

(2) - In use adjustment factors per Table A5 EPA July 2010 NR-009d Publication.

(3) - PM10 and SO2 adjustments due to Equation 3 and Equation 5 on pages 6 and 23, Respectively of EPA Report No. NR-009d

(4) - Calculation uses adjusted BSFC and assumed 7.1 lbs/gallon. The onroad emission factors are not adjusted.

(5) - Daily fuel use based on peak combustion month equipment schedule.

(6) - Annual fuel use based on average level during peak 12-month period.

Table G-2.19
Combustion Emission Ranking

Combustion Emission Ranking Equipment	Hrs/Day Per Unit (1)	Gals/Hr Per Unit	Month															
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Hydro Crane 35-50 Ton RT	3.4	3.6	0	0	0	0	12	12	12	**12**	12	12	12	12	0	0	0	0
RT 760 - 60 ton Crane	3.4	12.9	0	44	44	44	88	88	88	**88**	88	88	88	44	0	0	0	0
Hydro Crane 75-80 Ton RT	3.4	12.9	0	0	0	0	0	0	0	**0**	44	44	44	44	44	44	44	44
2250 Manitowoc 300 Ton (track mounted crane)	3.4	21.7	0	0	0	0	74	74	74	**74**	74	74	0	0	0	0	0	0
40' - 60' Manlift	4	5.8	0	0	0	0	69	115	184	**207**	184	138	92	46	0	0	0	0
90' Manlift	4	5.8	0	0	0	0	46	69	92	**138**	92	92	46	46	0	0	0	0
Forklift	2.4	5.8	14	14	14	14	28	28	28	**28**	28	28	14	14	14	14	14	14
Diesel Welder 400 Amp	3.6	1.3	0	9	9	9	9	9	9	**14**	14	14	14	9	9	9	5	5
185 CFM Compressor	3.8	2.8	22	22	22	22	22	22	22	**22**	22	22	22	11	11	0	0	0
Light Tower 5 KW	5	1.3	13	19	19	19	19	19	19	**19**	19	19	19	13	6	6	6	6
Water Truck 4000 Gal	5	3.1	16	16	16	16	16	16	16	**16**	16	16	16	16	16	16	16	16
Track 330 Excavator	4.6	14.0	64	64	64	64	64	0	0	**0**	0	0	0	0	0	0	0	0
RT Hoe 710 (Backhoe)	3.7	9.1	0	68	68	68	68	34	34	**34**	34	34	34	34	0	0	0	0
Roller	4.6	7.8	0	36	36	36	36	36	36	**36**	36	36	36	36	36	36	0	36
950/960 Loader	4.3	14.6	0	126	126	126	126	63	63	**63**	63	63	63	63	63	63	0	0
Cat D6 Dozer	5.2	13.1	68	68	68	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Dump Truck	4.6	3.1	14	14	14	0	0	0	0	**0**	0	0	0	0	0	0	0	0
Grader	4.6	10.4	48	48	48	0	0	0	0	**0**	0	0	0	48	48	48	0	0
Fusion Machine	5	1.3	19	19	19	19	19	19	0	**0**	0	0	0	0	0	0	0	0
Asphalt Paver	4.7	6.3	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	29
Paving Equipment	4.7	6.3	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	29
		Total =	278	567	567	436	696	604	677	**751**	725	679	499	436	247	236	84	179
		12-month Total =												6914	6883	6552	6070	5813

Table G-2.20
Vehicle Emission Factors

	Emission Factors (1)					
	NOx	CO	VOC	SOx	PM10	
Truck Hauling (lbs/vmt)	0.03205	0.01597	0.00281	0.00004	0.00140	
Truck Hauling (lbs/1000 gals)	173.70	86.54	15.22	0.21	7.61	
Notes:						
(1) From EMFAC 2007 V.2.3, heavy-heavy duty Diesel trucks, fleet average for calendar year 2011, Fresno County.						
	Emission Factors					
	NOx	CO	POC	SOx	PM10	
Light Duty Trucks/Cars (lbs/vmt)(1)	0.00081	0.00809	0.00077	0.00001	0.00009	
Light Duty Trucks (lbs/1000 gals)(2)	18.19	157.61	14.43	0.18	1.92	
Medium Duty Trucks (lbs/1000 gals)(3)	17.57	136.64	11.07	0.18	1.51	

Notes:
(1) From EMFAC 2007 V.2.3, average of light duty automobiles and light duty trucks, fleet average for calendar year 2011.
(2) From EMFAC 2007 V.2.3, light duty trucks (gasoline and Diesel), fleet average for calendar year 2011.
(3) From EMFAC EMFAC 2007 V.2.3, medium duty trucks (gasoline and Diesel), fleet average for calendar year 2011.

Gasoline Equipment Factors - Small Engines					
			(gm/bhp-hr)		
	NOx	CO	POC	SO2	PM10
Small Equipment(1) (g/bhp-hr)	0.0066	0.082	0.0010	0.00059	0.00072
Small Equipment(1) (lb/1000 gal)	116.78	1459.70	17.75	10.49	12.80

Notes:

(1) NOx, CO and VOC factors reflect Tier 1 Emissions Standards for Large SI Engines, effective starting in 2004.
SO2 and PM10 factors from AP-42 Table 3.3-1.

Table G-2.21: EmFac Emissions Inventory (tons per day)

Title : 2011 Annual San Diego County
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2010/11/24 16:25:30
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season : Annual
Area : San Diego County
I/M Stat : Enhanced Interim (2005)
Emissions: Tons Per Day

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	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCAT	LDT1-CAT	LDT1-DSL	LDT1-TOT	LDT2-NCAT	LDT2-CAT	LDT2-DSL	LDT2-TOT	MDV-NCAT	MDV-CAT	MDV-DSL	MDV-TOT	HDT1-NCA	HDT1-CA	HDT1-DSL	HDT1-TO	HDT2-NCA	HDT2-CA	HDT2-DSL	HDT2-TO	MHDT-NCA	MHDT-CAT
Vehicles	10799	1177670	3662	1192130	3846	190927	9152	203925	2601	548192	1010	551803	1629	212372	851	214852	154	30957	9336	40447	58	5695	5846	11599	365	3421
VMT/1000	177	42986	88	43251	75	7416	299	7790	51	21118	30	21199	38	8725	31	8794	4	1397	444	1844	1	243	243	487	3	171
Trips	42501	7404550	19802	7466860	15257	1200740	55985	1271980	10405	3448290	5887	3464580	6912	1341740	5280	1353930	5089	1023640	117438	1146170	1922	188320	73536	263779	16650	156243
Reactive Organic Gas Emissions																										
Run Exh	1.23	3.2	0.01	4.44	0.54	0.43	0.02	1	0.36	1.63	0	2	0.36	0.89	0	1.25	0.03	0.62	0.1	0.74	0.01	0.09	0.08	0.17	0.02	0.1
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0	0.04	0	0.01	0	0.01	0	0.01
Start Ex	0.24	3.89	0	4.14	0.09	0.52	0	0.6	0.06	1.98	0	2.04	0.05	0.99	0	1.04	0.03	0.61	0	0.65	0.01	0.11	0	0.13	0.16	0.22
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Total Ex	1.47	7.09	0.01	8.58	0.63	0.95	0.02	1.6	0.42	3.62	0	4.04	0.41	1.89	0	2.3	0.06	1.27	0.1	1.43	0.02	0.21	0.08	0.3	0.19	0.33
Diurnal	0.07	0.83	0	0.9	0.02	0.12	0	0.14	0.02	0.38	0	0.4	0	0.13	0	0.13	0	0	0	0	0	0	0	0	0	0
Hot Soak	0.15	1.36	0	1.51	0.05	0.21	0	0.26	0.04	0.63	0	0.67	0.01	0.21	0	0.22	0	0.05	0	0.06	0	0.01	0	0.01	0.01	0.01
Running	0.84	3.58	0	4.42	0.19	0.9	0	1.09	0.12	3.04	0	3.15	0.02	0.97	0	0.99	0.02	0.71	0	0.73	0.01	0.14	0	0.15	0.08	0.1
Resting	0.06	0.63	0	0.69	0.02	0.1	0	0.12	0.01	0.3	0	0.31	0	0.11	0	0.11	0	0	0	0	0	0	0	0	0	0
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Total	2.58	13.5	0.01	16.09	0.91	2.28	0.02	3.21	0.6	7.97	0	8.58	0.44	3.3	0	3.75	0.09	2.04	0.1	2.23	0.03	0.36	0.08	0.47	0.27	0.43
Carbon Monoxide Emissions																										
Run Exh	15.61	100.66	0.07	116.35	6.64	19.44	0.19	26.27	4.44	64.39	0.02	68.85	5.92	28.7	0.02	34.63	0.55	6.92	0.55	8.01	0.18	1	0.35	1.53	0.5	1.67
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0.01	0.27	0	0.05	0.01	0.05	0	0.04
Start Ex	1.42	45.58	0	47	0.52	7.37	0	7.89	0.35	25.37	0	25.72	0.44	11.2	0	11.64	0.23	7.58	0	7.81	0.09	1.28	0	1.36	1.1	3.78
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Total Ex	17.03	146.24	0.07	163.35	7.16	26.81	0.19	34.16	4.78	89.76	0.02	94.57	6.36	39.9	0.02	46.27	0.77	14.76	0.56	16.09	0.27	2.33	0.35	2.95	1.61	5.5
Oxides of Nitrogen Emissions																										
Run Exh	0.86	10.22	0.15	11.23	0.36	1.76	0.51	2.64	0.24	8.89	0.05	9.19	0.3	4.45	0.05	4.8	0.01	0.92	1.93	2.86	0	0.16	1.31	1.47	0.01	0.45
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.03	0	0	0.02	0.02	0	0
Start Ex	0.07	3.01	0	3.07	0.02	0.48	0	0.5	0.02	2.51	0	2.53	0.02	1.13	0	1.15	0	1.99	0	1.99	0	0.37	0	0.37	0.02	0.49
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Total Ex	0.93	13.23	0.15	14.31	0.39	2.24	0.51	3.14	0.26	11.41	0.05	11.72	0.31	5.58	0.05	5.95	0.01	2.9	1.96	4.87	0	0.52	1.32	1.85	0.03	0.94
Carbon Dioxide Emissions (000)																										
Run Exh	0.1	18.19	0.03	18.33	0.04	3.91	0.11	4.07	0.03	11.17	0.01	11.21	0.03	6.31	0.01	6.35	0	1.49	0.25	1.75	0	0.26	0.14	0.4	0	0.13
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0
Start Ex	0.01	0.59	0	0.6	0	0.12	0	0.12	0	0.34	0	0.34	0	0.18	0	0.18	0	0.05	0	0.05	0	0.01	0	0.01	0	0.01
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Total Ex	0.11	18.78	0.03	18.93	0.05	4.03	0.11	4.19	0.03	11.51	0.01	11.56	0.03	6.5	0.01	6.54	0.01	1.55	0.26	1.81	0	0.27	0.14	0.41	0.01	0.14
PM10 Emissions																										
Run Exh	0.01	0.59	0.01	0.61	0	0.11	0.01	0.13	0	0.7	0	0.71	0	0.28	0	0.29	0	0.02	0.02	0.05	0	0	0.02	0.02	0	0
Idle Exh	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
Start Ex	0	0.06	0	0.06	0	0.01	0	0.01	0	0.06	0	0.06	0	0.02	0	0.02	0	0	0	0	0	0	0	0	0	0
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Total Ex	0.01	0.65	0.01	0.67	0	0.12	0.01	0.14	0	0.77	0	0.77	0	0.31	0	0.31	0	0.03	0.02	0.05	0	0	0.02	0.02	0	0
TireWear	0	0.38	0	0.38	0	0.07	0	0.07	0	0.19	0	0.19	0	0.08	0	0.08	0	0.02	0.01	0.02	0	0	0	0.01	0	0
BrakeWr	0	0.59	0	0.6	0	0.1	0	0.11	0	0.29	0	0.29	0	0.12	0	0.12	0	0.02	0.01	0.03	0	0	0	0.01	0	0
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Total	0.01	1.62	0.01	1.65	0	0.29	0.02	0.32	0	1.24	0	1.25	0	0.51	0	0.51	0	0.06	0.04	0.1	0	0.01	0.02	0.04	0	0.01
Lead	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
SOx	0	0.18	0	0.18	0	0.04	0	0.04	0	0.11	0	0.11	0	0.06	0	0.06	0	0.02	0	0.02	0	0	0	0	0	0
Fuel Consumption (000 gallons)																										
Gasoline	14.63	1948.96	0	1963.59	6.11	417.64	0	423.75	4.15	1194.35	0	1198.5	4.16	672.06	0	676.22	0.67	161.1	0	161.77	0.23	27.98	0	28.21	0.96	15.05
Diesel	0	0	3.12	3.12	0	0	10.27	10.27	0	0	1.04	1.04	0	0	1.05	1.05	0	0	23.03	23.03	0	0	12.87	12.87	0	0

Table G-2.21 Cont.

MHDT-DSL	MHDT-TOT	HDT-NCA	HDT-CAT	HDT-DSL	HDT-TOT	BUS-NCA	BUS-CAT	BUS-DSL	BUS-TOT	BUS-NCA	SBUS-CAT	SBUS-DSL	SBUS-TOT	UB-NCAT	UB-CAT	UB-DSL	UB-TOT	MH-NCAT	MH-CAT	MH-DSL	MH-TOT	MCY-NCAT	MCY-CAT	MCY-DSL	MCY-TOT	ALL-TOT
15142	18928	39	525	8344	8908	27	814	864	1704	64	240	1798	2102	8	157	714	880	891	24873	3044	28808	54097	30036	0	84132	2360220
1003	1177	1	51	1516	1567	0	42	55	97	3	11	85	100	1	22	101	124	9	330	41	380	467	330	0	797	87607
424576	597468	1787	23990	42223	68000	1232	37162	24219	62614	256	960	7193	8408	33	628	2857	3518	89	2488	304	2882	108182	60065	0	168247	1.6E+07
0.25	0.37	0.01	0.18	1.65	1.84	0	0.03	0.01	0.04	0.02	0.02	0.03	0.08	0.01	0.02	0.09	0.12	0.06	0.13	0	0.19	2.19	0.79	0	2.98	15.22
0.01	0.01	0	0	0.19	0.19	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.26
0	0.39	0.03	0.11	0	0.15	0.01	0.05	0	0.07	0	0	0	0.01	0	0	0	0	0	0	0	0	0.28	0.14	0	0.42	9.62
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0.25	0.77	0.04	0.29	1.84	2.17	0.01	0.08	0.01	0.11	0.03	0.03	0.04	0.09	0.01	0.03	0.09	0.12	0.06	0.13	0	0.2	2.47	0.93	0	3.4	25.11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.13	0	0.16	1.74
0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.05	0	0.07	2.82
0	0.17	0.01	0.02	0	0.03	0.01	0.01	0	0.02	0	0	0	0.01	0	0	0	0	0	0.01	0	0.01	0.14	0.19	0	0.33	11.1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.08	0	0.1	1.34
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0.25	0.96	0.05	0.31	1.84	2.2	0.02	0.1	0.01	0.13	0.03	0.03	0.04	0.1	0.01	0.03	0.09	0.13	0.06	0.15	0	0.21	2.68	1.38	0	4.06	42.11
2.37	4.54	0.32	2.48	6.8	9.61	0.04	0.48	0.12	0.64	0.53	0.28	0.29	1.1	0.22	0.21	0.4	0.83	1.4	3.64	0.05	5.08	30.16	5.42	0	35.58	313.04
0.04	0.09	0	0	0.74	0.74	0	0.01	0	0.01	0.01	0.02	0.03	0.05	0	0	0	0	0	0	0	0	0	0	0	0	1.22
0	4.89	0.55	1.61	0	2.17	0.08	0.92	0	1.01	0.02	0.06	0	0.08	0	0.03	0	0.03	0.01	0.04	0	0.05	0.93	0.85	0	1.78	111.42
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2.41	9.52	0.87	4.1	7.54	12.51	0.12	1.42	0.13	1.66	0.56	0.35	0.32	1.23	0.23	0.23	0.4	0.86	1.41	3.68	0.05	5.13	31.09	6.27	0	37.36	425.68
8.48	8.94	0.01	0.66	22.48	23.15	0	0.15	0.42	0.57	0.01	0.04	1.05	1.11	0	0.06	2	2.06	0.03	0.49	0.36	0.88	0.68	0.39	0	1.06	69.95
0.12	0.12	0	0	1.73	1.73	0	0	0.01	0.01	0	0	0.08	0.08	0	0	0	0	0	0	0	0	0	0	0	0	1.99
0	0.51	0.01	0.21	0	0.22	0	0.13	0	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.02	0	0.06	10.55
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8.61	9.57	0.02	0.88	24.21	25.11	0	0.28	0.43	0.71	0.01	0.05	1.13	1.19	0	0.07	2	2.07	0.03	0.49	0.36	0.88	0.72	0.4	0	1.12	82.49
1.66	1.8	0	0.03	3.06	3.09	0	0.03	0.09	0.12	0	0.01	0.14	0.15	0	0.02	0.3	0.32	0.01	0.25	0.07	0.32	0.06	0.07	0	0.13	48.05
0.01	0.01	0	0	0.1	0.1	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.13
0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	1.33
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1.67	1.81	0	0.03	3.16	3.2	0	0.03	0.09	0.13	0	0.01	0.15	0.16	0	0.02	0.3	0.32	0.01	0.25	0.07	0.32	0.07	0.07	0	0.14	49.51
0.29	0.29	0	0	0.96	0.96	0	0	0.02	0.02	0	0	0.04	0.04	0	0	0.03	0.04	0	0	0.01	0.01	0.03	0	0	0.03	3.19
0	0	0	0	0.03	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03
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	0.17
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0.29	0.29	0	0	0.99	0.99	0	0	0.02	0.02	0	0	0.04	0.04	0	0	0.03	0.04	0	0	0.01	0.01	0.03	0	0	0.03	3.39
0.01	0.02	0	0	0.06	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0.83
0.01	0.02	0	0	0.05	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0.01	1.23
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
0.32	0.33	0	0	1.09	1.1	0	0	0.02	0.02	0	0	0.05	0.05	0	0	0.04	0.04	0	0.01	0.01	0.02	0.04	0	0	0.04	5.46
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
0.02	0.02	0	0	0.03	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48
0	16.01	0.23	4.18	0	4.41	0.07	3.69	0	3.76	0.38	1.1	0	1.48	0.14	1.92	0	2.05	0.95	26.14	0	27.09	12.65	8.65	0	21.3	4528.15
150.31	150.31	0	0	284.71	284.71	0	0	8.24	8.24	0	0	13.14	13.14	0	0	26.8	26.8	0	0	6.11	6.11	0	0	0	0	540.69

Table G-2.22
Dust Emission Ranking

Dust Emission Ranking Equipment	Hrs/Day Per Unit (1)	PM10 lbs/hr Per Unit	Month															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Hydro Crane 35-50 Ton RT	3.4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RT 760 - 60 ton Crane	3.4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydro Crane 75-80 Ton RT	3.4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2250 Manitowoc 300 Ton (track mounted crane)	3.4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40' - 60' Manlift	4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90' Manlift	4	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	2.4	0.4	1.05	1.05	1.05	1.05	2.09	2.09	2.09	2.09	2.09	2.09	1.05	1.05	1.05	1.05	1.05	1.05
Diesel Welder 400 Amp	3.6	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
185 CFM Compressor	3.8	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Light Tower 5 KW	5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Truck 4000 Gal	5	0.7	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62
Track 330 Excavator	4.6	0.0	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RT Hoe 710 (Backhoe)	3.7	0.2	0.00	1.41	1.41	1.41	1.41	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.00	0.00	0.00	0.00
Roller	4.6	0.8	0.00	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	0.00	3.80
950/960 Loader	4.3	0.3	0.00	2.37	2.37	2.37	2.37	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	0.00	0.00
Cat D6 Dozer	5.2	0.4	2.18	2.18	2.18	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
Dump Truck	4.6	0.4	1.68	1.68	1.68	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
Grader	4.6	0.3	1.27	1.27	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	1.27	1.27	0.00	0.00
Fusion Machine	5	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Paver	4.7	0.8	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	3.88
Paving Equipment	4.7	0.8	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	3.88
Total			9.8	17.4	17.4	12.3	13.3	11.4	11.4	11.4	11.4	11.4	10.3	11.6	10.9	10.9	4.7	16.2
			56%	100%	100%	71%	77%	66%	66%	66%	66%	66%	60%	12 67%	13 63%	12 63%	11 27%	11 93%

APPENDIX G-3

Emissions and Operating Parameters

Table G-3.1

Pio Pico Energy Center

Emissions and Operating Parameters for Gas Turbine

Case	1) Hot Peak	2) Avg Peak	3) Cold Peak	4) Hot Low	5) Avg Low	6) Cold Low
CTG Gross Power, MW	100	100	100	100	100	100
Ambient Temp, F	110	63	30	122	63	30
Turbine Load, %	100%	100%	100%	50%	50%	50%
CTG Heat Input, MMBTU/Hr (HHV)	852	903	890	653	546	542
Stack Flow, lb/hr	1,598,692	1,691,263	1,730,193	1,312,293	1,158,831	1,168,649
Stack Flow, acfm	877,825	913,717	909,632	733,309	646,428	645,580
Stack Flw, dscfm	320,354	340,311	349,912	263,898	236,320	238,986
Stack Temp, F	802	785	754	825	831	820
Stack Exhaust, vol %						
O2 (dry)	13.07%	13.08%	13.40%	13.60%	14.10%	14.22%
CO2 (dry)	4.50%	4.49%	4.31%	4.20%	3.92%	3.85%
H2O	11.43%	10.86%	10.23%	11.06%	9.22%	8.85%
Emissions						
NOx, ppmvd @ 15% O2	2.5	2.5	2.5	2.5	2.5	2.5
NOx, lb/hr	7.72	8.18	8.07	5.92	4.94	4.92
NOx, lb/MMBtu	0.0091	0.0091	0.0091	0.0091	0.0091	0.0091
SO2, ppmvd @ 15% O2	0.4	0.4	0.4	0.4	0.4	0.4
SO2, lb/hr short-term)	1.79	1.90	1.87	1.38	1.15	1.14
SO2, lb/MMBtu (short-term)	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021
SO2, lb/hr (long-term)	0.60	0.63	0.62	0.46	0.38	0.38
SO2, lb/MMBtu (long-term)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
CO, ppmvd @ 15% O2	4.0	4.0	4.0	4.0	4.0	4.0
CO, lb/hr	7.52	7.97	7.86	5.77	4.82	4.79
CO, lb/MMBtu	0.0088	0.0088	0.0088	0.0088	0.0088	0.0088
VOC, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0
VOC, lb/hr	2.15	2.28	2.25	1.65	1.38	1.37
VOC, lb/MMBtu	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
PM10, gr/dscf	0.0020	0.0019	0.0018	0.0024	0.0027	0.0027
PM10, lb/hr	5.50	5.50	5.50	5.50	5.50	5.50
PM10, lb/MMBtu	0.0065	0.0061	0.0062	0.0084	0.0101	0.0101
NH3, ppmvd @ 15% O2	5.0	5.0	5.0	5.0	5.0	5.0
NH3, lb/hr	5.71	6.05	5.96	4.38	3.66	3.63

Table G-3.2
Calculation of Wet SAC Emissions
Pio Pico Energy Center

Typical Worst-Case Design Parameters		
	Per Cell	Total
Water Flow Rate, 10E6 lbm/hr	0.980	11.755
Water Flow Rate, gal/min	1960.000	23520.000
Drift Rate, %	0.001	0.001
Drift, lbm water/hr	9.796	117.553
PM10 Emissions based on TDS Level		
TDS level, ppm	5600.000	5600.000
PM, lb/hr	0.055	0.658
PM, lb/day	1.317	15.799
PM, tpy	0.119	1.428
PM10, lb/hr	0.055	0.658
PM10, lb/day	1.317	15.799
PM10, tpy	0.119	1.428
PM2.5, lb/hr	0.055	0.658
PM2.5, lb/day	1.317	15.799
PM2.5, tpy	0.119	1.428
PM2.5, g/s	6.912E-03	8.295E-02
Based on 4337	hrs/yr	

Table G-3.3
Pio Pico Energy Center
Detailed Calculations for Maximum Hourly, Daily, and Annual Criteria Pollutant Emissions

Daily Emission Scenario		NOx	SOx	CO	VOC	PM10
Equipment	hrs/day	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
Gas Turbine, baseload (each)	16	8.18	1.90	7.97	2.28	5.5
Gas Turbine, shutdowns	4	12.68	1.90	53.51	5.81	5.5
Gas Turbine, startups	4	26.63	1.90	21.84	6.53	5.5

Annual Emission Scenario		NOx	SOx	CO	VOC	PM10
Equipment	hrs/yr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
Gas Turbine, baseload (each)	3335	8.18	0.63	7.97	2.28	5.5
Gas Turbine, shutdowns	500	12.68	0.63	53.51	5.81	5.5
Gas Turbine, startups	500	26.63	0.63	21.84	6.53	5.5

NOTE: Annual SO2 emissions based on 0.25 gr/100 scf

	NOx			SOx			CO			VOC			PM10		
	Max	Max	Total	Max	Max	Total	Max	Max	Total	Max	Max	Total	Max	Max	Total
Equipment	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy
Gas Turbine 1	26.6	288.1	23.5	1.9	45.6	1.4	53.5	428.9	32.1	6.5	85.9	6.9	5.5	132.0	11.92
Gas Turbine 2	26.6	288.1	23.5	1.9	45.6	1.4	53.5	428.9	32.1	6.5	85.9	6.9	5.5	132.0	11.92
Gas Turbine 3	26.6	288.1	23.5	1.9	45.6	1.4	53.5	428.9	32.1	6.5	85.9	6.9	5.5	132.0	11.92
Cooling Tower	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	0.8	0.1
Total	79.9	864.3	70.4	5.7	136.8	4.1	160.5	1286.6	96.4	19.6	257.7	20.7	16.5	396.8	35.8
	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy	lb/hr	lb/day	tpy

Table G-3.4
Startup Emissions
Pio Pico Energy Center
Maximum Hour Emissions

	0-30 minutes	31-60 minutes	lb/hr
NOx, lbs	22.54	4.09	26.63
CO, lbs	17.86	3.98	21.84
VOC, lbs	4.67	1.14	5.81

Table G-3.5
Shutdown Emissions
Pio Pico Energy Center
Maximum Hour Emissions

	10-49 minutes	50-60 minutes	lb/hr
NOx, lbs	6.68	6.00	12.68
CO, lbs	6.51	47.00	53.51
VOC, lbs	1.86	4.67	6.53

Table G-3.6
Commissioning Emissions--Maximum Hour Emissions
Pio Pico Energy Center

	NOx	**CO**	**SO2**	**PM10**
lb/hr	50	75	0.63	5.5
g/s	6.30	9.45	0.08	0.69

Table G-3.7
Greenhouse Gas Emissions Calculations: Project Operation

Unit	Rated Capacity, MW	Operating Hours per year	Maximum Fuel Use, MMBtu/yr	Estimated Gross Annual MWh	Maximum Emissions, metric tonnes/yr				Estimated Emissions, metric tonnes/MWh		
					CO2	CH4	N2O	SF6	CO2	CH4	N2O
Turbine 1	100.0	4337	3,914,556	433,700	206,963	3.52	0.39	0.00	0.477	8.12E-06	9.03E-07
Turbine 2	100.0	4335	3,914,556	433,700	206,963	3.52	0.39	0.00	0.477	8.12E-06	9.03E-07
Turbine 3	100.0	4335	3,914,556	433,700	206,963	3.52	0.39	0.00	0.477	8.12E-06	9.03E-07
Total	--	--	11,743,669	1,301,100	620,888	11	1	0	0.477	8.12E-06	9.03E-07
CO2eq					620,888	222	364	0			
							TOTAL	621,474			

Natural Gas GHG Emission Rates (Note 1)

	Emission Factors, kg/MMBtu			
	CO2 (2)	CH4 (3)	N2O (3)	SF6
Natural Gas	52.870	9.00E-04	1.00E-04	n/a
Global Warming Potential (4)	1	21	310	23,900

Notes:
1. Calculation methods and emission factors from ARB, "Regulation for the Mandatory Reporting of Greenhouse Gas
2. Appendix A, Table 4; heat content 1000 to 1025 Btu/scf.
3. Appendix A, Table 6.
4. Appendix A, Table 2.

APPENDIX G-4

Modeling Analysis

Dispersion modeling was conducted following the modeling protocol presented in Appendix G-8. The analysis followed the protocol with the following exceptions:

- Under guidance from the District, the analysis was based on the three year period 2006-2008 (instead of the five year period 2004-2008). A supplemental PSD analysis will be submitted to EPA that covers the full five-year period.
- Under guidance from the District, in-stack NO/NOx ratios of 0.13 (normal operations) and 0.24 (Commissioning, startup, and other situations where SCR is not fully operational) were used instead of 0.10, as proposed in the protocol. The District's recommendation for normal operations is based on source tests of four natural-gas-fired LM6000PC SPRINT turbines equipped with water injection, SCR, and oxidation catalysts. These appear to be the closest analogue to the LMS100 proposed for Pio Pico (i.e., aeroderivative, simple cycle, diffusion flame combustors, same NOx controls, oxidation catalysts, and interstage cooling—albeit with water injection for the SPRINTs). The value is an average over the four turbines (rounded up) of the average NO_2/NOx ratio for each turbine. The average NO_2/NOx ratios for the four turbines were 0.0393 (2 tests), 0.0603 (2 tests), 0.185 (1 test), and 0.205 (1 test), respectively.

  For situations when the SCR is not operating, the ratio is based on source tests of 11 natural-gas-fired GE Frame 5 turbines. These turbines all have water injection but no other NOx controls and no oxidation catalyst. The NO_2/NOx ratio for these turbines ranges from about 0.18 to 0.285 (averaged over 7-10 source tests of each turbine).

Electronic modeling and meteorological data files are provided on a separate CD.

Table G-4.1

Screening Modeling Inputs

Pio Pico Energy Center

Operating Mode	Ambient Temp deg F	Stack height feet	Stack Diam feet	Stack flow wacfm	Stack Vel ft/sec	Stack Temp deg F	Stack Height meters	Stack Diam Meters	Stack flow m3/sec	Stack Vel m/sec	Stack Temp deg K
Startup/shutdown	30	100	14.5	733,309	74.01	825	30.48	4.4196	346.13	22.56	713.8
Hot Peak	110	100	14.5	877,825	88.60	802	30.48	4.4196	414.34	27.01	700.9
Avg Peak	63	100	14.5	913,717	92.22	785	30.48	4.4196	431.28	28.11	691.2
Cold Peak	30	100	14.5	909,632	91.81	754	30.48	4.4196	429.36	27.98	674.0
Hot Low	122	100	14.5	733,309	74.01	825	30.48	4.4196	346.13	22.56	713.8
Avg Low	63	100	14.5	646,428	65.24	831	30.48	4.4196	305.12	19.89	717.2
Cold Low	30	100	14.5	645,580	65.16	820	30.48	4.4196	304.72	19.86	711.2

Operating Mode	NOx lb/hr	CO lb/hr	SOx lb/hr	PM10 lb/hr	NOx g/sec	CO g/sec	SOx g/sec	PM10 g/sec
Startup/Shutdown	26.63	53.51			3.36	6.74		
Hot Peak	7.72	7.52	1.79	5.50	0.97	0.95	0.23	0.69
Avg Peak	8.18	7.97	1.90	5.50	1.03	1.00	0.24	0.69
Cold Peak	8.07	7.86	1.87	5.50	1.02	0.99	0.24	0.69
Hot Low	5.92	5.77	1.38	5.50	0.75	0.73	0.17	0.69
Avg Low	4.94	4.82	1.15	5.50	0.62	0.61	0.14	0.69
Cold Low	4.92	4.79	1.14	5.50	0.62	0.60	0.14	0.69

Table G-4.2

Startup Modeling Inputs

Pio Pico Energy Center

Case	Amb Temp	Stack height	Stack Diam	Stack flow	Stack Vel	Stack Temp	Stack Height	Stack Diam	Stack flow	Stack Vel	Stack Temp
	deg F	feet	feet	wacfm	ft/sec	deg F	meters	meters	m3/sec	m/sec	deg K
Hot Low	122	100	14.5	733,309	74.01	825.1	30.48	4.42	346.13	22.56	713.8

Table G-4.3

Commissioning Modeling Inputs

Pio Pico Energy Center

Case	Amb Temp	Stack height	Stack Diam	Stack flow	Stack Vel	Stack Temp	Stack Height	Stack Diam	Stack flow	Stack Vel	Stack Temp
	deg F	feet	feet	wacfm	ft/sec	deg F	meters	meters	m3/sec	m/sec	deg K
Cold Low	30	100	14.5	645,580	65.16	820	30.48	4.42	304.72	19.86	711.2

Table G-4.4
Screening Modeling Results
Pio Pico Energy Center

Operating Mode/Year	Conc. (ug/m3) NO2 1-hr	Conc. (ug/m3) CO 1-hr	Conc. (ug/m3) SO2 1-hr	Conc. (ug/m3) SO2 3-hr	Conc. (ug/m3) CO 8-hr	Conc. (ug/m3) PM10 24-hr	Conc. (ug/m3) SO2 24-hr	Conc. (ug/m3) NO2 Annual	Conc. (ug/m3) PM10 Annual	Conc. (ug/m3) SO2 Annual
2008 Met Data										
Startup/shutdown	100.3	201.6	0.0	0.0	38.9	0.0	0.0	N/A	N/A	N/A
Hot Peak	25.7	25.0	6.0	2.3	4.8	1.3	0.4	0.25	0.18	0.06
Avg Peak	26.5	25.8	6.2	2.4	5.0	1.3	0.5	0.26	0.18	0.06
Cold Peak	**26.6**	**25.9**	**6.2**	2.4	5.0	1.3	0.5	0.26	0.18	0.06
Hot Low	22.3	21.7	5.2	2.0	4.2	1.5	0.4	0.23	0.22	0.05
Avg Low	20.4	19.9	4.7	1.8	3.9	1.7	0.4	0.22	0.25	0.05
Cold Low	20.4	19.9	4.7	1.8	3.9	1.7	0.4	0.22	0.25	0.05
2007 Met Data										
Startup/shutdown	89.0	178.7	0.0	0.0	36.3	0.0	0.0	N/A	N/A	N/A
Hot Peak	22.7	22.1	5.3	2.1	4.7	1.3	0.4	0.26	0.18	0.06
Avg Peak	23.4	22.8	5.4	2.2	4.9	1.3	0.5	0.27	0.18	0.06
Cold Peak	23.5	22.9	5.5	2.2	4.9	1.3	0.5	0.27	0.18	0.06
Hot Low	19.8	19.3	4.6	1.8	3.9	1.5	0.4	0.22	0.20	0.05
Avg Low	18.1	17.6	4.2	1.7	3.6	1.6	0.3	0.20	0.23	0.05
Cold Low	18.1	17.6	4.2	1.7	3.5	1.6	0.3	0.20	0.23	0.05
2006 Met Data										
Startup/shutdown	95.6	192.0	0.0	0.0	47.4	0.0	0.0	N/A	N/A	N/A
Hot Peak	24.8	24.1	5.8	3.1	5.9	1.9	0.6	0.29	0.21	0.07
Avg Peak	25.8	25.1	6.0	3.2	6.1	1.9	0.6	0.30	0.20	0.07
Cold Peak	25.8	25.1	6.0	**3.2**	**6.2**	1.9	**0.6**	**0.30**	0.21	**0.07**
Hot Low	21.2	20.7	4.9	2.7	5.1	2.3	0.6	0.25	0.23	0.06
Avg Low	20.3	19.8	4.7	2.4	4.7	2.6	0.5	0.23	0.26	0.05
Cold Low	20.3	19.8	4.7	2.4	4.7	**2.6**	0.5	0.23	**0.26**	0.05

Table G-4.5
Fumigation Modeling
Pio Pico Energy Center

Emission Rates **Operating Mode**	**NOx lb/hr**	**CO lb/hr**	**SOx lb/hr**	**PM10 lb/hr**		**NOx g/sec**	**CO g/sec**	**SOx g/sec**	**PM10 g/sec**
Startup/Shutdown	26.63	53.51				3.36	6.74		
Hot Peak	7.72	7.52	1.79	5.50		0.97	0.95	0.23	0.69
Avg Peak	8.18	7.97	1.90	5.50		1.03	1.00	0.24	0.69
Cold Peak	8.07	7.86	1.87	5.50		1.02	0.99	0.24	0.69
Hot Low	5.92	5.77	1.38	5.50		0.75	0.73	0.17	0.69
Avg Low	4.94	4.82	1.15	5.50		0.62	0.61	0.14	0.69
Cold Low	4.92	4.79	1.14	5.50		0.62	0.60	0.14	0.69

SCREEN3 Results SimpleTerrain		Unit Impacts	Distance to Max (m)
Startup/shutdown		0.5907	1197
Hot Peak		0.5867	1198
Avg Peak		0.5703	1206
Cold Peak		0.5582	1214
Hot Low		0.6321	1234
Avg Low		0.6572	1220
Cold Low		0.6359	1232

Inversion Breakup Results		Unit Impacts	Distance to Max (m)
Startup/shutdown		0.8536	21294
Hot Peak		0.7362	23738
Avg Peak		0.7313	23856
Cold Peak		0.7532	23343
Hot Low		0.8247	21840
Avg Low		0.9149	20236
Cold Low		0.9341	19931

Appropriate 1-hr unit impacts to use for longer averaging periods - Inversion Breakup Fumigation

		1-hr unit	3-hr unit	8-hr unit	24-hr unit
Startup/shutdown		0.8536	0.6499	0.4480	0.2429
Hot Peak		0.7362	0.5953	0.4303	0.2384
Avg Peak		0.7313	0.5857	0.4203	0.2321
Cold Peak		0.7532	0.5901	0.4163	0.2282
Hot Low		0.8247	0.6556	0.4677	0.2577
Avg Low		0.9149	0.7074	0.4939	0.2693
Cold Low		0.9341	0.7065	0.4843	0.2618

Inversion Fumigation impacts		NOx 1 hour	CO 1hour	SO2 1 hour	SO2 3 hour	CO 8 hour	SO2 24 hour	PM 24 hour
Startup/shutdown		2.86	5.75	0.00	0.00	3.02	0.00	0.00
Hot Peak		0.72	0.70	0.17	0.13	0.41	0.05	0.17
Avg Peak		0.75	0.73	0.18	0.14	0.42	0.06	0.16
Cold Peak		0.77	0.75	0.18	0.14	0.41	0.05	0.16
Hot Low		0.62	0.60	0.14	0.11	0.34	0.04	0.18
Avg Low		0.57	0.56	0.13	0.10	0.30	0.04	0.19
Cold Low		0.58	0.56	0.13	0.10	0.29	0.04	0.18

Figure G-4.1
Layout of the Modeling Receptor Grids

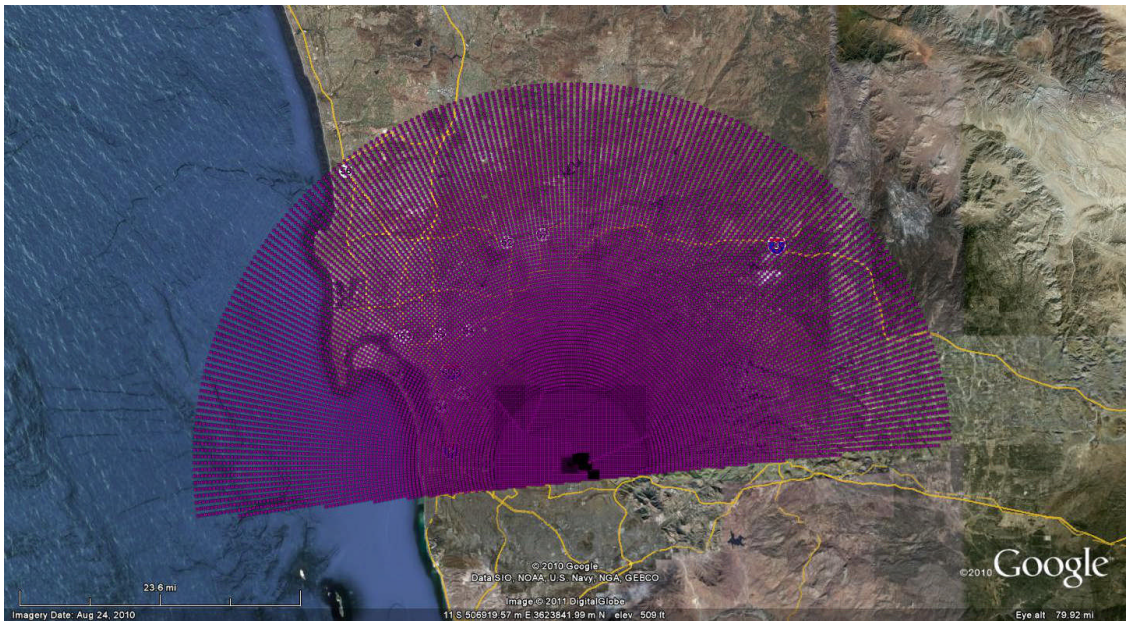
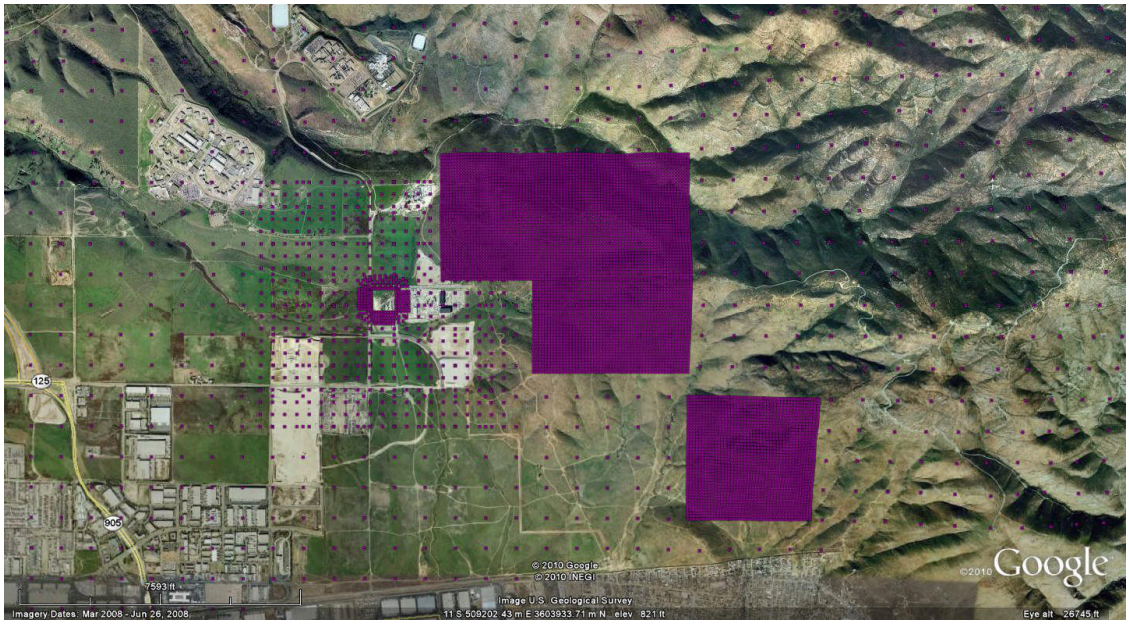


Figure G-4.2
Layout of the Modeling Receptor Grids – Detail



APPENDIX G-5

Evaluation of Best Available Control Technology (BACT)

EVALUATION OF BEST AVAILABLE CONTROL TECHNOLOGY

PPEC is required to use best available control technology (BACT) on the combustion turbine generators (CTGs) and the cooling system for regulated pollutants, in accordance with the requirements of District rules and the federal Prevention of Significant Deterioration (PSD) regulations. For sources subject to PSD, BACT is defined in 40 CFR 52.21(j) as:

> "an emissions limitation…based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant…"

The regulated pollutants for which the federal PSD BACT requirement is applicable are nitrogen oxides (NOx), fine particulate matter ($PM_{2.5}$), particulate matter with nominal aerodynamic diameter less than or equal to 10 microns (PM_{10}), and greenhouse gases (GHG).

BACT is defined in San Diego Air Pollution Control District (SDAPCD or District) Regulation 2, Rule 20.1 as:

> *The lowest emitting of any of the following:*
>
> *(A) the most stringent emission limitation, or the most effective emission control device or control technique, which has been proven in field application and which is cost-effective for such class or category of emission unit, unless the applicant demonstrates to the satisfaction of the Air Pollution Control Officer that such limitation, device or control technique is not technologically feasible, or*
>
> *(B) any emission control device, emission limitation or control technique which has been demonstrated but not necessarily proven in field application and which is cost-effective for such class or category of emission unit, as determined by the Air Pollution Control Officer, unless the applicant demonstrates to the satisfaction of the Air Pollution Control Officer that such limitation, device or control technique is not technologically feasible, or*
>
> *(C) any control equipment, process modifications, changes in raw material including alternate fuels, and substitution of equipment or processes with any equipment or processes, or any combination of these, determined by the Air Pollution Control Officer on a case-by-case basis to be technologically feasible and cost-effective, including transfers of technology from another category of source, or*
>
> *(D) the most stringent emission limitation, or the most effective emission control device or control technique, contained in any State Implementation Plan (SIP) approved by the federal EPA for such emission unit category, unless the applicant demonstrates to the satisfaction of the Air Pollution Control Officer that such limitation or technique has not been proven in field application, that it is not*

technologically feasible or that it is not cost-effective for such class or category of emission unit.

The District NSR rules require BACT for NOx, SO_2, VOC and PM_{10}. The BACT analyses required under both programs are presented here. The emission rates and control technologies determined to be BACT for this project are discussed in detail in the following sections. For the CTGs, separate determinations are provided for normal operation and startup/shutdown operation.

Steps in a Top-Down BACT Analysis

Step 1 – Identify All Possible Control Technologies

The first step in a top-down analysis is to identify, for the emissions unit and pollutant in question, all available control options. Available control options are those air pollution control technologies or techniques, including alternate basic equipment or processes, with a practical potential for application to the emissions unit in question. The control alternatives should include not only existing controls for the source category in question, but also, through technology transfer, controls applied to similar source categories and gas streams.

BACT must be at least as stringent as what has been achieved in practice (AIP) for a category or class of source. Additionally, USEPA guidelines require that a technology that is determined to be AIP for one category of source be considered for transfer to other source categories. There are two types of potentially transferable control technologies: (1) exhaust stream controls, and (2) process controls and modifications. For the first type, technology transfer must be considered between source categories that produce similar exhaust streams. For the second type, technology transfer must be considered between source categories with similar processes.

Candidate control options that do not meet basic project requirements (i.e., alternative basic designs that "redefine the source") are eliminated at this step.

Step 2 – Eliminate Technologically Infeasible Options

To be considered, the candidate control option must be technologically feasible for the application being reviewed.

Step 3 – Rank Remaining Control Options by Control Effectiveness

All feasible options are ranked in the order of decreasing control effectiveness for the pollutant under consideration. In some cases, a given control technology may be listed more than once, representing different levels of control (e.g., the use of SCR for control of NOx may be evaluated at 2 and 2.5 parts per million by volume, dry [ppmvd]). Any control option less stringent than what has been already achieved in practice for the category of source under review must also be eliminated at this step.

Step 4 – Evaluate Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

To be required as BACT, the candidate control option must be cost effective, considering energy, environmental, economic, and other costs. The most stringent control technology for

control of one pollutant may have other undesirable environmental or economic impacts. The purpose of Step 4 is to either validate the suitability of the top control option or provide a clear justification as to why that option should not be selected as BACT.

Once all of the candidate control technologies have been ranked, and other impacts have been evaluated, the most stringent candidate control technology is deemed to be BACT, unless the other impacts are unacceptable.

Step 5 – Determine BACT/Present Conclusions

BACT is determined to be the most effective control technology subject to evaluation, and not rejected as infeasible or having unacceptable energy, environmental, or cost impacts.

BACT for the CTGs: Normal Operations

NOx Emissions

Step 1 – Identify All Possible Control Technologies

The emissions unit for which BACT is being considered is a nominal 100 MW gas turbine operating in simple cycle.

Potential control technologies were identified by searching the following sources for determinations pertaining to combustion gas turbines:

- South Coast Air Quality Management District (SCAQMD) BACT Guidelines;
- San Joaquin Valley Air Pollution Control District (SJVAPCD) BACT Clearinghouse;
- Bay Area Air Quality Management District (BAAQMD) BACT Guidelines;
- USEPA Reasonably Available Control Technology (RACT)/BACT/ Lowest Achievable Emission Rate (LAER) Clearinghouse;
- Other districts' and states' BACT Guidelines; and
- BACT/LAER requirements in New Source Review permits issued by District[1] or other air pollution control agency.

The following technologies for control of NOx have been identified:

- A Selective Catalytic Reduction (SCR) system capable of continuously complying with a limit of 2.5 ppmvd @15% oxygen (O_2) (1-hour average).
- An EMx (formerly SCONOx) system capable of continuously complying with a limit of 2.5 ppmvd @15% O_2 (1-hour average).
- Alternative Basic Equipment:
    - Renewable Energy Source (e.g. Solar, Wind, etc.)

It should be noted that the use of renewable energy in lieu of a simple-cycle gas turbine would "redefine the source." Renewable energy facilities require significantly more land to

[1] Any Air Quality Management District or Air Pollution Control District in California.

construct, and need to be located in areas with very specific characteristics. Wind and solar facilities have power generation profiles that cannot match demand; conventional power plants are needed in order to follow demand. The capital costs for wind or solar facilities are substantially higher than for a comparable conventional facility, making financing of such a project significantly different. Finally, one of the fundamental objectives of the proposed PPEC project is to provide firming capacity for renewable energy facilities, making the use of renewable energy for the project fundamentally incompatible with the project objective. Nevertheless, these technologies are feasible, and the technical feasibility of renewable energy sources for this specific application will be considered in Step 2.

Step 2 – Eliminate Technologically Infeasible Options

Exhaust Stream Controls

The most recent NOx BACT listings for aeroderivative simple-cycle combustion turbines in this size range are summarized in Table G-5.1. The most stringent NOx limit in these recent BACT determinations is a 2.5 ppm[2] limit averaged over a 1-hour averaging period, excluding startups and shutdowns. This level is achieved using water injection combustors and SCR.

SCONOx is a NOx reduction system produced by Goal Line Environmental Technologies. It is now distributed by EmeraChem as EMx. This system uses a single catalyst to oxidize both NO and CO, a second catalyst system to absorb NO_2, and then a regeneration system to convert the NO_2 to N_2 and water vapor. The EMx system does not use ammonia as a reagent. The EMx process has been demonstrated in practice on much smaller gas turbines, including Redding Electric Utility's (REU) Units 5 and 6, a 43-MW Alstom GTX100 and 45 MW Siemens SGT 800 combined-cycle gas turbines, respectively. While the technology has never been demonstrated on a gas turbine the size of the LMS100 or on a simple-cycle gas turbine, the technology is considered by the manufacturer to be scalable.

The SCR system uses ammonia injection to reduce NOx emissions. SCR systems have been widely used in simple-cycle gas turbine applications of all sizes. The SCR process involves the injection of ammonia into the flue gas stream via an ammonia injection grid upstream of a reducing catalyst. The ammonia reacts with the NOx in the exhaust stream to form N_2 and water vapor. The catalyst does not require regeneration, but must be replaced periodically; typical SCR catalyst lifetimes are in excess of three years.

Either SCR or EMx technology, in combination with water injection, is capable of achieving a NOx emission level of 2.5 ppmvd @ 15% O_2. Neither has been demonstrated to consistently achieve lower emission levels in water-injected simple cycle turbines in peaking service.

[2] All turbine/HRSG exhaust emissions concentrations shown are by volume, dry corrected to 15% O_2.

TABLE G-5.1
Recent NOx BACT Determinations for Simple-Cycle Combustion Turbines[1]

Facility	District	NOx Limit[2]	Averaging Prd	Control Method Used	Date Permit Issued	Source
TID Almond 2 Power Plant	SJVAPCD	2.5 ppmvd	1 hr	water injection and SCR	2/16/2010	FDOC
Miramar Energy Facility II	SDCAPCD	2.5 ppmvd	3 hrs	water injection and SCR	11/4/08	ATC
Starwood Midway Firebaugh/Panoche	SJVAPCD	2.5 ppmvd	1 hr	water injection and SCR	9/5/07 (FDOC)	CEC Siting Div website
EIF Panoche	SJVAPCD	2.5 ppmvd	1 hr	water injection and SCR	7/13/07 (FDOC)	CEC Siting Div website
San Francisco Electric Reliability Project	BAAQMD	2.5 ppmvd	1 hr	water injection and SCR	2/8/06 (FDOC)	CEC Siting Div website
EI Colton	SCAQMD	3.5 ppmvd	3 hrs	water injection and SCR	1/10/03	SCAQMD website
MID Ripon	SJVAPCD	2.5 ppmvd	3 hrs	water injection and SCR	2004	ATC

Note:
1. All projects listed here utilize GE LM6000-model units except Starwood Midway, which utilizes P&W FT8-3 SwiftPacs and EIF Panoche, which uses GE LMS 100 CTGs.
2. All concentrations expressed as parts per million by volume dry, corrected to 15% O_2.

Alternative Basic Technology

Solar Thermal

Solar thermal facilities collect solar radiation, then heat a working fluid (water or a hydrocarbon liquid) to create steam to power a steam turbine generator. All solar thermal facilities require considerable land for the collection field and are best located in areas of high solar incident energy per unit area. In addition, power is only generated while the sun shines, so the units do not supply power at night or on cloudy days. The PPEC parcel is not sufficiently large to be feasible for a commercial solar power plant. Furthermore, a solar power plant would not meet the project's objective of providing firming capability for intermittent renewable resources such as solar and wind energy projects. For these reasons, a solar thermal power plant is rejected as BACT for this application.

Wind

Wind power facilities use a wind-driven rotor to turn a generator to generate electricity. Only limited sites in California have an adequate wind resource to allow for the economic construction and operation of large-scale wind generators. Most of these sites have already been developed or are remote from electric load centers and have little or no transmission access. Even in prime locations the wind does not blow continuously, so power is not always available. Due to the lack of availability of good sites, limited dependability, and relatively high cost, this technology is not feasible for this project. Furthermore, a wind power plant would not meet the project's objective of providing firming capability for intermittent renewable resources such as solar and wind energy projects. For these reasons, a wind power plant is rejected as BACT for this application.

Other alternatives

A number of other alternative generating systems are described in the Alternatives Analysis Section (Section 4.0) of the Application for Certification. These additional analyses failed to identify an alternative generating technology that was technically feasible for this site and that would meet the project's objectives.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Both SCR and EMx technologies, each in combination with water injection, are capable of achieving a NOx emission level of 2.5 ppmvd @ 15% O_2. They are therefore ranked together in terms of control effectiveness.

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

The use of SCR will result in ammonia emissions due to an allowable ammonia slip limit of 5 ppmvd @ 15% O_2. A health risk screening analysis of the proposed project using air dispersion modeling showed the acute health hazard index and a chronic health hazard index each to be much less than 1, based on an ammonia slip limit of 5 ppmv @ 15% O_2. In accordance with the District's Toxics program and currently accepted practice, a hazard index below 1.0 is not considered significant. Therefore, the toxic impact of the ammonia slip resulting from the use of SCR is deemed to be not significant, and is not a sufficient reason to eliminate SCR as a control alternative.

Further, in its evaluation of BACT for the Carlsbad Energy Center Project, the SCAPCD determined that:

> "Whatever the relative merits of ammonia emissions from the EMx™ (SCONOX) system relative to conventional SCR, the EMx™ system, which requires a large number of louvers that open and close in a synchronized manner, has not been demonstrated or achieved in practice for large turbines and is therefore not BACT or LAER for control of NOx for the CECP."[3]

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[3] San Diego APCD, "Responses To PDOC Comments, Carlsbad Energy Center Project," November 19, 2009; Simpson Comment 18, p. 55.

The same concern applies to PPEC.

A second potential environmental impact that may result from the use of SCR involves the storage and transport of aqueous or anhydrous ammonia.[4] Although ammonia is toxic if swallowed or inhaled and can irritate or burn the skin, eyes, nose, or throat, it is a commonly used material that is typically handled safely and without incident. The project operator will be required to develop and maintain a Risk Management Plan (RMP) and to implement a Risk Management Program to prevent accidental releases of ammonia. The RMP provides information on the hazards of the substance handled at the facility and the programs in place to prevent and respond to accidental releases. The accident prevention and emergency response requirements reflect existing safety regulations and proven industry safety codes and standards. Thus, the potential environmental impact due to aqueous ammonia use at the Project is minimal and does not justify the elimination of SCR as a control alternative.

Regeneration of the EMx catalyst is accomplished by passing hydrogen gas over an isolated catalyst module. The hydrogen gas is generated by reforming steam, so steam would be required and there is no steam source in the project design. This would require the installation of an auxiliary boiler, and would result in a new source of emissions as well as additional consumption of natural gas.

"Achieved in Practice" Criteria

While there are no formal "achieved in practice" criteria in the SDAPCD, the SCAQMD has established formal criteria for determining when emission control technologies should be considered achieved in practice (AIP) for the purposes of BACT determinations. The criteria include the elements outlined below.

- Commercial Availability: At least one vendor must offer this equipment for regular or full-scale operation in the United States. A performance warranty or guarantee must be available with the purchase of the control technology, as well as parts and service.
- Reliability: All control technologies must have been installed and operated reliably for at least six months. If the operator did not require the basic equipment to operate daily, then the equipment must have at least 183 cumulative days of operation. During this period, the basic equipment must have operated (1) at a minimum of 50% design capacity; or (2) in a manner that is typical of the equipment in order to provide an expectation of continued reliability of the control technology.
- Effectiveness: The control technology must be verified to perform effectively over the range of operation expected for that type of equipment. If the control technology will be allowed to operate at lesser effectiveness during certain modes of operation, then those modes of operation must be identified. The verification shall be based on a performance test or tests, when possible, or other performance data.

Each of these criteria is discussed separately below for SCR and for EMx.

---

[4] The Project proposes to use the less concentrated, safer aqueous form of ammonia.

SCR Technology – SCR has been achieved in practice at numerous combustion turbine installations throughout the world. There are numerous aeroderivative simple-cycle gas turbine projects that limit NOx emissions to 2.5 ppm, as shown in the table above. An evaluation of the proposed AIP criteria as applied to the achievement of 2.5 ppm, and to extremely low NOx levels (below 2.5 ppm) using SCR technology, is summarized below.

- Commercial Availability: Turbine-out NOx from water-injected, aeroderivative gas turbines is generally 25 ppm. Achieving a controlled NOx limit below 2.5 ppm would require SCR technology to achieve reductions greater than 90 percent. Further, because of the relatively high temperature of exhaust from simple-cycle turbines compared with combined-cycle units, there is a more limited selection of SCR technology available. Consequently, it is not clear that this criterion is satisfied for limits below 2.5 ppm for water-injected, aeroderivative gas turbines. As shown in the table above, this criterion is satisfied for water-injected aeroderivative gas turbines at a 2.5 ppm permit level.

- Reliability: SCR technology has been shown to be capable of achieving NOx levels consistent with a 2.5 ppm permit limit during extended, routine operations at several commercial power plants. There are no reported adverse effects of operation of the SCR system at these levels on overall plant operation or reliability. There has been no demonstration of operation at levels below 2.5 ppm during extended, routine operation of water-injected, simple-cycle aeroderivative gas turbines; consequently, this criterion is not satisfied for NOx limits below 2.5 ppm.

- Effectiveness: SCR technology has been demonstrated to achieve NOx levels of 2.5 ppm with water-injected aeroderivative turbines, but not at lower limits for this generating technology. Short-term excursions have resulted in NOx concentrations above the permitted level of 2.5 ppm; however, these excursions have not been associated with diminished effectiveness of the SCR system. Rather, these excursions have been associated with SCR inlet NOx levels in excess of those for which the SCR system was designed. Consequently, this criterion is satisfied at a NOx limit of 2.5 ppm, but not at lower NOx limits.

- Conclusion: SCR technology capable of achieving NOx levels of 2.5 ppm is considered to be achieved in practice. The permit limits for the proposed project CTGs include a NOx limit of 2.5 ppm. This proposed limit is consistent with the available data. The AIP criteria are not met for SCR on water-injected, simple-cycle aeroderivative gas turbines at NOx limits lower than 2.5 ppm.

EMx Technology – EMx has been demonstrated in service in five applications: the Sunlaw Federal cogeneration plant, the Wyeth BioPharma cogeneration facility, the Montefiore Medical Center cogeneration facility, the University of California San Diego facility, and the City of Redding Power Plant. The combustion turbines at these facilities are much smaller than for the proposed project turbine, and none of the existing installations are simple cycle turbines. The largest installation of the EMx system is at the Redding Power Plant. The Redding Power Plant includes two combined-cycle combustion turbines, a 43 MW Alstom GTX100 with a permitted NOx emission rate of 2.5 ppm and the new 45 MW Siemens SGT 800 with a permitted NOx emission rate of 2.0 ppmvd.

A review of NOx continuous emissions monitoring (CEM) data obtained from the EPA's Acid Rain program website[5] indicates a mean NOx level for the Redding Unit 5 of less than 1.0 ppm during the period from 2002 to 2007. After the first year of operation, Unit 5 has experienced only a few hours of non-compliance per year (fewer than 0.1% of the annual operating hours exceed that plant's NOx permit limit of 2.5 ppm). The experience at the City of Redding Plant indicates the ability of the EMx system to control NOx emissions to levels of 2.5 ppm. These data do not indicate the ability to consistently achieve NOx levels below 2.0 ppm, notwithstanding the lower annual average emission rate. This is due to the cyclical nature of EMx NOx levels in between plant shutdowns and scheduled catalyst cleanings. Redding Unit 6 started up on October 2011; there is not sufficient operating data available to draw conclusions regarding its performance.

Based on this information, the following paragraphs evaluate the proposed AIP criteria as applied to the achievement of low NOx levels (2.5 ppm) using EMx technology.

- Commercial availability: While a proposal has not been sought, presumably EmeraChem Power would offer standard commercial guarantees for the proposed project. Consequently, this criterion is expected to be satisfied.

- Reliability: As discussed above, based on a review of the CEM data for Redding Unit 5 the EMx system complied with the 2.5 ppm NOx permit limit but with a few hours each year of excess emissions (approximately 3% of annual operating hours following the first year, and approximately 2% following the second year, dropping to approximately 0.1% after 4 years). This level of performance was also associated with some significant operating and reliability issues. According to a June 23, 2005 letter from the Shasta County Air Quality Management District,[6] repairs to the EMx system began shortly after initial startup and have continued during several years of operation. Redesign of the EMx system was required due to a problem with the reformer reactor combustion production unit that led to sulfur poisoning of the catalyst, despite the sole use of low-sulfur, pipeline quality natural gas as the turbine fuel. In addition, the EMx system catalyst washings had to occur at a frequency several times higher than anticipated during the first three years of operation, which resulted in substantial downtime of the combustion turbine. Since the REU installation is the most representative of all of the EMx-equipped combustion turbine facilities for comparison to the proposed Project, the problems encountered at REU bring into question the reliability of the EMx system for the proposed project.

- Effectiveness: The EMx system at REU Unit 5 has recently been able to demonstrate compliance with a NOx level of 2.0 ppm, and the new REU Unit 6 has been permitted with a 2.0 ppm NOx limit. However, there is not sufficient operating experience with REU Unit 6 to conclude that 2.0 ppm is reliably achieved in practice for EMx, and there are no EMx-equipped facilities on simple-cycle facilities in peaking service. Consequently, due to the

[5] Available at http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=prepackaged.results
[6] Letter dated June 23, 2005, from Shasta County Air Quality Management District to the Redding Electric Utility regarding Unit 5 demonstration of compliance with its NOx permit limit.

lack of actual performance data, there is some question regarding the effectiveness of the EMx systems on simple-cycle, peaking combustion turbine projects.

- Conclusion: EMx systems are capable of achieving NOx levels of 2.5 ppm and less. However, the operating history at the Redding Power Plant does not support a conclusion that this technology is achieved in practice for simple-cycle, peaking turbines, based on SCAQMD guidelines.

Summary of Achieved in Practice Evaluation

SCR's capability to consistently achieve 2.5 ppmvd NOx (1-hour average) in large turbines has been demonstrated by numerous installations. EMx's ability to consistently achieve 2.5 ppmvd in large turbines has not been demonstrated, nor has the technology been demonstrated in simple-cycle, peaking service. An emission level of 2.5 ppm NOx has therefore been achieved in practice, and any BACT determination must be at least as stringent as that.

Technologically Feasible/Cost Effective Criterion

No candidate technology with lower emission levels than those achieved in practice has been identified.

Determine BACT/Present Conclusions

BACT must be at least as stringent as the most stringent level achieved in practice, federal NSPS, or district prohibitory rule. Based upon the results of this analysis, the NOx BACT determination of 2.5 ppmvd @ 15% O_2 on a 1-hour average basis made for recently permitted simple cycle turbine projects in SDAPCD and elsewhere reflects the most stringent NOx emission limit that has been achieved in practice. No more stringent level has been suggested as being technologically feasible. Therefore, BACT for NOx for this application is any technology capable of achieving 2.5 ppmvd @ 15% O_2 on a 1-hour average basis.

Both SCR and EMx are expected to achieve the proposed BACT NO_x emission limit of 2.5 ppmvd @ 15% O_2 averaged over one hour. However, the use of EMx would require a source of supplemental steam, and this is considered a potentially significant energy, economic, and environmental impact. In addition, concerns remain regarding the long-term effectiveness of EMx as a control technology because the technology has not been demonstrated on the turbine used in this project, in a simple cycle peaking application. For this reason, SCR has been selected as the NOx control technology to be used for the Project.

The Project facility will be designed to meet a NOx level of 2.5 ppmvd @ 15% O_2 on a 1-hour average basis using SCR.

Control of Sulfur Oxides

Step 1 -- Identify All Possible Control Technologies

Natural gas fired combustion turbines have inherently low SOx emissions due to the small amount of sulfur present in the fuel. With typical pipeline quality natural gas sulfur contents well below 1 grain/100 scf, the SOx emissions for natural gas fired combustion turbines are orders of magnitude less than oil-fired turbines. Firing by natural gas and the resulting control of SOx

emissions have been used by numerous combustion turbines throughout the world. Due to the prevalence of the use of natural gas to control SOx emissions from combustion turbines, only an abbreviated discussion of post-combustion controls will be addressed in this section.

Post-combustion SOx control systems include dry and wet scrubber systems. These types of systems are typically installed on high SOx emitting sources such as coal-fired power plants. Post-combustion control systems for combustion turbines also include ESx catalyst systems. These systems trap the sulfur in the exhaust stream on an ESx catalyst. During a regeneration process, the sulfur is removed from the ESx catalyst and is either reintroduced back into the exhaust stream or sent to a sulfur scrubbing system. If the sulfur removed from the ESx catalyst is reintroduced back into the exhaust stream, there is no SOx control associated with the system.

Step 2 -- Eliminate Technically Infeasible Options

All of the control options discussed above are technically feasible.

Step 3 -- Rank Remaining Control Technologies by Control Effectiveness

The typical SOx control level for a well-designed wet or dry scrubber installed on a coal fired boiler ranges from approximately 70% to 90%,[7] with some installations achieving even higher control levels. According to EmeraChem literature,[8] the ESx system is capable of removing approximately 95% of the SOx emissions from the exhaust stream of natural gas fired combustion turbines. With the sulfur scrubber option, during the regeneration cycle of the ESx system the sulfur captured on the ESx catalyst is sent to a sulfur scrubbing unit. A high efficiency sulfur scrubbing unit would achieve a control level similar to that of the wet/dry scrubbers discussed above.

Step 4 -- Evaluate Most Effective Controls and Document Results

The use of low sulfur content pipeline natural gas has been achieved in practice at numerous combustion turbine installations throughout the world, and the use of this fuel minimizes SOx emissions. While it would be technically feasible to install some type of post-combustion control such as a dry/wet scrubber system or an ESx catalyst with a sulfur scrubber on a natural gas fired turbine, due to the inherently low SOx emissions associated with the use of natural gas, these systems are not cost effective and regulatory agencies do not require them. Consequently, no further discussion of post-combustion SOx control is necessary.

The SOx control method for the proposed PPEC is the use of pipeline-quality natural gas. Consequently, the proposed project is consistent with BACT requirements.

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[7] Air Pollution Control Manual, Air and Waste Management Association, Second Edition, page 206.

[8] High Performance EMx Emissions Control Technology for Fine Particles, NOx, CO, and VOCs from Combustion Turbines and Stationary IC Engines, by Steven DeCicco and Thomas Girdlestone, EmeraChem Power, June 2008, page 19.

VOC Emissions

Step 1 – Identify All Possible Control Technologies

Most VOCs emitted from natural gas-fired turbines are the result of incomplete combustion of fuel. Therefore, most of the VOCs are methane and ethane, which are not effectively controlled by an oxidation catalyst. However, oxidation catalyst technology designed to control CO can also provide some degree of control of VOC emissions, especially the more complex and toxic compounds formed in the combustion process. Therefore, use of an oxidation catalyst is generally considered BACT for VOC.

Alternative Basic Equipment, including renewable energy sources such as solar and wind, has also been identified as a technology for the control of VOC emissions.

Step 2 – Eliminate Technologically Infeasible Options

The only technology under consideration is use of an oxidation catalyst in combination with combustion controls. This combination of technologies has been demonstrated to be feasible in many applications. No other technologies have been identified which are capable of achieving the same level of control. As a result, the goal of the rest of this analysis is to determine the appropriate emission limit that constitutes BACT for this application.

The CARB's BACT guidance document for electric generating units rated at greater than 50 MW[9] indicates that BACT for the control of VOC emissions for combined-cycle and cogeneration power plants is 2 ppmvd @ 15% O_2.

The BAAQMD's BACT guidelines specify that, for natural gas-fired simple-cycle combustion gas turbines larger than 40 MW, a VOC limit of 2 ppmvd @ 15% O_2 has been "achieved in practice."

The SJVAPCD's BACT guidelines contain a determination for gas turbines rated at larger than 50 MW with uniform load and without heat recovery. The SJVAPCD concluded that a VOC exhaust concentration of 2.0 ppmvd @ 15% O_2 constituted BACT that had been achieved in practice, while 0.6 to 1.3 ppmvd @ 15% O_2 is considered technologically feasible.

Published prohibitory rules from the BAAQMD, SMAQMD, SDCAPCD, SJVAPCD, and SCAQMD were reviewed to identify the VOC standards that govern existing natural gas-fired simple cycle combustion gas turbines. None of the prohibitory rules for combustion gas turbines specify an emission limit for VOC. The applicable NSPS (40 CFR 60 Subpart KKKK) does not include a VOC limit.

This "top-down" VOC BACT analysis will consider the following VOC emission limitations:

- 0.6 ppmvd @ 15% O_2
- 1.3 ppmvd @ 15% O_2
- 2 ppmvd @ 15% O_2

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[9] CARB, "Guidance for Power Plant Siting and Best Available Control Technology," September 1999.

Alternative basic equipment, including renewable energy sources such as solar and wind, was already discussed above (Step 2 for NOx BACT on the CTGs). For the same reasons, solar, wind and other renewable energy sources are rejected as VOC BACT for this application.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

The control technologies under consideration are ranked as follows:

- Oxidation catalyst unit capable of achieving 0.6 ppmvd @ 15% O_2
- Oxidation catalyst unit capable of achieving 1.3 ppmvd @ 15% O_2
- Oxidation catalyst unit capable of achieving 2 ppmvd @ 15% O_2

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

This step evaluates any source-specific environmental, energy, or economic impacts which demonstrate that the top alternative listed in the previous step is inappropriate as BACT.

"Achieved in Practice" Criterion

As discussed above, the SJVAPCD BACT guideline for large gas turbines without heat recovery suggests that VOC emission rates of between 0.6 and 1.3 ppm may be technologically feasible, based on two recently-permitted projects. The Sunrise Power Company project used a 165 MW GE Frame 7FA gas turbine with dry low NOx (DLN) combustors for NOx control. The Tracy Peaker project used an 84 MW GE Frame 7EA gas turbine, also with a DLN combustor. Both the 7EA and the 7FA are industrial turbines.

Unlike these two projects used to establish SJVAPCD Guideline 3.4.7, the PPEC gas turbines are aeroderivative turbines, not industrial turbines, and utilize water injection and not dry low NOx combustors for NOx control. The characteristics of aeroderivative turbines make them particularly well-suited for applications where high simple cycle efficiency and quick responsiveness matters, such as use for peaking generation to support power grids and applications needing multiple start/stop cycles. Water injection reduces NOx emissions by absorbing some of the heat generated during combustion, reducing peak flame temperature and thereby reducing thermal NOx formation. Water injection has operating advantages versus DLN in that it allows for a greater turn-down ratio. However, a side effect of the reduction in peak flame temperature is a slight reduction in combustion efficiency and corresponding increases in VOC and CO emissions. This means that turbine-out VOC emissions from water-injected gas turbines are higher than corresponding emissions from turbines equipped with DLN combustors. Numerous projects have been permitted with and have demonstrated continuous compliance with a 2 ppmc VOC limit, so 2 ppmc is considered achieved in practice for this generating technology.

Technologically Feasible/Cost Effective Criterion

As discussed above, a VOC limit of 2 ppmc has been achieved in practice for the CTGs being considered for the Project. Lower VOC limits that may be technologically feasible for this class and category of source have not been identified. The 0.6 and 1.3 ppm limits identified in the

SJVAPCD guideline were associated with projects utilizing industrial turbines with DLN combustors, which are not proposed for this project.

The applicant has proposed to meet a 2 ppmc limit on a 3-hour average basis. This level meets BACT.

Determine BACT/Present Conclusions

BACT must be at least as stringent as the most stringent achieved in practice, required in a federal NSPS or district prohibitory rule, or considered technologically feasible. Based upon the results of this analysis, the VOC emission limits of 2.0 ppmvd @ 15% O_2 are considered to be BACT for the proposed project.

PM/PM_{10}/$PM_{2.5}$ Emissions

Step 1 – Identify All Possible Control Technologies

Alternative Basic Equipment, including renewable energy sources such as solar and wind, has also been identified as a technology for the control of PM/PM_{10}/$PM_{2.5}$ emissions. Such alternative basic equipment was already discussed above (Step 2 for NOx BACT on the CTGs/HRSGs). For the same reasons, solar, wind and other renewable energy sources are rejected as PM_{10}/$PM_{2.5}$ BACT for this application.

Achievable Controlled Levels and Available Control Options

PM emissions from natural gas-fired turbines primarily result from carryover of noncombustible trace constituents in the fuel. PM emissions are minimized by using clean burning pipeline quality natural gas with low sulfur content.

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

The CARB's BACT guidance document for stationary gas turbines used for power plant configurations[10] indicates that BACT for the control of PM emissions is an emission limit corresponding to natural gas with fuel sulfur content of no more than 1 grain/100 standard cubic foot.

Title 40 CFR Part 60 Subpart KKKK contains the applicable NSPS for combustion gas turbines. Subpart KKKK does not regulate PM_{10} emissions.

Published prohibitory rules from the SCAQMD, SJVAPCD, SMAQMD, and SDCAPCD were reviewed to identify the PM_{10} standards that govern natural gas-fired combustion gas turbines. These prohibitory rules do not regulate PM_{10} emissions.

Step 2 – Eliminate Technologically Infeasible Options

As discussed above, solar, wind and other renewable energy alternatives are not considered technologically feasible for this application.

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[10] Ibid, Table I-2.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

No control technology other than use of clean natural gas fuel has been identified for this application.

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

Based upon the results of this analysis, the use of natural gas as the primary fuel source constitutes BACT for PM_{10} emissions from combustion gas turbines. Through the use of natural gas, the turbine is expected to be able to meet the proposed emission limit of 5.5 lbs/hr.

Recent BACT determinations for criteria pollutants from similar gas turbine projects are summarized in Tables G-5.2 through G-5.5 below.

Greenhouse Gases (GHG)

Step 1 -- Identify All Possible Control Technologies

EPA has indicated in its guidance on BACT for GHGs[11] that the following types of controls must be considered in determining BACT for GHGs:

- Inherently lower-emitting processes/practices/designs;
- Add-on controls; and
- Combinations of inherently lower emitting processes/practices/designs and add-on controls.[12]

EPA further acknowledges that the requirement to consider inherently lower-emitting processes/practices/designs does not require a fundamental redesign of the nature of the source. This suggests that lower-emitting process/practices/designs that do not achieve the goals, objectives or purposes of the project may be considered technologically infeasible as BACT for a project.

The following control technologies were identified as potentially "available" for PPEC.

- Renewable energy technology (solar or wind)
- Alternative generating technologies
- Alternative fuels
- Energy efficiency
- Carbon capture and storage.

Step 2 -- Eliminate Technologically Infeasible Options

EPA considers a technology to be technically feasible if has been demonstrated in practice on a similar facility, or is available and applicable to the source type under review. EPA considers a technology to be "available" where it can be obtained through commercial channels or is

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[11] EPA, *PSD and Title V Permitting Guidance for Greenhouse Gases*, November 2010, p. 33

[12] Ibid. at p.27.

TABLE G-5.2

Simple Cycle Gas Turbine BACT Determinations (EPA RBLC Clearinghouse}

Facility/Location	Date Permit Issued	Equipment/Rating	NOx Limit/Control Technology	CO Limit/Control Technology	VOC Limit/Control Technology
Shady Hills Generating Station Pasco Co., FL	January 2010	GE Frame 7FA 2 turbines, 340 MW total	9.0 ppm Dry low-Nox burners and water injection	6.5 ppm (3 hour)	No BACT determination
Rawhide Energy Station Larimer Co., CA	June 2009	GE Frame 7FA 1 turbine, 150 MW total	9.0 ppm Dry low-Nox burners	No BACT determination	No BACT determination
TEC/Polk Power Energy Station Polk Co., FL	October 2007	Unspecified 2 turbines, 330 MW total	9.0 ppm Dry low-Nox burners	No BACT determination	No BACT determination

TABLE G-5.3

Summary of BACT Determinations (CARB BACT Clearinghouse)

Facility/District	Permit No./Date	Equipment/Rating	NOx Limit/ Control Technology	CO Limit/Control Technology	VOC Limit/Control Technology
CalPeak Power El Cajon San Diego Co., CA	June 2001	Pratt & Whitney FT-8 DLN Twin Pac 2 turbines 49.5 MW total	3.5 ppm SCR	50 ppm Oxidation catalyst	2.0 ppm Oxidation catalyst
Indigo Energy Facility Los Angeles Co., CA	July 2001	LM6000 (Enhanced Sprint) 1 turbine, 45 MW total	5.0 ppm SCR	6.0 ppm Oxidation catalyst	2.0 ppm Oxidation catalyst
El Colton, LLC San Bernardino Co., CA	January 2003	LM6000 (Enhanced Sprint) 1 turbine, 48.7 MW total	3.5 ppm SCR	6.0 ppm Oxidation catalyst	2.0 ppm Oxidation catalyst
Lambie Energy Center Solano Co., CA	December 2002	GE LM6000 Sprint PC 1 turbine, 49.9 MW total	2.5 ppm SCR	6.0 ppm Oxidation catalyst	2.0 ppm Oxidation catalyst
Los Angeles Dept. of Water and Power Los Angeles Co., CA	May 2001	GE LM6000 1 turbine, 47.4 MW total	5.0 ppm SCR	6.0 ppm Oxidation catalyst	2.0 ppm Oxidation catalyst

TABLE G-5.4

Summary of BACT Determinations (CEC Decisions)

Facility/District	Decision Date	Equipment/Rating	NOx Limit/ Control Technology	CO Limit/Control Technology	VOC Limit/Control Technology
TID Almond 2 Power Plant Ceres, CA	December 2010	GE LM6000 Sprint PG 3 turbines, 174 MW	2.5 ppm Ultra-low NOx burners, water injection and SCR	4.0 ppm (3 hour) Oxidation catalyst	2.0 ppm Oxidation catalyst
Canyon Power Plant Orange Co., CA	March 2010	GE LM6000 Sprint PC 4 turbines, 200 MW total	2.5 ppm Ultra-low NOx burners, water injection and SCR	4.0 ppm (3 hour) Oxidation catalyst	2.0 ppm Oxidation catalyst
Starwood Power-Midway Fresno Co., CA	January 2008	Pratt & Whitney FT8-3 SwiftPac 2 turbines, 120 MW total	2.5 ppm Water injection and SCR	6.0 ppm (3 hour) Oxidation catalyst	2.0 ppm Oxidation catalyst
Panoche Energy Project Fresno Co., CA	December 2007	GE LMS100 4 turbines, 400 MW total	2.5 ppm Water injection and SCR	6.0 ppm (3 hour) Oxidation catalyst	2.0 ppm Oxidation catalyst
San Francisco Electric Reliability Project Power Plant San Francisco Co., CA	October 2006	GE LM6000 Sprint PC 3 turbines, 145 MW total	2.5 ppm Water injection and SCR	4.0 ppm (3 hour) Oxidation catalyst	2.0 ppm Oxidation catalyst
Niland Power Plant Imperial County, CA	October 2006	GM LM6000 Sprint PC 2 turbines, 93 MW total	2.5 ppm Dry low-NOx burners and SCR	6.0 ppm (3 hour) Oxidation catalyst	2.0 ppm Oxidation catalyst

TABLE G-5.5

CARB BACT Guidance For Power Plants

Pollutant	BACT
Nitrogen Oxides	2.5 ppmv @ 15% O_2 (1-hour average) 2.0 ppmv @ 15% O_2 (3-hour average)
Sulfur Dioxide	Fuel sulfur limit of 1.0 grains/100 scf
Carbon Monoxide	Nonattainment areas: 6 ppmv @ 15% O_2 (3-hour average) Attainment areas: District discretion
VOC	2 ppmv @ 15% O_2 (3-hour average)
NH_3	5 ppmv @ 15% O_2 (3-hour average)
PM_{10}	Fuel sulfur limit of 1.0 grains/100 scf

otherwise available within the common meaning of the term (e.g., it has been demonstrated in practice on a comparable, but not necessarily similar, facility). A technology is applicable if it may reasonably be expected to be successfully applied to the source type under review.

Renewable Energy Technology

One of the fundamental objectives of the proposed PPEC project is to provide firming capacity for renewable energy facilities, making the use of renewable energy for the project fundamentally incompatible with the project objective. As discussed in Section 3.1:

> The Pio Pico Energy Center (PPEC)…is a simple-cycle electrical generating facility that is contracted under a 20-year power purchase agreement (PPA) with San Diego Gas & Electric (SDG&E) in response to their 2009 Request for Offers (RFO). The RFO was a broad solicitation for power generation that included peaking facilities, like PPEC, as well as demand-side management and generation from renewable energy resources.
>
> PPEC is designed to directly satisfy the San Diego area peaking and load-shaping generation current and long-term requirements. Key among these requirements is supporting wind and solar generation, whose overall output varies…

As discussed in Section 5.2.5.3 of the AFC, natural gas-fired power plants cannot simply be replaced with renewable energy resources without endangering the reliability of the electric system:

> The Energy Commission's 'Framework for Evaluating Greenhouse Gas Implications of Natural Gas-Fired Power Plants in California' found that as California's integrated electricity system evolves to meet GHG emissions reduction targets, the operational characteristics associated with increasing

> renewable generation will increase the need for flexible generation to maintain grid reliability. The report asserts that natural gas-fired power plants are generally well-suited for this role and that ***California cannot simply replace all natural gas fired power plants with renewable energy without endangering the safety and reliability of the electric system***.[13] [emphasis added]

Because this proposed project is responding directly to a utility Request for Offers, the design of the project as a fully dispatchable, peaking project intended to support the intermittent generation from renewable energy sources is fundamental to the project objective, so renewable energy technology is not a technologically feasible alternative to the proposed combustion technology.

Nuclear Generating Technology

Although nuclear generation has essentially no greenhouse gas emissions, this technology is not considered technologically feasible for this application. To be responsive to the requirements of the RFO, the project must (1) be online by 2014, and (2) be a peaking technology, able to start up and shut down quickly and often. Because of the extensive licensing requirements for nuclear generating technology, it would not be possible to license and construct a nuclear power plant in time to meet the 2014 online date. In addition, nuclear generating units are not fast-start units. For both of these reasons, nuclear generating technology would not meet the fundamental objectives of the proposed project.

Alternative Fossil Fuel Generating Technologies

Alternative fossil fuel generating technologies such as reciprocating internal combustion engines, boilers and combined-cycle combustion turbines may be considered as potentially technologically feasible alternatives to the proposed use of simple-cycle combustion turbine technology. Reciprocating engine technology is generally well-suited to peaking applications such as that proposed project, so can be considered technologically feasible for this application. However, boilers have very high thermal inertia, so are not quick-starting or fast ramping. Boiler technology is generally used for baseload power and not for peaking power applications. Because boiler technology cannot meet the objectives of the project, it is not considered a technologically feasible alternative. Combined-cycle gas turbines are now available with fast startup capability that makes them more compatible with the dispatch and ramping requirements of peaking projects that are intended to back up renewables. Therefore, combined cycle gas turbine technology is potentially technologically feasible for the proposed project.

Alternative Fuels

Biomass fuel can only be used with boiler technology and must be gasified for use in turbines. As discussed previously, boiler technology is not considered a technologically feasible alternative. Although gaseous biofuel could potentially be used as an alternative to natural gas for this project from a technological perspective, SDG&E has specified

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[13] California Energy Commission, "2009 Integrated Energy Policy Report," CEC-100-2009-003-CMF, December 5, 2007.

natural gas as the fuel source in its RFO. Requiring the use of a different fuel would not be compatible with the purpose of the project, which is to respond to the RFO. Therefore, there are no alternative fuels that are considered technologically feasible without redefining the project.

Energy Efficiency

There are two potential applications of energy efficiency as potential BACT for the proposed project: (1) demand-side management (DSM) and similar electric load reduction programs to minimize or eliminate the need for the proposed project altogether; and (2) utilizing the most efficient generating technology that meets the objectives of the project. As discussed above, the project is being proposed to meet a request from the utility for peaking facilities; DSM programs are a separate component of the utility's system management effort and therefore DSM is not an alternative to this project. Utilization of the most efficient generating technology that meets the objects of the project is technologically feasible.

Carbon Capture and Storage (CCS)

CCS technology may be considered to be "available," in the sense that commercial facilities have been built on a scale comparable to PPEC (e.g., a natural gas processing operation.[14] in Wyoming captures 3.6 million tonnes per year of CO_2, compared to the 0.6 million tonnes per year that would be emitted from PPEC.)

However, the technology cannot yet be considered "applicable." The Interagency Task Force on Carbon Capture and Storage (ITF) found that

> "it is unclear how transferable the experience with natural gas processing is to separation of power plant flue gases, given the significant differences in the chemical make-up of the two gas steams. In addition, integration of these technologies with the power cycle at generating plants present significant cost and operating issues that will need to be addressed."[15]

CCS has not yet reached the licensing and commercial sales stage of development. It is an emerging technology that has had limited successful applications on an industrial scale, and no successful applications on a comparably-sized natural gas power plant. There are no CCS systems commercially available for natural gas power plants in the United States. The Department of Energy expects commercial deployment in 2025.[16] Because the proposed project must go online by 2014, CCS does not appear to be commercially available for this application.

Step 3. Rank remaining control technologies.

Absent post-combustion removal or sequestration, CO_2 and other GHG emissions are a direct function of the amount of natural gas fuel burned. GHG emissions will be

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[14] Interagency Task Force on Carbon Capture and Storage, *Report of the Interagency Task Force on Carbon Capture and Storage*¸ August 2010. p. 28.

[15] Id.

[16] 73 FR 44370

minimized by minimizing heat rate and maximizing generating efficiency. The remaining technologies are ranked by their overall heat rate for consideration as BACT for this project, as shown in Table G-5.6.

TABLE G-5.6
Ranking of Potential Generating Technologies/Controls by Heat Rate

Technology	Heat Rate Range (HHV basis)	Technologically Feasible for This Project?
Renewable energy sources	n/a	No
Nuclear generation	n/a	No
Biomass and other biofuels	n/a	No
Demand-side management	n/a	No
CCS	n/a	Maybe
Combined-cycle gas turbines	~7000 to 8000 Btu/kWh[1,2,3]	Yes
Reciprocating IC engines	~7500 Btu/kWh[4]	Yes
Simple-cycle gas turbines	~9400 to 10,000 Btu/kWh[1,2,3]	Yes
Boilers	>10,000 Btu/kWh[1,2,3]	No

Sources:
1. CEC FSA, Avenal Project. http://www.energy.ca.gov/sitingcases/avenal/index.html
2. CEC FSA, TIC Almond 2 Power Plant Project. http://www.energy.ca.gov/sitingcases/almond/index.html
3. CEC FSA, Carlsbad Energy Center Project. http://www.energy.ca.gov/sitingcases/carlsbad/index.html
4. Wärtsilä, specifications for 1V34SG and 20V34SG gas engines. www.wartsila.com

CO_2 is not the byproduct of incomplete combustion or contaminants in the fuel supply. It is an essential product of the combustion of natural gas. Therefore, the only way to reduce the amount of CO_2 generated is to minimize the amount of fuel combustion required to produce the desired amount of electricity. This is achieved by operating the unit efficiently and conducting regular maintenance to ensure continued good combustion. Good combustion practices are a well-established and widely used technique to minimize emissions from combustion sources. Good combustion operation and maintenance will maintain the thermal efficiency of the selected generating technology and therefore must also be considered a component of BACT to minimize GHG emissions.

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

Combined-cycle gas turbines

Combined-cycle gas turbines are inherently more efficient than simple cycle gas turbines because they extract and use exhaust heat that would otherwise be wasted. However, combined cycle gas turbines require heat recovery steam generators and steam turbines, which greatly increase the cost of a generating facility on a dollar per megawatt basis. When a facility is built to operate as a base load plant with a high capacity factor, the

additional cost incurred can be reasonable. However, the proposed project will operate as a peaking plant with an expected capacity factor of approximately 50%. Therefore, the additional cost imposed for a combined cycle plant could not be recovered and would make the project cost uncompetitive. In addition, conventional combined cycle power plants have greater thermal inertia because of the additional equipment downstream of the gas turbine, so generally take longer to start up than simple cycle gas turbines. Although gas turbine vendors have developed fast-start gas turbine technology that allows some new combined cycle units to come online in less than 30 minutes, only simple-cycle turbines are proven to provide the multiple fast startups required as an objective of the project.

Further, the fast-start combined-cycle technology is available only on industrial turbines that are much larger than the 100 MW increment identified for the PPEC: the 300 MW Siemens SCC6-5000F and GE 7FA Rapid Response CTGs. A larger-capacity turbine would be operated at less than optimum (full) output more frequently than a smaller-capacity turbine, and since gas turbine efficiency drops rapidly at less than full load, this mode of operate would likely reduce the overall efficiency of the combined-cycle units to below that of the proposed simple-cycle gas turbines.

Once-through steam generators (OTSG) can be used in place of conventional heat recovery steam generators in a combined-cycle plant to reduce startup time and increase overall plant efficiency. However, in a recent evaluation of this technology as an alternative to simple-cycle turbine technology, the CEC staff determined that under some operating scenarios, emissions of some pollutants would be higher with an OTSG-equipped project than without. Further, even with the faster startups possible with OTSG technology, it still takes some time for the steam side to warm up and be available to produce power. This means that during the period when the steam side is warming up, there is no difference between a simple cycle plant and a once-through combined cycle plant.[17] Therefore, for peaking/firming plants that will undergo multiple startups, most of the time the steam side would not be used so would have no actual beneficial impact on project efficiency. For these reasons, and because inclusion of OTSGs in the project design would greatly increase project cost for essentially no benefit, the use of combined cycle technology with OTSG is not considered BACT for the project.

Reciprocating IC engines

Reciprocating IC engines are fast-starting, but the largest natural gas-fired IC engine currently available is the approximately 9 MW Wärtsilä 20V34SG.[18] The 300 MW size of the proposed project would require over 30 of these engines, which would result in a far more complex and expensive plant and control system. Further, BACT for NOx from engines of this type was recently determined to be 5 ppm, so NOx emissions from a comparable reciprocating engine plant would be approximately twice the NOx emissions from the proposed simple-cycle gas turbine project. Therefore, reciprocating IC engine technology is not considered BACT for the project.

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[17] CEC, "Final Staff Assessment for the Canyon Power Plant: Alternatives," September 2009.

[18] http://powerservices.lakho.com/2009/05/19/largest-natural-gas-reciprocating-engine-plant/

Carbon Capture and Storage

CCS technology applicable to natural gas-fired projects refers to post-combustion capture. EPA's Interagency Task Force on Carbon Capture and Storage[19] found:

> "Post-combustion CO_2 capture … is challenging for the following reasons:
>
> - A high volume of gas must be treated because the CO_2 is dilute (13 to 15 percent by volume in coal-fired systems, three to four percent in natural-gas-fired systems);
> - The flue gas is at low pressure (near atmosphere);
> - trace impurities (particulate matter [PM], sulfur oxides [SO_x], nitrogen oxides [NO_x], etc.) can degrade the CO_2 capture materials; and
> - Compressing captured CO_2 from near atmospheric pressure to pipeline pressure (about 2,000 pounds per square inch absolute) requires a large auxiliary power load…
>
> …Installing current amine post-combustion CO_2 capture technology on new conventional subcritical, supercritical, and ultra-supercritical coal-fired power plants would increase the COE by about 80 percent. Further, the large quantity of energy required to regenerate the amine solvent and compress the CO_2 to pipeline conditions would result in about a 30 percent energy penalty." (pp.29-30)

The International Energy Agency estimates that "CCS can reduce CO_2 emissions from power plants … by more than 85%, and power plant efficiency by about 8-12 percentage points."[20] Although this energy penalty is for coal-fired plants and is not directly applicable to natural gas firing, it is expected to be reasonably representative of the energy penalty for a natural gas-fired system because the lower content of CO_2 in gas turbine exhaust would not necessarily result in an efficiency savings (separation is still required, and there is no data to suggest that the differences in CO_2 concentrations between coal exhaust and gas turbine exhaust would result in lower separation costs). Assuming a minimum 8% energy penalty for CCS, the project would have to generate 8% more electricity to provide energy for CCS without reducing the electricity supply provided by the facility. Criteria pollutant and GHG emissions would also be 8% higher. In view the energy and emissions penalties, the cost and the lack of commercial availability, CCS is not considered BACT for the proposed project.

As shown in Table G-5.2 above, simple cycle gas turbines typically have heat rates that range between 9000 and 10,000 Btu/kWh. PPEC proposes to use a newer, more energy efficient simple cycle turbine technology, the LMS100, which incorporates intercooling to promote enhanced energy efficiency. The heat rate of the LMS100 is approximately 8,694 Btu/kWh (HHV), well below the range of heat rates shown above for typical simple-cycle gas turbines. The use of this highly-efficient simple cycle gas turbine

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[19] EPA, "Report of the Interagency Task Force on Carbon Capture and Storage," 2010. http://www.epa.gov/climatechange/downloads/CCS-Task-Force-Report-2010.pdf

[20] IEA Energy Technology Essentials, December 2006. http://www.iea.org/techno/essentials.htm

technology, combined with good combustion operation and maintenance to maintain optimum efficiency, is determined to be BACT for GHG.

BACT for the CTGs: Startup/Shutdown

Startup and shutdown periods are a normal part of the operation of simple-cycle power plants such as PPEC. BACT must also be applied during the startup and shutdown periods of gas turbine operation. The BACT limits discussed in the previous section apply to steady-state operation, when the turbines have reached stable operations and the emission control systems are fully operational.

NOx Emissions

Step 1 – Identify All Possible Control Technologies

The following technologies for control of NOx during startups and shutdowns have been identified:

- A Selective Catalytic Reduction (SCR) system capable of continuously complying with a limit of 2.5 ppmvd @15% O_2 (1-hour average)
- An EMx system capable of continuously complying with a limit of 2.5 ppmvd @15% O_2 (1-hour average)
- Fast-start technologies (i.e., Rapid Response)
- General Electric OpFlex Startup NOx
- Operating practices to minimize the duration of startup and shutdown

Step 2 – Eliminate Technologically Infeasible Options

During gas turbine startup, there are equipment and process requirements that must be met in sequential order to protect the equipment. In the case of combined cycle turbine projects, many of these require holding the gas turbine at low loads, where operation is inefficient and emissions are relatively high, to allow the HRSG and steam turbine to warm up, and establish steam turbine seals and condenser vacuum. In the case of combustion turbines with dry low NOx combustors, at low turbine loads, the combustors are not yet operating in lean pre-mix mode so turbine NOx emission rates are also high during startup. For these reasons, the specification of combined cycle technology as BACT for other pollutants (e.g., GHGs) would be inconsistent with a determination of BACT for startups and shutdowns.

For all turbine technologies, incomplete combustion at low loads results in higher CO and VOC emission rates. Further, the post-combustion controls that are used to achieve additional emissions reductions (SCR and oxidation catalyst) require that specific exhaust temperature ranges be reached to be fully effective. The use of SCR to control NOx is not technically feasible when the surface of the SCR catalyst is below the manufacturer's recommended operating range. When catalyst surface temperatures are low, ammonia will not react completely with the NOx, resulting in excess NOx emissions or excess ammonia slip or both. The oxidation catalyst is not effective at controlling CO emissions when exhaust temperature is below the optimal temperature range. Therefore, exhaust

gas controls used to achieve BACT for normal operations are not feasible control techniques during startups and shutdowns.

GE's OpFlex Startup NOx is not available for or applicable to simple-cycle gas turbines.

This "top-down" BACT analysis will consider the following NOx emission limitations:

- Operating practices to minimize emissions during startup and shutdown
- Design features to minimize the duration of startup and shutdown

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Operating Practices to Minimize Emissions during Startup and Shutdown

There are basic principles of operation, or Best Management Practices, that minimize emissions during startups and shutdowns. These Best Management Practices are as follows:

- During a startup, bring the gas turbine to the minimum load necessary to achieve compliance with the applicable NOx and CO emission limits as quickly as possible, consistent with the equipment manufacturers' recommendations and safe operating practices;
- During a startup, initiate ammonia injection to the SCR system as soon as the SCR catalyst temperature and ammonia vaporization system have reached their minimum operating temperatures;
- During a shutdown, once the turbine reaches a load that is below the minimum load necessary to maintain compliance with the applicable NOx and CO emission limits, reduce the gas turbine load to zero as quickly as possible, consistent with the equipment manufacturers' recommendations and safe operating practices; and
- During a shutdown, maintain ammonia injection to the SCR system as long as the SCR catalyst temperature and ammonia vaporization system remain above their minimum operating temperatures.

A key underlying consideration of these Best Management Practices is the overall safety of the plant staff by promoting operation within the limitations of the equipment and systems, and allowing for operator judgment and response times to respond to alarms and trips during the startup sequence.

Design Features to Minimize the Duration of Startup and Shutdown

An additional technique to reduce startup emissions is to minimize the amount of time the gas turbine spends in startup. The use of simple-cycle gas turbine technology inherently minimizes this time, in that simple-cycle gas turbines generally start up and shut down much more quickly than combined-cycle turbines.

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

Utilizing best operating practices to minimize emissions during startups and shutdowns has no adverse environmental or energy impacts, nor does it require additional capital expenditure.

The approach of reducing startup/shutdown duration has no adverse environmental or energy impacts, and the use of simple-cycle generating technology minimizes startup/shutdown duration.

Step 5 - Determine BACT/Present Conclusions

BACT for NOx during startups/shutdowns is the use of operating systems/practices that reduce the duration of startups and shutdowns to the greatest extent feasible, and the use of operational techniques to initiate ammonia injection as soon as possible during a startup. Therefore, BACT is determined to be the use of simple-cycle gas turbine technology and the application of operating systems/practices that minimize startup and shutdown durations, in combination with the use of operational techniques to initiate ammonia injection as soon as possible during a startup.

VOC Emissions

The VOC control technologies under consideration for startups and shutdowns are ranked as follows:

- Oxidation catalyst unit capable of achieving 2 ppmvd @ 15% O2
- Fast-start technologies (e.g., Rapid Response)
- Operating practices to minimize the duration of startup and shutdown

Step 1 – Identify All Possible Control Technologies

The analysis for VOC is identical to the analysis for NOx.

Step 2 – Eliminate Technologically Infeasible Options

The analysis for VOC is identical to the analysis for NOx.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

The analysis for VOC is identical to the analysis for NOx.

Step 4 – Evaluate the Most Effective Control Technology Considering Environmental, Energy, and Cost Impacts

The analysis for VOC is identical to the analysis for NOx.

Step 5 – Determine BACT/Present Conclusions

BACT for VOC during startups/shutdowns is the use of simple cycle gas turbine technology and operating practices that reduce the duration of startups and shutdowns to the greatest extent feasible.

PM/PM_{10}/$PM_{2.5}$ Emissions

Because PM and PM_{10} emissions result from the characteristics of the fuel burned and do not rely on any emissions control system, the BACT determinations for SO_2 and PM_{10} emissions during normal operations are applicable during startup and shutdown as well.

SOx Emissions

Because SO_2 emissions result from the characteristics of the fuel burned and do not rely on any emissions control system, the BACT determinations for SO_2 (and PM_{10}) emissions during normal operations are applicable during startup and shutdown as well.

Proposed BACT determinations for the PPEC simple-cycle gas turbines are summarized in Table G-5.7.

TABLE G-5.7
Proposed BACT Determinations for PPEC Simple-Cycle Gas Turbines

Pollutant	Proposed BACT Determination
Nitrogen Oxides	Water injection and SCR system, 2.5 ppmc[a], 1-hour average, with excursions under specific conditions; no CCS
Sulfur Dioxide	Natural gas fuel (sulfur content not to exceed 0.75 grain/100 scf short-term average, 0.25 grains/100 scf long-term average)
Carbon Monoxide	Good combustion practices and oxidation catalyst, 4.0 ppmc, 1-hour average
VOC	Good combustion practices, 2.0 ppmc, 1-hour average
PM_{10}	Natural gas fuel, 5.5 PM_{10} lbs/hr
$PM_{2.5}$	Natural gas fuel, 5.5 $PM_{2.5}$ lbs/hr
Startup/Shutdown	Best operating practices to minimize startup/shutdown times and emissions
GHGs	LMS 100 simple-cycle gas turbine technology, good combustion practices

Note:

a. ppmc: parts per million by volume, corrected to 15% O_2

BACT for the Cooling System

Step 1 – Identify All Possible Control Technologies

Available control options are those air pollution control technologies or techniques, including alternate basic equipment or processes, with a practical potential for application to the emissions unit in question. The control alternatives should include not only existing controls for the source category in question, but also, through technology transfer, controls applied to similar source categories and gas streams.

The emissions source for which BACT is being considered is the partial dry-cooling system (PDCS), which is a closed-loop two-stage cooling system. In this system, the heat will be rejected using ambient air in a dry cooling system, followed by a closed-loop evaporative fluid cooler for additional cooling. This will reduce plant water consumption in two ways. First, the dry-cooling section will reduce the amount of heat that must be rejected in the closed-loop evaporative fluid cooler, which results in a corresponding reduction in the total amount of water evaporated during the cooling process. Second, the closed-loop evaporative fluid cooler will allow the contaminants in the evaporative cooling water to be concentrated to a much greater extent than in a traditional open-loop cooling system because that water does not pass through the combustion turbine equipment.

The dry cooling portion of the cooling system has no air emissions. The evaporative fluid cooler portion of the cooling system will be a 7000 gallon per minute (gpm) fluid cooler. The fluid cooler uses mechanical, induced-draft technology in a closed circuit. In the fluid cooler, the process fluid to be cooled is pumped through coils and cooling water passes over the coils, cooling the process fluid by evaporation. Particulate emissions result from the wet cooling portion of the system.

Potential control technologies applicable to particulate emissions from the evaporative (wet) cooling portion of the cooling system were identified by searching the following sources for entries pertaining to cooling towers:

- SCAQMD BACT Guidelines;
- SJVAPCD BACT Clearinghouse;
- BAAQMD BACT Guidelines;
- USEPA RACT/BACT/LAER Clearinghouse;
- Other districts' and states' BACT Guidelines; and
- BACT/LAER requirements in New Source Review permits issued by AQMD or other agencies.

BACT determinations from the SCAQMD, SJVAPCD, BAAQMD, and USEPA are summarized in Table G-5.8.

TABLE G-5.8
Summary of PM_{10} BACT Clearinghouse Guidelines

Permitting Agency	Guideline	Operation	PM_{10} BACT for Cooling Towers
SCAQMD	None	N/A	N/A
SJVAPCD	8.3.10	Induced Draft Evaporative Cooling Tower	Cellular Type Drift Eliminator
BAAQMD	None	N/A	N/A

USEPA	RBLC Listings	≤10,000 gpm Cooling Towers	Drift Eliminators 0.001% Drift Rate

Cooling devices of the size range used in simple-cycle power plants are generally not subject to local district BACT requirements because their emission rates are usually below district BACT thresholds. Table G-5.9 summarizes information on evaporative coolers of the type proposed for use at PPEC that have recently been approved by the California Energy Commission (CEC) through the Application for Certification (AFC) process; these controlled emission rates were approved by the indicated permitting authority. Recent BACT determinations for similarly sized cooling towers from the EPA RBLC listings are summarized in Table G-5.10.

TABLE G-5.9
PM_{10} Emission Rates for Small Cooling Towers in CEC Proceedings

Permitting Agency	Project	Permit Required?	Permit Date	Circulating Water Flow Rate	Drift Rate Limit
SCAQMD	Canyon Power Plant	yes	2010	7,740 gpm	0.001%
BAAQMD	SF Electric Reliability Project	no (exempt)	2006	3,912 gpm	0.001%
SJVAPCD	MID Ripon	no (exempt)	2004	3,218 gpm	0.001%

TABLE G-5.10
PM_{10} BACT Determinations for Small Cooling Towers From RBLC Database

Project	Permit # (Date)	Circulating Water Flow Rate	Drift Rate Limit
MGM Mirage	NV-0050 (Nov. 2009)	10,890 gpm	0.001%
Harrah's Operating Company	NV-0049 (Aug. 2009)	7,200 gpm	0.005%
Crescent City Power	LA-0192 (June 2005)	35,000 gpm	0.005%

BACT must be at least as stringent as what has been achieved in practice (AIP) for a category or class of source. Additionally, USEPA guidelines require that technology that is determined to be AIP for one category of source be considered for transfer to other source categories. There are two types of potentially transferable control technologies: (1) exhaust stream controls, and (2) process controls and modifications. For the first type,

technology transfer must be considered between source categories that produce similar exhaust streams. For the second type, technology transfer must be considered between source categories with similar processes. In order to be considered, the candidate control technology must be technologically feasible for the application being reviewed. In order to be required as BACT, the candidate technology must be cost effective, considering energy, environmental, economic, and other costs.

Three possible alternate basic technologies were identified from background technical materials prepared during the rulemaking of USEPA's National Pollutant Discharge Elimination System (NPDES): "Regulations Addressing Cooling Water Intake Structures for New Facilities" (Federal Register 66:24, December 18, 2001). The NPDES regulation establishes national technology-based performance requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities using once-through cooling. During the rulemaking process, USEPA also evaluated alternatives to once-through cooling, including recirculating wet cooling systems, dry cooling systems, and hybrid cooling systems.

Recirculating Wet Cooling Tower with High Efficiency Drift Eliminator

In conventional open-cycle recirculating wet cooling towers, cooling water that has been used to cool the condensers is pumped to the top of a recirculating cooling tower; as the heated water falls, it cools through an evaporative process and warm, moist air rises out of the tower, often creating a vapor plume. Approximately 80% of the heat transfer (cooling) occurs due to evaporation, and 20% of the heat transfer occurs due to convection. Therefore, wet cooling towers are more effective in areas of low relative humidity.

Evaporative Coolers

Evaporative fluid coolers isolate process fluid from cooling water and operate as a closed-loop system.

Dry Cooling Tower

Dry cooling systems (towers) use either a natural or a mechanical air draft to transfer heat from the condenser tubes to air. Their effectiveness is independent of relative humidity and purely a function of the ambient (dry-bulb) temperature. Therefore, dry cooling towers are more effective in areas of low ambient temperature.

Hybrid Cooling Tower (Plume-Abated Wet Cooling)

There are two types of hybrid wet-dry cooling towers. One type is essentially a wet cooling tower with an additional dry section installed on top that reduces visible plumes by heating the wet air from the wet section. This is done to reduce or eliminate the visible condensation plume.

Hybrid Cooling Tower (Spray-Enhanced Dry Cooling)

The second type of hybrid system is essentially a dry cooling tower that enhances heat transfer in the condenser tubes by spraying water on the outside of the tubes.

Once-Through Cooling

Once-through cooling systems eliminate the cooling tower entirely by drawing cooling water from a water source (such as a river or the ocean), using the water to cool the condensers, and then discharging the heated water, usually back to the original water source.

Step 2 – Eliminate Technologically Infeasible Options

The next step in the top-down BACT procedure is to eliminate technologically infeasible options.

Recirculating Wet Cooling Tower

Recirculating wet cooling towers are generally used for large, combined cycle projects because of the much larger volume of cooling water that must be cooled and condensed. However, this technology is available for smaller applications and is technologically feasible for the proposed project.

Evaporative Cooling

An evaporative fluid cooler with drift eliminator has been proposed as part of the cooling system for this project. However, the capacity of this evaporative fluid cooler is reduced by including a dry cooling section in the cooling system design for the project.

Dry Cooling

USEPA has adopted standards for new facilities that draw cooling water from waters of the U.S. The regulation established the best technology available for minimizing adverse environmental impacts associated with the use of cooling water intake structures.

As part of the rulemaking process, USEPA considered the technical issues, cost, and environmental impacts associated with replacing once-through cooling with recirculating cooling towers and dry cooling. USEPA rejected dry cooling as the best replacement technology due to all three of these factors. For the purposes of this BACT analysis, the technical issues are evaluated in this step.

The main technical issue associated with dry cooling towers for this application is the limited availability to provide adequate cooling under high-temperature conditions. The plant will use a PDCS in a closed-loop configuration that utilizes dry cooling but also requires additional cooling capacity. For the purposes of this analysis, dry cooling was eliminated as a potential BACT option for the second stage of the cooling system because enhanced cooling is required for the plant beyond what is already being provided by the dry cooling system.

Hybrid Cooling (Plume-Abated Wet Cooling Tower)

Hybrid wet-dry (plume abated) cooling towers employ both a wet section and dry section and reduce or eliminate the visible plumes associated with wet cooling towers. In general, a hybrid cooling tower is used only where a visible plume presents a threat to public safety by its interference with major infrastructure, such as airports, or in some cases if the plume will block prominent landscape features or scenic coastal areas.

Hybrid cooling towers offer only insignificant changes in PM, PM10, and PM2.5 emissions compared to wet cooling towers. After the warm, moist air passes through the drift eliminators of the wet section, it is mixed with warm dry air that passed through the dry section. This step speeds the evaporation that would normally occur after the plume was released. While most remaining liquid drift may be eliminated within the dry section of the cooling tower via evaporation, the particulate nuclei are not reduced or eliminated by any physical process and are exhausted through the top of the cooling tower.

Even though this option does not decrease PM emissions from the cooling tower, it also has not been deemed technologically infeasible as appropriate BACT for the PPEC cooling tower. Thus, the environmental and economic impacts of this option are discussed in the following steps.

Hybrid Cooling Tower (Spray-Enhanced Dry Cooling)

A spray-enhanced hybrid cooling tower works essentially as a dry cooling tower that enhances heat transfer in the condenser tubes by spraying water on the outside of the tubes. The addition of the evaporating water spray can help alleviate the technical issues associated with dry cooling. Increased cooling may allow for fewer, more efficient dry cooling cells to be installed, thus shrinking the plant footprint required for the cooling tower. However, it is not clear that this technology would provide adequate additional cooling that would eliminate the need for the evaporative fluid cooler. Therefore, this technology is not considered technologically feasible for the proposed project.

Once-Through Cooling

Once-through cooling involves the water withdrawn from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters. In general, once-through cooling is only technologically feasible when a large surface water body exists in immediate proximity to the power plant. Since this situation does not exist for the PPEC project, once through cooling has been deemed a technologically infeasible BACT option and will not be further evaluated.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Aside from the proposed BACT technology of the partial dry cooling system, a wet cooling tower with high-efficiency drift eliminators, the remaining technologies are (1) a wet cooling tower and (2) a plume-abated wet cooling tower.

Recirculating Wet Cooling Tower

A recirculating wet cooling tower would have higher water requirements and would require additional water treatment than the proposed partial dry system that utilizes an evaporative fluid cooler. The increase in water use would, by itself, be a negative environmental impact. While the evaporative fluid cooler portion of the cooling system could be replaced by a recirculating wet cooling tower, additional water treatment would

still be required. For this reason, wet cooling tower technology is not considered to be BACT for the proposed project.

Hybrid Cooling (Plume-Abated Wet Cooling)

A plume-abated wet cooling tower is no more effective in eliminating drift and particulate matter compared to a wet cooling tower, but carries some of the energy penalties associated with dry cooling. For this reason, a plume-abated cooling tower is ranked lower than an evaporative fluid cooler for PM10 BACT purposes. Since this technology is less effective than the proposed technology, it is eliminated from consideration and no further analysis is necessary.

The remaining technologies were ranked according to PM_{10} reductions, as shown in Table G-5.11.

TABLE G-5.11
Environmental, Energy and Cost Impacts of Cooling System Alternatives

Equipment	Environmental	Energy	Cost
Partial Dry Cooling System (PDCS) with Evaporative Fluid Cooling	Minimizes water use; minimizes water treatment requirements	Higher energy consumption than wet cooling alone	Higher cost than wet cooling alone

* Not including any drift losses from spray enhancement (see discussion above).

Step 4 – Evaluation of Environmental, Energy, and Cost Impacts

This step evaluates any source-specific environmental, energy, or economic impacts that demonstrate that the top alternative shown in Table G.5-11 is inappropriate as BACT. Only the proposed partial dry cooling system technology is considered a technologically feasible and environmentally beneficial option. The remaining issue is the drift rate limit that should be applied to the evaporative fluid cooling portion of the PDCS. Drift rates for similar projects, shown in Tables G.5-9 and G.5-10, range from 0.001% to 0.005%; no installations have been identified with drift rates below the proposed 0.001% level.

Step 5 – Select BACT

Based upon the above information, BACT is use of a PDCS with evaporative fluid cooler and high-efficiency drift eliminator with a drift rate of 0.001% or less. The proposed cooling tower complies with this BACT level.

APPENDIX G-6

Cumulative Impacts Analysis

Search for Nearby Sources

Two types of cumulative air quality impact analyses are often conducted in association with power plant projects. The first type is a CEQA cumulative impacts analysis: an analysis of potential cumulative air quality impacts that may result from the project and other reasonably foreseeable projects. Such an analysis is generally required only when project impacts are significant.

The second type of cumulative impact analysis is part of the PSD review process, and is designed to ensure that industrial facilities which have the potential to cause locally elevated concentrations of air contaminants are adequately considered when determining the project's potential to cause or contribute to a violation of a federal air quality standard. The PSD air quality impact analysis process, as administered by EPA Region 9, is now an iterative process, requiring a series of submittals and approvals. The first step in the process is the submittal, review, and approval of the modeling protocol. The modeling protocol was provided to EPA for review in November, 2010. The next step in the process will be identification of the nearby sources that will be explicitly modeled for the compliance demonstration. The final submittal will be the compliance demonstration itself.

Because EPA's PSD process is now an iterative one, it will require supplemental submittals on a different schedule than the CEC/District permitting process.

CEQA Cumulative Analysis

CEC requirements specify that an analysis is required to determine the cumulative impacts of the project and other projects within a 6-mile radius that have received construction permits, but are not yet operational, or that are in the permitting process, or can be expected to do so in the near future. The District provided a list of projects that meet these criteria (see Table G-6.1). The District has indicated that all of these projects will have emissions of less than 5 TPY of any pollutant. Based on consultation with the District, and consistent with past practice, none of these sources were evaluated by cumulative modeling.

Table G-6.1

Permit Applications in San Diego Since January 1, 2004

App No.	Equip Descr	Issue Date	Company	Address		City
976949	VAPOR DEGREASER	28-Apr-04	TOP BRASS CO	2731	VIA ORANGE WY #112	SPRING VALLEY
978687	EMERGENCY GENERATOR MODEL #50075 S/N 263377	06-Jan-04	SUNRISE DEVELOPEMENT INC	3302	BONITA RD	BONITA
978744	MARINE COATING ON SHIPS & SUBMARINES GRACO MODEL 243283 BG, BRUSH & ROLLER	19-May-04	Q E D SYSTEMS INC	1330	30TH ST #D	SAN DIEGO
978829	INSTALLATION OF NEW ODOR CONTROL SYSTEM TO AN EXISTING SEWER PUMP STATION	30-Mar-04	SD CITY DEPT OF METRO WASTEWATER	1800	BOUNDRY AV	SAN DIEGO
978838	INTERNAL COMBUSTION ENGINE MODEL 200I W/CATALYST SYSTEM	25-Feb-04	VERALLIANCE PROPERTIES INC	2300	BOSWELL RD	CHULA VISTA
978839	INTERNAL COMBUSTION ENGINE W/CATALYST SYSTEM MODEL 2001	25-Feb-04	VERALLIANCE PROPERTIES INC	2300	BOSWELL RD	CHULA VISTA
978902	EMERGENCY GENERATOR FORD MODEL ESG-642	09-Mar-04	TARGET STORE T1815	910	EASTLAKE PY	CHULA VISTA
979038	CONCRETE BLOCK MANUFACTURING PLANT	28-Feb-05	RCP BLOCK & BRICK INC	2480	BRITANNIA BL	SAN DIEGO
979101	3 GASOLINE & 2 DIESEL TANKS, 6 NEW SINGLE-HOSE MPD DISPENSERS W/ BLENDERS	23-Jun-04	LA CIMA OIL INC	8289	OTAY MESA RD	SAN DIEGO
979299	SOIL REMEDIATION	17-Feb-04	ATC ASSOCIATES INC	505	3RD AV	CHULA VISTA
979471	WOOD PARTS/PRODUCTS APPLICATION STATION	28-Sep-04	SD FURNITURE	3137	BEYER BL #C	SAN DIEGO
979477	TWO (2) BLEEKER BROS. MODEL F-12-7-10,10'L X 12'W X 6'10"H, PAINT SPRAY BOOTH	30-Jan-07	WOOD CRAFT CO	1520	CORPORATE CENTER DR	SAN DIEGO
980002	CONCRETE BATCH PLANT, DRY, TRANSIT MIXED	30-Sep-05	ROBERTSONS	7961	AIRWAY RD	SAN DIEGO
980013	MOBILE FUEL BARGE; CAPACITY OF 9,800 GAL OF DIESEL & 800 GAL OF GAS	06-May-04	MARINE GROUP LLC THE	997	G ST	CHULA VISTA
980026	GASOLINE SITE	15-Jun-05	EASTLAKE PETROLEUM LP	950	EASTLAKE PY	CHULA VISTA
980106	REPLACE EXISTING USTS RE-PIPE NEW PHASE 2 EVR PHASE 1 NEW DISPENSERS AND UNDER DISPENSER CONTAINMENT	12-Apr-04	GASCO SELF SERVE	899	3RD ST	CHULA VISTA
980156	INTERNAL COMBUSTION ENGINE - DETROIT DIESEL, MODEL #12V2000-R1237K36, S/N#0760606, 1120 HP	04-Mar-05	CHULA VISTA CITY OF POLICE STATION	315	4TH AV	CHULA VISTA
980216	IC ENGINE MODEL BF4M1013EC	28-Apr-04	PROFIL RESEARCH	855	THIRD AV	CHULA VISTA
980246	HEALEY ORVR PHASE 11 VAPOR RECOVERY SYSTEM 8 NOZZLES 3 GRADES	17-Jan-05	USA GASOLINE PROFIT CENTER #68121	1382	PALOMAR ST E	CHULA VISTA
980851	AUTOMOTIVE APPLICATION STATION	03-Mar-05	SUPERIOR AUTO BODY	363	E ST	CHULA VISTA
981018	BALANCE PHASE I & II VAPOR RECOVERY	29-Aug-05	CHEVRON #301124	2115	OLYMPIC PY	CHULA VISTA
981076	WOOD PARTS/PRODUCTS APPLICATION STATION	11-Mar-05	IEER MANUFACTURING	2311	BOSWELL RD #1	CHULA VISTA
981189	GASOLINE SERVICE SITE	16-Dec-05	IUST 4 FUN LLC	2535	OTAY CENTER DR	SAN DIEGO
981204	SOLVENT CLEANING PROCESS LINE: SOLVENT CLEANING <5 SQ FT FOLLOWED BY DRYING OPERATION	14-Jul-04	PARKER HANNIFIN INC	7664	PANASONIC WY	SAN DIEGO
981205	SOLVENT CLEANING PROCESS LINE: SOLVENT CLEANING >5 SQ FT FOLLOWED BY DRYING OPERATION	14-Jul-04	PARKER HANNIFIN INC	7664	PANASONIC WY	SAN DIEGO
981206	SOLVENT APPLICATION OPER: DETACHMENT OF RUBBER SEALERS FROM METAL PARTS	04-Apr-05	PARKER HANNIFIN INC	7664	PANASONIC WY	SAN DIEGO
981207	SOLVENT APPLICATION OPER: DETACHMENT OF RUBBER SEALERS FROM METAL PARTS	04-Apr-05	PARKER HANNIFIN INC	7664	PANASONIC WY	SAN DIEGO
981208	SOLVENT APPLICATION OPER: DETACHMENT OF RUBBER SEALERS FROM METAL PARTS	04-Apr-05	PARKER HANNIFIN INC	7664	PANASONIC WY	SAN DIEGO
981324	APPLICATION STATION HVLP SPRAY GUN ACCUSPRAY SERIES 10	12-Oct-04	OTAY MESA SALES	1596	RADAR RD	SAN DIEGO
981326	DEGREASER MODEL PL36-A SN ICR90-B4	15-Jul-04	CROWER CAMS & EQUIPMENT	6180	BUSINESS CENTER CT	SAN DIEGO
981327	DEGREASER MODEL PL36-A SN ICGF7	15-Jul-04	CROWER CAMS & EQUIPMENT	6180	BUSINESS CENTER CT	SAN DIEGO

Table G-6.1 (cont'd)

Permit Applications in San Diego Since January 1, 2004

App No.	Equip Descr	Issue Date	Company	Address		City
981328	DEGREASER MODEL PL36-A SN ICGF7	15-Jul-04	CROWER CAMS & EQUIPMENT	5180	BUSINESS CENTER CT	SAN DIEGO
981329	DEGREASER MODEL PL36-A SN IATT7	15-Jul-04	CROWER CAMS & EQUIPMENT	5180	BUSINESS CENTER CT	SAN DIEGO
981330	DEGREASER MODEL PL36A SN ICR90-B4	15-Jul-04	CROWER CAMS & EQUIPMENT	5180	BUSINESS CENTER CT	SAN DIEGO
981475	GASOLINE SERVICE SITE	28-Sep-06	ATTISHA ARCO	765	E ST	CHULA VISTA
981531	RECYCLE CRUSHING PLANT MODEL 62040 SN 1181	19-Aug-05	RCP BLOCK & BRICK INC	2480	BRITANNIA BL	SAN DIEGO
981540	IC ENGINE MODEL 6081AF001 SN RC6081A154970	27-Dec-05	REYNOLDS COMMUNITIES	4655	DEL SOL BL	SAN DIEGO
981556	AUTOMOTIVE APPLICATION STATION	01-Nov-04	US BORDER PATROL	7682	POGO ROW	SAN DIEGO
981629	CONCRETE BATCH PLANT PO 980222 FROM PORTABLE TO STATIONARY	19-Aug-05	SUPERIOR READY MIX CONCRETE LP	6935	CACTUS CT	SAN DIEGO
981661	MARINE COATING OPERATION	19-Oct-06	PACIFIC YACHT REFITTERS INC	997	G ST	CHULA VISTA
981766	IC ENGINE MODEL 6068TF250	27-Mar-06	THE HOME DEPOT	725	PLAZA CT	CHULA VISTA
981873	GASOLINE SERVICE SITE	17-Nov-05	CHULA VISTA CITY OF FIRE STATION #7	1640	SANTA VENETIA ST	CHULA VISTA
981912	CENTRAL MIXED CONCRETE BATCH PLANT AND SILOS; REX MODEL 120DRP528	23-Nov-05	ASSOCIATED READY MIXED CONRETE INC	1696	CACTUS RD	SAN DIEGO
982042	SAND AND AGGREGATE BAGGING UNIT	10-May-05	RCP BLOCK & BRICK INC	2480	BRITANNIA BL	SAN DIEGO
982263	CUMMINS DIESEL ENGINE MODEL DGDA 170 HP RATING CARB CERT# U-R-002-0223	10-Mar-06	CITY OF CHULA VISTA PUBLIC WORKS	800	AGUA VISTA DR	CHULA VISTA
982471	500 GAL AST	01-Sep-05	BONITA GOLF CLUB	5540	SWEETWATER RD	BONITA
983125	SMALL COLD SOLVENT DIP TANKS/REMOTE RESERVOIR CLEANERS	21-Jun-05	US BORDER PATROL IMMIGRATION & NATURALIZATION SVCS	7685	POGO ROW	SAN DIEGO
983376	IC ENGINE, CATERPILLAR, S/N GZS00307, MODEL 3516B, DIESEL, 2847 HP	10-Mar-06	OTAY WATER DISTRICT	1230	EASTLAKE PY	CHULA VISTA
983720	TARPAULIN FUMIGATION USING METHYL BROMIDE	14-Apr-06	HARBOR PEST CONTROL	8515	AVENIDA DE LA FUENTE	SAN DIEGO
983937	PORTABLE ASBESTOS MASTIC REMOVAL APPLICATION STATION	29-Dec-05	CLANCY CONTRACTING SERVICES	825	HOLLISTER ST #M	SAN DIEGO
984040	I/C ENGINE - CATERPILLAR MODEL C-18 DITA; S/N WJH00262, 630 HP, DIESEL.	15-Jun-07	OTAY WATER DISTRICT	1502	WUESTE RD	CHULA VISTA
984092	MARINE COATING APPLICATION	03-May-07	Q E D SYSTEMS INC	1330	30TH ST #D	SAN DIEGO
984176	GASOLINE DISPENSING FACILITY	09-Sep-08	PILOT TRAVEL CENTERS LLC	1497	PIPER RANCH RD	SAN DIEGO
984293	SELF SERVE. GASOLINE DISPENSING FACILITY. 10,000 GALLON AST. AVIATION FUEL ONLY	02-Apr-07	FIRST FLIGHT CORP	6810	CURRAN ST	SAN DIEGO
984435	IC ENGINE GENERAL MODEL 0046267; S/N 4356149, 80HP, NATURAL GAS.	25-Aug-06	CUSTOMS AND BORDER PROTECTION (CBP)		ARNIE'S POINT	CHULA VISTA
985041	SPRAY BOOTH M&W MODEL MWTR431616.	10-Jul-07	WORK TRUCKS UNLIMITED	2500	SWEETWATER SPRINGS BL	SPRING VALLEY
985175	OLYMPIAN DIESEL ENGINE MODEL D60P2 S/N GABL001576 HP RATING 98.4	27-Jun-07	MISSION IMPRINTABLES	6060	BUSINESS CENTER CT #200	SAN DIEGO
985439	LINDUS MODEL PM60 DRY CLEANING MACHINE	09-Jul-07	SATURN CLEANERS	555	SATURN BL #E	SAN DIEGO
985469	ABRASIVE BLASTING POT/MACHINE MODEL 1-9 DEZ S/N 27040070 HP 9.39	16-Jun-08	CLANCY CONTRACTING SERVICES	825	HOLLISTER ST #M	SAN DIEGO
985516	IC ENGINE CLARKE/JOHN DEERE MODEL JU4H-UF40, S/N PE4045T652489, 94HP DIESEL	18-Feb-08	PRUDENTIAL INSURANCE CO OF AMERICA THE	1440	INNOVATIVE DR	SAN DIEGO
985975	SOIL VAPOR EXTRACTION EQUIP. SOIL-THERM MODEL 2002-LR-EN	09-Apr-08	AMI ADINI & ASSOCIATES INC	77	BROADWAY (PORTABLE)	CHULA VISTA
986927	JOHN DEERE DIESEL ENGINE MODEL 6068HF285K S/N PE66068L039363 HP RATING 197	02-Jun-09	INNOVATIVE COLD STORAGE II	7350	BRITANNIA CT	SAN DIEGO
987439	MARINE COATING OPERATION	17-Mar-09	VT MILCOM	2232	VERUS ST	SAN DIEGO
987548	REPLACEMENT EMERGENCY STANDBY DIESEL 30K W ENGINE FOR PO #983068	19-Mar-09	FEDERAL AVIATION ADMINISTRATION		PGY BLDG	CHULA VISTA

APPENDIX G-7

Compliance Demonstration

Federal NO_2 and $PM_{2.5}$ Standards

The worst-case modeling analysis, in which maximum project impacts were added to maximum measured background concentrations, demonstrated compliance with all ambient air quality standards except for the federal 1-hour NO_2 standard and the federal 24-hour $PM_{2.5}$ standard (see Appendix G-2). A more refined analysis that more closely matches the actual ambient concentrations with the modeled project impact under the same meteorological conditions has been performed as a more realistic assessment of expected impacts of the proposed project.

The methodology for performing this analysis is described in detail in the modeling protocol (Appendix G-8), and will be summarized here. It should be noted that this analysis, although more refined than the screening analysis, is still conservative, for reasons that will be discussed below.

The stack parameters used for this analysis are shown in Table G-7.1.

Compliance with the Federal 1-hour NO_2 Standard

Form of the Standard

The federal 1-hour NO_2 standard is met if the 3-year average of the 98th percentile highest daily 1-hour average NO_2 concentration, including background, does not exceed 100 ppb. At standard temperature and pressure, this limit is equivalent to 188 µg/m^3. The standard is converted to µg/m^3 for the analysis because the modeling results are in those units.

The procedure for determining compliance is to determine the highest 1-hour NO_2 concentration, including background, for each calendar day in the year at every receptor. These concentrations are rank-ordered, highest to lowest, and the 98th percentile value (8th highest concentration for a reasonably complete data set) is selected to represent that year. These values are then averaged over the three years included in the analysis. The resulting average must be less than or equal to 188 µg/m^3.

Compliance Demonstration Procedure

The output from the dispersion model provides the worst case project impact at all of the receptors in the impact area (the area where the maximum project impact exceeds the Significant Impact Level [SIL])[21] for each hour of the year (see Figures G-7.1 and G-7.2). Receptors outside the impact area are excluded from the analysis because the project impact cannot, by definition, cause or contribute significantly to a violation of the standard if the project impact, by itself, does not exceed the SIL.

Use of the worst-case modeled impact is the first conservative assumption in this analysis. It is conservative because it assumes that the project will be operating under its worst case conditions (i.e., all three turbines in simultaneous startup, for NO_2) every single hour of the year. Although this is clearly unrealistic, it is not possible to further refine the assumptions; it is **possible**, although extremely **unlikely**, that such operation will line up with each of the 8 highest impact hours during the year.

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[21] It should be noted that USEPA has not adopted a SIL for the 1-hour NO_2 standard. Following EPA guidance, the interim SIL value of 4 ppb (7.5 µg/m^3) has been used for this analysis.

The ambient background NO_2 concentration for each hour is then added to the modeled impact at each receptor. EPA has requested that the actual concentrations corresponding to the meteorological conditions not be used for this analysis. Instead, another conservative adjustment has been made to the results: for each calendar month, a composite daily background profile has been used. The composite daily background profile for a given calendar month is comprised of the highest ambient monitor NO_2 reading from the month for each clock GMT hour.

Once the modeled impact for each hour has been added to the corresponding ambient background concentration, the highest combined impact for each calendar day is determined. Daily maxima are rank ordered; because the data set is complete, the 8th highest result is averaged with those from the other years in the analysis to determine compliance.

Compliance Demonstration Results

The results of the compliance demonstration are shown in Table G-7.2. The project's impact of 156 µg/m^3 is below the standard of 188 µg/m^3.

Compliance with the Federal 24-hour $PM_{2.5}$ Standard

Form of the Standard

The federal 24-hour $PM_{2.5}$ standard is met if the 3-year average of the 98th percentile daily 24-hour average $PM_{2.5}$ concentration, including background, does not exceed 35 µg/m^3.

The procedure for determining compliance is to determine the 24-hour $PM_{2.5}$ concentration, including background, for each calendar day in the year at every receptor. These concentrations are rank-ordered, highest to lowest, and the 98th percentile value (8th highest concentration for a reasonably complete data set) is selected to represent that year. These values are then averaged over the three years included in the analysis. The resulting average must be less than or equal to 35 µg/m^3.

Compliance Demonstration Procedure

The output from the dispersion model provides the worst case project impact at all of the receptors in the impact area (the area where the maximum project impact exceeds the Significant Impact Level [SIL]) for each hour of the year. Receptors outside the impact area are excluded from the analysis because the project impact cannot, by definition, cause or contribute significantly to a violation of the standard if the project impact alone does not exceed the SIL. The ambient background concentration for each day is then added to the modeled impact at each receptor.

Once the modeled impact for each day has been added to the corresponding ambient background concentration, daily impacts are rank ordered; because the data set is complete, the 8th highest result is averaged with those from the other years in the analysis to determine compliance.

Compliance Demonstration Results

The results of the compliance demonstration are shown in Table G-7.2. The project's impact of 25.8 µg/m^3 is below the standard of 35 µg/m^3.

Table G-7.1

Emission Rates and Stack Parameters for Refined Modeling

Case/Year	Stack Height meters	Stack Diam meters	Stack flow m3/sec	Stack Vel m/sec	Stack Temp deg K	Emission Rates, lb/hr NOx	Emission Rates, lb/hr PM10	Emission Rates, g/s NOx	Emission Rates, g/s PM_{10}
Averaging Period: One hour Startup NOx									
Hot Low	30.48	4.42	346.13	22.56	713.8	26.63	n/a	3.36	n/a
Averaging Period: 24-hour PM2.5									
Cold Low	30.48	4.42	414.34	27.01	700.9	n/a	5.50	n/a	0.69

Table G-7.2

Results of Compliance Demonstration

Pollutant	Averaging Time	Maximum Predicted Impact (operating mode) ($\mu g/m^3$)	Maximum Background Concentration ($\mu g/m^3$)	3 year Average of 98th Percentile of Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	CAAQS ($\mu g/m^3$)
NO_2	1-hr	79 (startup)	154	156	188	339
$PM_{2.5}$	24-hr	2.6 (normal)	45.7	25.8	35	

Figure G-7.1

Areas Where Maximum 1-Hour Average NO_2 Impacts During Startup Exceed the Significant Impact Level

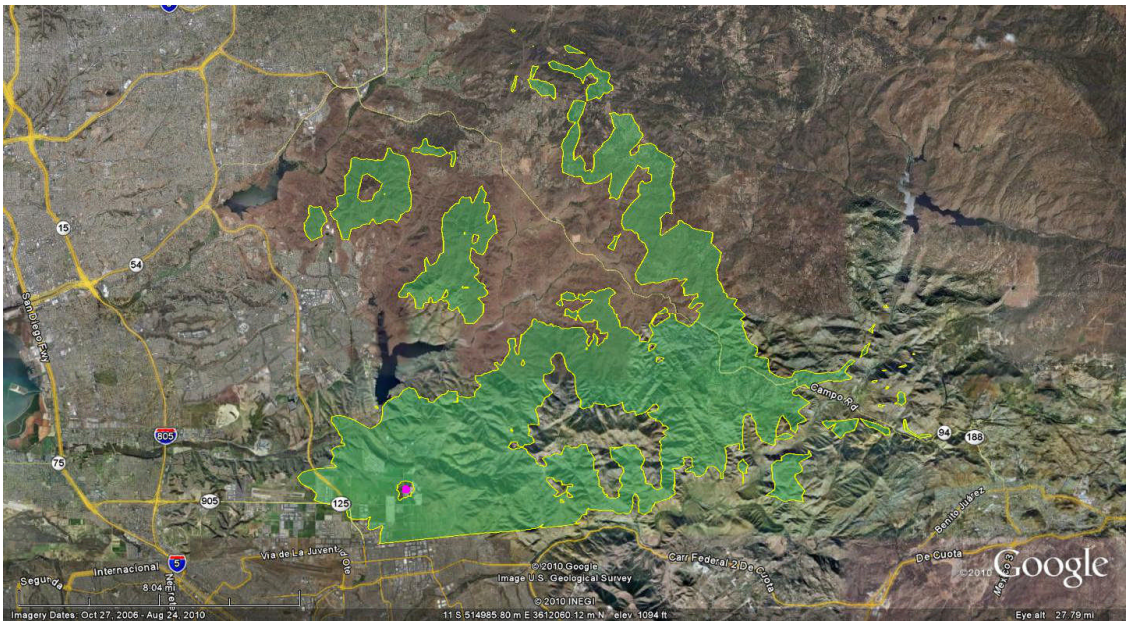
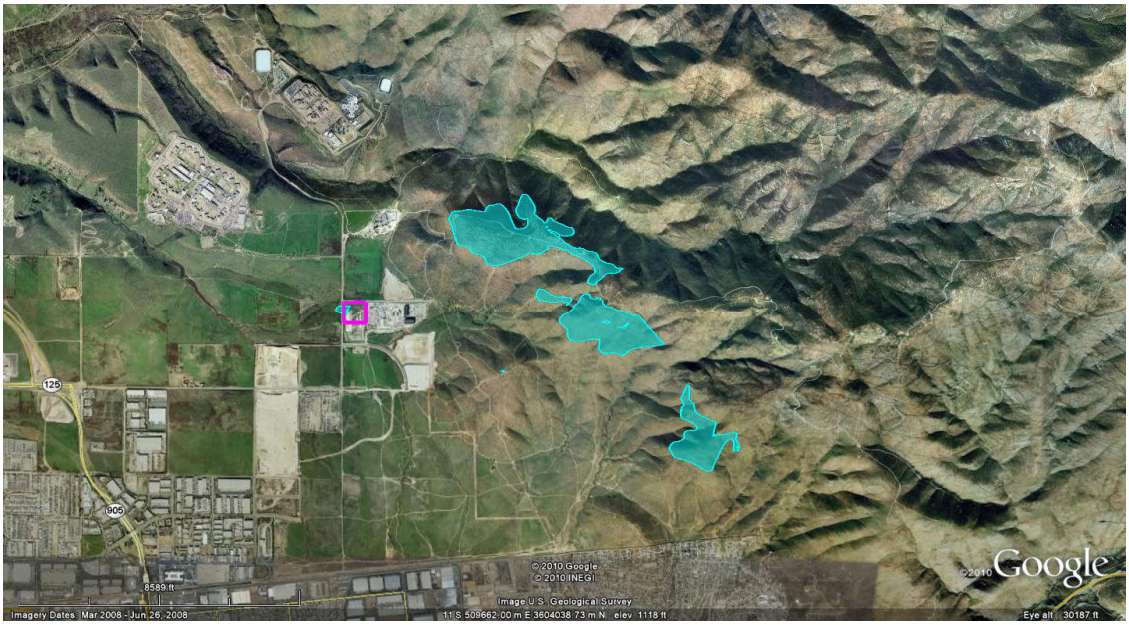


Figure G-7.2

Areas Where Maximum 24-Hour Average $PM_{2.5}$ Impacts Exceed the Significant Impact Level



APPENDIX G-8

Modeling Protocol

sierra research

Air Dispersion Modeling and Health Risk Assessment Protocol Pio Pico Energy Center San Diego County, California

Submitted to:

San Diego County Air Pollution Control District
California Energy Commission
US Environmental Protection Agency

prepared for:

Apex Power Group

prepared by:

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Air Dispersion Modeling And Health Risk Assessment Protocol

Pio Pico Energy Center San Diego County, California

November 2010

Prepared by

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Air Dispersion Modeling and Health Risk Assessment Protocol
Pio Pico Energy Center

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Appendix A – Information on CTDMPLUS Model

Pio Pico Energy Center
Modeling Protocol
November 2010

1. Background

On behalf of Apex Power Group (Apex), Sierra Research is submitting this modeling protocol to the San Diego County Air Pollution Control District (SDAPCD or District), California Energy Commission (CEC), and the United States Environmental Protection Agency (EPA) for approval of the air dispersion and health risk assessment modeling proposed to be conducted in support of the Pio Pico Energy Center (PPEC) Project (Project) Application for a Determination of Compliance (DOC) from the District, the Application for Certification (AFC) from the CEC, and the Application for a Prevention of Significant Deterioration (PSD) Permit from EPA. The District will be providing a meteorological data set appropriate for use with AERMOD[1] (current version 09292), the primary air dispersion model to be used on this project. The data set combines surface meteorological data (e.g., wind speed and direction, temperature) from the District's Otay Mesa/Paseo International monitoring station and upper air data from the Marine Corps Air Station Miramar (MCAS Miramar). This protocol follows modeling guidance provided by the EPA in its "*Guideline on Air Quality Models*"[2] (including supplements).

The proposed project will consist of the construction and operation of three LMS100 combustion gas turbines in simple-cycle mode. The new emitting units will be installed on a 9.9 acre parcel in the southeast quadrant of the intersection of Alta Road and Calzada De La Fuente Road, adjacent to the existing Otay Mesa Generating Project. The new turbines will use partial air cooling and will have a total nominal net generating capacity of 300 MW. PPEC will be a new major source under District New Source Review regulations[3] because it will have a potential to emit more than 50 TPY of NOx; it will also be a new major stationary source under the federal Prevention of Significant Deterioration (PSD) program[4] because it will have a potential to emit more than 100,000 TPY of Greenhouse Gases (GHGs) and construction will commence after July 1, 2011. PPEC is not a PSD stationary source under District regulations.[5]

The proposed data sources, models, and modeling assumptions are identical for all three analyses (APCD, CEC, and EPA) except where specifically noted.

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[1] AERMOD stands for American Meteorological Society/Environmental Protection Agency Regulatory Model, and was developed by the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC).

[2] USEPA, *Guideline on Air Quality Models (Revised).* U.S. EPA-45/2-78-027R,1986

[3] SDAPCD Rule 20.1(c)(35).

[4] 40 CFR 52.21(b)(49)(v)(b).

[5] SDAPCD Rule 20.1(c)(58).

Net increases in emissions of NOx and PM_{10} are expected to exceed the District's thresholds for preparation of an Air Quality Impact Analysis (AQIA).[6] Under District rules, an AQIA must be prepared that demonstrates that emissions from the project will not cause or contribute to a violation of an ambient air quality standard.

Net increases in emissions of NOx, PM_{10}, $PM_{2.5}$, and GHGs are expected to exceed the significant increase thresholds for federal PSD requirements.[7] Under federal rules, an Air Quality Impact Analysis (AQIA) must be performed to demonstrate that emissions from the project will not cause or contribute to a violation of an ambient air quality standard.

Dispersion modeling will be performed to demonstrate compliance with ambient air quality standards. Because there are no ambient air quality standards for GHGs, no modeling will be performed for that pollutant. This document describes the procedures that will be used to conduct that modeling.

Impacts from operation of the facility will be compared to the following thresholds:

Air Quality Criteria	NO_2	PM_{10}	$PM_{2.5}$	CO	SO_2
PSD Significant Impact Levels[a]	√	√	√		
SDAPCD Significant Impact Levels	√	√	√		
PSD Monitoring Exemption Levels[a,b]	√	√	√		
Ambient Air Quality Standards (AAQS)[b]	√	√	√	√	√
Class I and Class II Visibility[b]	√	√			√
Impacts to Soils and Vegetation[b]	√	√			√
Class I Area Acid Deposition[b]	√	√			√

Notes:
a. PSD significant impact and monitoring exemption levels apply only to pollutants subject to an AQIA analysis under PSD
b. Pursuant to EPA's "PSD and Title V Permitting Guidance for Greenhouse Gases" (Nov. 2010; p. 48), these analyses will not be conducted for GHGs.

Comparison of project impacts with the standards will be conducted using a tiered approach, on a pollutant-by-pollutant basis (see Section 12). If compliance for a particular pollutant can be demonstrated using a simple conservative screening approach, no further analysis will be performed for that pollutant.

[6] SDAPCD Rule 20.3(d)(2)(ii)
[7] 40 CFR 52.21.

2. Project Location

The proposed gas turbine units will be constructed on a 9.9-acre parcel in the southeast quadrant of the intersection of Alta Road and Calzada De La Fuente Road, adjacent to the existing Otay Mesa Generating Project. The location of the site is approximately the following:

- Latitude: 32° 34' 22" N
- Longitude: 116° 55' 02" W

or, in Universal Transverse Mercator (UTM) coordinates,

- Northing: 3,603.9 kilometers (km) and
- Easting: 507.7 kilometers (North American Datum [NAD] 27, Zone 11).

The nominal site elevation is 196 meters (645 feet) above mean sea level.

3. Project Emission Sources

The Project includes three combustion gas turbines in simple-cycle mode. The turbines will be fired with natural gas only, and will utilize advanced combustion design and emission controls to limit emissions of nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOC). Emissions of particulate matter with nominal aerodynamic diameter less than or equal to 10 and 2.5 microns (PM_{10} and $PM_{2.5}$), and sulfur oxides (SOx) will be kept to a minimum through the exclusive use of natural gas as the fuel.

The project also includes a small partial dry cooling tower, which is a source of particulate emissions from evaporation of aerosol drift. For the purposes of the AQIA, all particulate from the cooling tower will be assumed to be $PM_{2.5}$.

There will not be a combustion engine-driven emergency generator or fire pump.

4. Existing Emission Sources

This is a new facility. There are no existing emission sources at this site.

5. Nearby Emission Sources

For purposes of the District and CEC applications, the air quality impact analysis and/or cumulative impact analysis requires consideration of the project emissions, nearby sources that might affect concentrations in the area impacted by the project (the "impact area"), and regional background concentrations.

For such analyses, to determine whether any new sources have been approved but are not reflected in the ambient monitoring data, the District will be requested to list all projects within 6 miles of the project site which have received construction permits but are not yet operating, or are in the permitting process. Sources with permitted emissions of less than 5 tons per year will be excluded. Sources on this list will be included in the District and CEC cumulative impacts analysis. This analysis will also include other sources, specifically identified by the District and CEC, for inclusion in this analysis. At the present time, the District has identified the Otay Mesa Generating Plant, located immediately adjacent to the proposed Project site, for inclusion in this analysis. The applicant will consult with the District and CEC staffs regarding the inclusion of other potential sources in the analysis.

For purposes of the PSD permit application, an alternative screening procedure will be used to determine whether any existing sources should be explicitly modeled because they could potentially have significant impacts at the time and place that the project has significant impacts, but are not adequately represented by the ambient monitoring data.

As described in Section 12 below, the PSD AQIA will be conducted in accordance with a two-step process. Step 1 of that process involves an analysis of the impacts of the project alone. Step 2 includes background concentrations and impacts from other sources, in addition to the project. The following steps will be followed for each pollutant subject to a Step 2 analysis in the PSD application:

1. *A list of all stationary sources within the District and within 50 km of the significant impact area (but no greater than 100 km from the project site), with actual emissions above 5 tpy for any pollutant subject to PSD review, during the most recent year for which emission inventory data are available, will be obtained from the District.*
2. *Projects with recently issued permits (i.e., after January 1, 2005) or recently submitted applications and a potential to emit above 5 TPY for any pollutant subject to PSD review, within the search area described above, will be added to the list (because their emissions are not reflected in ambient monitoring data).*
3. *If the pollutant is subject to a Step 2 analysis only for a 1-hour average standard, sources that are downwind[8] of the Project's impact area will be screened out because they cannot affect the concentration at the same time and place as the Project.*
4. *In consultation with EPA, additional sources may be eliminated from the AQIA because size and location make it unlikely that they will affect the concentration gradient in the impact area at the same time that the Project's impacts occur. NOTE: this process may result in different lists for District/CEC and PSD modeling.*

EPA has considered and accepted several methods for screening sources for inclusion in an AQIA inventory. These are summarized in the meeting notes for an EPA/State/Local PSD Workshop held in New Orleans in May 2005. As discussed in the workshop notes:

[8] Preliminary modeling indicates that all of the impact areas are in the same compass quarter. Any offsite source that is on the other side of the impact areas from the project cannot possibly be modeled to affect the impact area at the same time as the project; the impact area will be affected by one or the other, but not both, at times that the project's impact is significant.

"The concept of 'significant concentration gradient' is used to catch all instances not represented by "regional" monitored concentrations, added to the combined sources' impacts to determine total impacts, which could interact with the proposed source's impacts. However, without some practical limitations, such gradients can occur anywhere in the "vicinity" of the sources defined by the SIA and could lead to a large and, at times, unnecessary resource expenditures. Thus, in order to balance the need for identifying all sources which meet the criteria in the Guideline and also to achieve a workable inventory of sources, various permitting agencies have developed and used objective tools to assist in the determination of an emission inventory. A 1992 EPA/States modelers' workgroup considered some of these approaches and concluded that all such tools should be used by the reviewing authority on a case by case basis to compliment [sic] their professional judgment in developing an inventory of nearby sources."[9]

Impacts from facilities identified by this screening process will be included in any compliance demonstration beyond Step 1. Emissions of relevant pollutants from each included facility will be modeled at the facility's potential to emit.

6. Site Representation – Meteorological Data

The District is expected to provide a meteorological dataset already processed by AERMET to generate AERMOD-compatible meteorological data for air dispersion modeling. The surface meteorological data were recorded at the District's Otay Mesa-Paseo International monitoring station (see Figure 1), and the upper air data were recorded at the MCAS Miramar (No. 03190).

EPA defines the term "on-site data" to mean data that would be representative of atmospheric dispersion conditions at the source and at locations where the source may have a significant impact on air quality. The meteorological data requirement originates in the Clean Air Act at Section 165(e)(1), which requires an analysis "of the ambient air quality at the proposed site and in areas which may be affected by emissions from such facility for each pollutant subject to regulation under [the Act] which will be emitted from such facility."

This requirement and EPA's guidance on the use of on-site monitoring data are also outlined in the *On-Site Meteorological Program Guidance for Regulatory Modeling Applications.*[10] The representativeness of the data depends on (a) the proximity of the meteorological monitoring site to the area under consideration, (b) the complexity of the topography of the area, (c) the exposure of the meteorological sensors, and (d) the period of time during which the data are collected. The District has determined, and the applicant concurs, that the District's Otay Mesa meteorological data are representative of conditions at the project site.

Representativeness has also been defined in the "*Workshop on the Representativeness of Meteorological Observations*" (Nappo et. al., 1982) as "the extent to which a set of measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application."

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[9] PSD Modeling Workgroup. EPA/State/Local Workshop. New Orleans, May 17, 2005.
[10] EPA, *Supplement A to the Guideline on Air Quality Models (Revised)*, 1987.

Representativeness is best evaluated when sites are climatologically similar, as are the project site and the Otay Mesa-Paseo International meteorological monitoring station. Representativeness has additionally been defined in the PSD Monitoring Guideline[11] as data that characterize the air quality for the general area in which the proposed project would be constructed and operated. As can be seen in Figure 1, the Otay Mesa-Paseo International meteorological monitoring station is in close proximity to the proposed project site (distance between the two locations is approximately 1.2 miles with no significant intervening terrain features), and the same large-scale topographic features located to the east and north that influence the meteorological data monitoring station also influence the proposed project site in the same manner.

Upper air meteorological data are taken from soundings obtained at the Marine Corps Air Station at Miramar, California, located approximately 24 miles northwest of the Project. No other upper air meteorological monitoring stations are located in the San Diego Air Basin. The next closest upper air station in California is located at Oakland International Airport.

7. Site Representation – Surface Data

The surface characteristics input to AERMET should be based on the topographic conditions in the vicinity of the meteorological tower used to provide meteorological data.[12,13] The District has selected values for the surface characteristics of albedo, Bowen Ratio and surface roughness appropriate to the area around the Otay Mesa-Paseo International meteorological monitoring station following EPA guidance.

8. Existing Ambient Air Quality Data

Background ambient air quality data for the project area from the monitoring site most representative of the conditions that exist at the proposed project site will be used to represent regional background concentrations. The District has determined that the Chula Vista monitoring station provides the most representative ambient air quality background data for PM_{10}, $PM_{2.5}$, NO_2, SO_2, O_3, and CO. Although the monitoring site at Otay Mesa-Paseo International is closer to the project site than the Chula Vista station, the Otay Mesa station is strongly impacted by traffic coming across the border from Mexico, and is therefore not representative of regional background concentrations.

> "Several thousand border-crossing trucks passing near the monitor each day heavily impact PM measurements at this location. To better gauge ambient PM10 concentrations throughout the Otay Mesa area as a whole, a second monitor was recently established in Otay Mesa, two miles north of the existing monitor. The additional monitor is not unduly influenced by specific local PM sources."[14]

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[11] USEPA, *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)*, 1987.
[12] Appendix W to Part 51—Guideline on air Quality Models, §8.3.c
[13] USEPA. *AERMOD Implementation Guide,* March 19, 2009.
[14] SDAPCD, *Measures to Reduce Particulate Matter in San Diego County,* December 2005, p. 3-6

Comparison of highest 24-hour PM_{10} data collected at the two monitors[15] show that maximum PM_{10} concentrations at the border station are about twice as high as maximum concentrations at the alternate site. The border trucks impact all combustion pollutant measurements at the Otay Mesa monitor, not just PM_{10}.

In contrast, the Chula Vista station is not impacted by nearby sources, and is only 8 miles from the project site. The 5-year period 2004-2008 is the most recent 5-year period for which all required data is available. Modeled concentrations for the Project and any qualifying nearby sources will be added to these representative background concentrations to determine compliance with the CAAQS and NAAQS.

Processed data files will be obtained from the District. Data for periods of time with invalid data will have been replaced by the District using data substitution procedures consistent with EPA guidance. Data substitution will ensure that there will be no gaps in the data. This will prevent exclusion of modeled high impact hours because of missing monitoring data.

9. Air Quality Dispersion Models

Overview

The following EPA air dispersion models are proposed for use to quantify pollutant impacts on the surrounding environment:

- American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) model, also known as AERMOD (Version 09292);
- Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME, current version 04274); and
- SCREEN3 (Version 96043).

The three primary models listed above, and how they will be used, are discussed in detail below. The three additional models listed below are not expected to be used, but they are shown in the event that specialized, more refined modeling is necessary for the project. Further information on the use of CTDMPLUS is provided in Appendix A.

- Complex Terrain SCREEN (CTSCREEN, Version 94111)
- Complex Terrain Dispersion Model (CTDMPLUS, Version 93228)
- Visibility Screening Model (VISCREEN (Version 88341)

[15] CARB ADAM database, accessed November 28, 2010. Because the Otay Mesa-Richard Correctional Facility monitor only collects PM_{10} data, and does not include data from 2004, data from this monitor will not be used for this AQIA.

Simple, Complex, and Intermediate Terrain Impacts

For modeling project emissions in simple, complex, and intermediate terrain, the EPA-recommended guideline model AERMOD will be used with the AERMET-processed hourly meteorological data furnished by the District. The AERMOD model requires hourly meteorological data consisting of wind vector and speed (with reference height), temperature (with reference height), Monin-Obukhov length, surface roughness length, heights of the mechanically and convectively generated boundary layers, surface friction velocity, convective velocity scale, and vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer. The model assumes that there is no variability in meteorological parameters over a one-hour time period, hence the term "steady-state." The AERMOD model allows input of multiple sources and source groupings, eliminating the need for multiple model runs. Complex phenomena such as building-induced plume downwash are treated in this model.

Standard AERMOD control parameters will be used (stack tip downwash, non-screening mode, non-flat terrain, sequential meteorological data check employed). Stack-tip downwash, which adjusts the effective stack height downward following the methods of Briggs[16] for cases where the stack exit velocity is less than 1.5 times the wind speed at stack top, will be selected per EPA guidance. The rural default option will be used by not invoking the URBANOPT option.[17] The use of the rural default in modeling for this project is consistent with District policy and guidance[18] for past modeling using ISCST3.

Ambient Ratio Method and Ozone Limiting Method

Annual NO_2 concentrations will be calculated using the Ambient Ratio Method (ARM), adopted in Supplement C to the Guideline on Air Quality Models.[19] The Guideline allows a nationwide default of 75% for the conversion of nitric oxide (NO) to NO_2 on an annual basis and the calculation of NO_2/NOx ratios.

If NO_2 concentrations need to be examined in more detail, the Plume Volume Molar Ratio Method (PVMRM) adaptation of the Ozone Limiting Method[20] will be used. AERMOD PVMRM will be used to calculate the NO_2 concentration based on the PVMRM method and hourly ozone data. Contemporaneous hourly ozone data collected at the Chula Vista monitoring station, in a data file provided by the District, will be used in conjunction with PVMRM to calculate hourly NO_2 concentrations from hourly NOx concentrations. Ozone background data from the Otay Mesa-Paseo International monitoring station is not appropriate for use, even though the station is closer, for several reasons. First, the data set does not meet EPA completeness criteria. Second, the site is

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[16] Briggs, G.A., *Discussion on Chimney Plumes in Neutral and Stable Surroundings*. Atmos. Environ. 6:507-510, 1972

[17] The rural vs. urban option in AERMOD is primarily designed to set the fraction of incident heat flux that is transferred into the atmosphere. This fraction becomes important in urban areas having an appreciable "urban heat island" effect due to a large presence of land covered by concrete, asphalt, and buildings. This situation does not exist for the proposed project site.

[18] SDAPCD. *Use of Rural vs Urban Modeling Coefficients,* Memorandum from Richard J. Smith, Deputy Director, to Judith M. Lake, Chief, Monitoring and Technical Services, October 29, 1996.

[19] USEPA, *Supplement C to the Guideline on Air Quality Models (revised)*, 1995.

[20] Cole, H.S. and J.E. Summerhays, *A review of techniques available for estimating short term NO2 concentrations*. Journal of the Air Pollution Control Association 29(8) 790-888, 1979.

heavily impacted by local traffic emissions, and is therefore not representative of regional concentrations. Third, because the Otay Mesa station is heavily impacted by traffic emissions, the measured ozone levels may be depressed because of scavenging by automobile NO emissions. If depressed ozone levels are used in the PVMRM model, the predicted NOx levels will be lower.

The Chula Vista station, located only 8 miles from the project site, suffers from none of these deficiencies. The collected data meet EPA completeness criteria, the project is not heavily impacted by local sources, and is therefore reasonably representative of regional background concentrations. There are no intervening topographic features, so pollution transport conditions should be similar for both stations.

PVMRM involves an initial comparison of the estimated maximum NOx concentration and the ambient O_3 concentration left in the plume after reaction of NO with O_3 to determine which is the limiting factor in NO_2 formation. If the remaining O_3 concentration is greater than the maximum NOx concentration, total conversion is assumed. If the NOx concentration is greater than the remaining O_3 concentration, the formation of NO_2 is limited by the remaining ambient O_3 concentration. In this case, the NO_2 concentration is set equal to the O_3 concentration plus a correction factor that accounts for in-stack and near-stack thermal conversion.

Fumigation

The SCREEN3 model will be used to evaluate inversion breakup fumigation impacts for short-term averaging periods (24 hours or less), as appropriate. The methodology in EPA, 1992 (Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised) will be followed for these analyses. Combined impacts for all sources under fumigation conditions will be evaluated, based on EPA and any applicable SDAPCD modeling guidelines.

10. Good Engineering Practice (GEP) Stack Height and Downwash

AERMOD can account for building downwash effects on dispersing plumes. Stack locations and heights and building locations and dimensions will be input to BPIP-PRIME. The first part of BPIP-PRIME determines and reports on whether a stack is being subjected to wake effects from a structure or structures. The second part calculates direction-specific building dimensions for each structure that are used by AERMOD to evaluate wake effects. The BPIP-PRIME output is formatted for use in AERMOD input files.

11. Receptor Selection

Receptor and source base elevations will be determined from USGS National Elevation Dataset (NED) data in the GeoTIFF format at a horizontal resolution of 1 arc-second (approximately 30 meters). All coordinates will be referenced to UTM North American Datum 1983 (NAD83), Zone 11. The AERMOD receptor elevations will be interpolated among the DEM nodes according to standard AERMAP procedure. For determining concentrations in elevated terrain,

the AERMAP terrain preprocessor receptor-output (ROU) file option will be chosen; hills will not be imported into AERMOD for CTDM-like processing.

Cartesian coordinate receptor grids will be used to provide adequate spatial coverage surrounding the project area for assessing ground-level pollution concentrations, to identify the extent of significant impacts, and to identify maximum impact locations. A 250-meter resolution coarse receptor grid will be developed and will extend outwards at least 10 km (or more as necessary to calculate the significant impact area).

For the full impact analyses, a nested grid will be developed to fully represent the maximum impact area(s). This grid will have 25-meter resolution along the facility fence-line in a single tier of receptors composed of four segments extending out to 100 meters from the fenceline, 100-meter resolution from 100 meters to 1,000 meters from the fenceline, and 250-meter spacing out to at least 10 km from the most distant source modeled, not to exceed 50 km from the project site. Additional refined receptor grids with 25-meter resolution will be placed around the maximum first-high or maximum second-high coarse grid impacts and extended out 1,000 meters in all directions. Concentrations within the facility fenceline will not be calculated. To simplify post-processing requirements, receptor locations at which the NO_2, $PM_{2.5}$, and PM_{10} significant impact levels are not exceeded will not be included in PSD analyses for these pollutants.

The Regions to be imported in Geographical Coordinates for the USGS National Elevation Dataset (NED) data are bounded as follows:

South West corner: Lat: 32.38, Lon: -117.82;
North East corner: Lat: 33.1, Lon: -116.26.

The analysis will be limited to impacts in the United States.

12. Modeling Scenarios

Pollutant emissions to the atmosphere from the proposed project will be dominated by the products of combustion of natural gas in the combustion turbines. Emission rates will be included in the Applications for the project and will be based on vendor data and additional conservative assumptions of equipment performance. Turbine emissions and stack parameters, such as flow rate and exit temperature, depend on ambient temperature and operating load. To calculate the maximum air quality impacts, a screening analysis will be performed to determine which combination of operating load and atmospheric temperature produces the maximum ground-level concentration (i.e., impact) for each combination of pollutant and averaging time used in an ambient air quality standard. Emissions from the partial dry-cooling tower will be modeled using the assumption that 100% of the particulate is $PM_{2.5}$.

In the modeling analysis, maximum impacts will be predicted for startup, base load (100%), and reduced load (50%) conditions. In addition, extreme hot, annual average, and extreme cold ambient temperatures will be evaluated for each load condition. Each of these conditions has unique performance characteristics that affect plume dispersion and thus predicted impacts. This

analysis is most relevant to analyses for short-term impacts (24 hours or less). Annual average impacts will be modeled using annual average turbine performance. The results of this screening analysis will be used to select the maximum-impact operational scenarios for each pollutant and averaging period for the complete modeling analyses.

Details of Operating Scenarios

Maximum emissions during normal operation would occur during periods of maximum fuel consumption, which would occur at peak load. Besides normal operation, two other modes of operation would occur: commissioning (one initial period), and startup/shutdown. In addition to the impacts associated with normal operation, the modeling analysis for the project will examine the short-term impacts associated with commissioning and gas turbine startup/shutdown activities. The following table gives more detail on all three operating modes.

Operating Modes of the Combustion Gas Turbines	
Mode	Description
Commissioning	The process of tuning each of the turbines. The facility will follow a systematic approach to optimize performance of the turbines and the associated control equipment. Emissions are expected to be greater during commissioning than during normal operation for NOx, CO, and VOC. This one-time mode affects only the initial year of operation. The analysis of impacts during commissioning periods will not be part of the PSD analysis.
Start-up/Shutdown	Startup NOx emissions are higher because the SCR has not reached optimal temperature to begin the chemical reactions needed to convert NOx to elemental nitrogen and water. Shutdown occurs at the initiation of the turbine shutdown sequence and ends with the cessation of turbine firing. Typically, the shutdown process will emit less than the start-up process but may emit slightly greater than during normal operation because ammonia injection into the SCR reactor ceases during part of this operation.
Normal Operation	Normal operation begins after the turbines and the control equipment are working optimally, at their designated levels. Emissions may vary between the extreme hot, annual average, and extreme cold ambient conditions.

The modeling with AERMOD-PVMRM will include the assumption of an initial 10% nitrogen dioxide (NO_2) to NOx ratio in the exhaust exiting the stack during normal operating conditions, and a 6% initial NO_2 to NOx ratio for startup and commissioning operations, based on guidance developed by the San Joaquin Valley APCD.[21]

[21] SJVAPCD, *Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM, Appendix C* (2010), Table 1

Ambient Air Quality Impact Analyses (AQIA)

The purpose of the ambient air quality impact analysis is to demonstrate compliance with applicable ambient air quality standards. Both USEPA and the District have regulations that prohibit construction of a project that will cause or contribute to violations of applicable standards.

If, for a given pollutant and averaging time, the project's impact is below significance thresholds, the project's impact is deemed to be *de minimis*, and no further analysis is required. If the project's impact is above the significance threshold, the project has the potential to cause or contribute to a violation of the ambient air quality standard at the times and locations where the threshold is exceeded. In that case, the analysis must consider the contribution of other sources to the ambient concentration. If the analysis indicates that there will be a violation of an ambient air quality standard, and the project's impact *at the time and place of the violation* is significant, then the project may not be approved unless the project's impact is reduced.

The Project requires approval from many agencies. An air quality impact analysis is required for Certification by the CEC, issuance of a Determination of Compliance by the District, and issuance of a PSD permit by USEPA. Each agency has its own criteria for preparation of the air quality impact analysis. The criteria used by the CEC and the District are similar enough that the same analysis will satisfy both. The same analysis will also meet EPA criteria for evaluating all standards except for the new federal 1-hour NO_2 standard.

EPA has not yet described, with any specificity, its criteria for evaluating compliance with the new federal 1-hour NO_2 standard; as a result, this protocol contains special procedures that will be utilized only for the PSD demonstration of compliance with the federal 1-hour NO_2 standard. These special procedures affect the Tier 4 analysis for NO_2 impacts and identification of nearby sources, and are identified below.

Step 1: Project Impact

The first step in the compliance demonstration is to determine, for each pollutant and averaging period, whether the proposed new equipment for the project has the potential to cause a significant ambient impact at any location, under any operating or meteorological conditions. As indicated in the NSR Workshop Manual,[22] "[i]f the significant net emissions increase from a proposed source would not result in a significant ambient impact anywhere, the application is usually not required to go beyond a preliminary analysis in order to make the necessary showing of compliance for a particular pollutant." The significance levels for air quality impacts are shown in the following table. If the maximum modeled impact for any pollutant and averaging period is below the appropriate significance level, no further analysis is necessary.

[22] USEPA, *New Source Review Workshop Manual (draft)*, October 1990. p. C.51.

Significance Levels for Air Quality Impacts in Class II Areas ($\mu g/m^3$)					
	Averaging Period				
Pollutant	Annual	24-hour	8-hour	3-hour	1-hour
SO_2	1	5	--	25	--
PM_{10}	1	5	--	--	--
$PM_{2.5}$	0.3	1.2	--	--	--
NOx	1	--	--	--	No SIL[23]
CO	--	--	500	--	2000

No further analysis is necessary for any location where the modeled impacts from the project alone are below the PSD significance thresholds shown in the table above.

> *The primary purpose of the SILs is to identify a level of ambient impact that is sufficiently low relative to the NAAQS or increments that such impact can be considered trivial or de minimis. Hence, the EPA considers a source whose individual impact falls below a SIL to have a de minimis impact on air quality concentrations that already exist. Accordingly, a source that demonstrates that the projected ambient impact of its proposed emissions increase does not exceed the SIL for that pollutant at a location where a NAAQS or increment violation occurs is not considered to cause or contribute to that violation. In the same way, a source with a proposed emissions increase of a particular pollutant that will have a significant impact at some locations is not required to model at distances beyond the point where the impact of its proposed emissions is below the SILs for that pollutant. When a proposed source's impact by itself is not considered to be "significant," EPA has long maintained that any further effort on the part of the applicant to complete a cumulative source impact analysis involving other source impacts would only yield information of trivial or no value with respect to the required evaluation of the proposed source or modification.*[24]

Step 2: Project Plus Background

Pollutants/averaging periods that are not screened out in Step 1 will be subject to full air quality impact analysis. In this step, the ambient impacts of the project are modeled and added to background concentrations. The results are compared to the relevant state and federal ambient standards.

The second step of the compliance demonstration is required to show that the proposed new project, in conjunction with existing sources, will not cause or contribute to a violation of any ambient air quality standard. As discussed in more detail in Section 8 of this protocol, the impacts of most existing sources are represented by the existing ambient air quality data collected at Chula Vista. In accordance with Section 8.2.1 of Appendix W to 40 CFR Part 51,

[23] EPA has not yet defined significance levels for one-hour NO_2 impacts. However, EPA has suggested that, until one has been promulgated, a value of 4 ppb (7.5 $\mu g/m^3$) may be used. That value will be used in this analysis wherever a SIL would be used for NO_2.

[24] 75 FR 64891

Background concentrations are an essential part of the total air quality concentration to be considered in determining source impacts. Background air quality includes pollutant concentrations due to: (1) Natural sources; (2) nearby sources other than the one(s) currently under consideration; and (3) unidentified sources. Typically, air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration.

The impact of natural sources and unidentified sources will be represented by ambient air quality monitoring data collected at the Chula Vista monitoring station. In this protocol, these impacts are characterized as part of the "regional background."

Nearby sources are those non-project sources that have the potential to create a significant concentration gradient in the project's impact area. Nearby sources will be identified by the processes described in Section 5 (separately for the District/CEC analysis and for the PSD analysis). The impact of nearby sources will be modeled using each source's potential to emit, as determined by the District.

The impact of the proposed new equipment will be modeled using the maximum allowable emission limits as proposed in the application and the design capacities of the turbines, assuming continuous operation, in accordance with the guidance in Table 8-2 of Appendix W.

If a Step 2 analysis is required, the maximum predicted concentration from all sources in the five-year modeling period is added to the representative background concentration for a comparison with the NAAQS. In accordance with EPA guidelines,[25] the highest second-highest modeled concentrations will be used to demonstrate compliance with the short-term federal standards (except for the statistically-based federal 1-hour NO_2 and SO_2, and 24-hour $PM_{2.5}$, standards) and the highest modeled concentration will be used to demonstrate compliance with the federal annual and all state standards. If the predicted total ground-level concentration is below the state or federal ambient air quality standard for each pollutant and averaging period, no further analysis is required for that pollutant and averaging period.

For the 1-hour average federal NO_2 standard for the District and CEC analyses, the comparison of impacts with the new federal 1-hour standard will be done in accordance with the four-tier process developed by the San Joaquin Valley Air Pollution Control District (SJVAPCD).[26] The tiered screening approach was developed to allow demonstration of compliance using the lowest amount of resources necessary. Each tier is a progressively more sophisticated and comprehensive analysis that reduces the level of conservatism without reducing the level of assurance of compliance.

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[25] 40 CFR part 51, Appendix W, Sections 11.2.3.2 and 11.2.3.3

[26] "This modeling protocol is meant to define the stepwise approach necessary to satisfy the requirements in General Guidance for Implementing the 1-Hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim NO_2 Significant Impact Level1 and the Applicability of Appendix W Modeling Guidance for 1-Hour NO_2 National Ambient Air Quality Standard. Nothing in this protocol should be taken as overriding guidance contained in those two memoranda, or Appendix W of Part 51 of Title 40 of the Code of Federal Regulations (40 CFR 51, Appendix W)."

Tier 1 Analysis – In Tier 1, the maximum predicted 1-hour concentration from all sources in the five-year modeling period is added to the representative background concentration for a comparison with the 1-hour NAAQS. If compliance is demonstrated using Tier 1 values, no further analysis is required.

Tier 2 Analysis – Tier 2 is the same as Tier 1, except that the 8th highest maximum predicted 1-hour concentration (in the five-year modeling period) is used.

Tier 3 Analysis – Tier 3 is the same as Tier 1, except that the 98th percentile predicted 1-hour concentration is used.

Tier 4 Analysis – The predicted concentrations from the model will be paired in time with the monitored hourly NO_2 concentrations. The 3-year average of the annual 98th percentile daily 1-hour maximum is used for comparison with the NAAQS. This approach follows the form of the standard, and is equivalent to siting an ambient monitoring site at each receptor, and demonstrating compliance at all of them.

> *For purposes of the PSD application, two synthetic background NO_2 data sets will be created using the following procedure. For the first data set, for each month in each year of the five year data period, the maximum hourly concentration will be determined for each clock hour period (i.e., 1 am, 2 am, 3 am, etc.). In this manner, 24 hourly NO_2 values will be determined for each month. These values will be used for each day of the month. For the second data set, for each year in the five year data period, the 98th percentile hourly concentration will be determined for each clock hour period. In this manner, 24 hourly NO_2 values will be determined for each year. These values will be used for each day of the year. For each of these two data sets, the predicted concentrations from the model will be paired in time with the concentrations from the synthetic data sets. The 3-year average of the annual 98th percentile daily 1-hour maximum is used for comparison with the NAAQS.*

For SO_2, the same four-tier process described above for the District/CEC analysis will be used, except that the 99th percentile value will be used in Tiers 2, 3 and 4. For $PM_{2.5}$, the comparison of impacts with the new federal 24-hour standard will be done in accordance with the same four-tier process described above for the District/CEC analysis, except that 24-hour averaging times will be used instead of 1-hour averaging times.

13. Class I Area Impact Methodology (PSD Application Only)

Class I areas are areas of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection. If a proposed major source or major modification may affect a Class I area, the federal PSD regulations require the reviewing authority to provide written notification of any such proposed source to the Federal Land Managers (FLM) (and the USDI and USDA officials delegated permit review responsibility). The meaning of the term "may affect" is interpreted by EPA policy to include all major sources or major modifications which propose to locate within 100 kilometers (km) of a Class I area.

There is one Class I area within 100 km of the project site. The nearest Class I areas are:

- Agua Tibia Wilderness 91 km
- San Jacinto Wilderness 122 km

EPA's policy requires, at a minimum, an Air Quality Related Values (AQRV) impact analysis of any PSD source the emissions from which increase pollutant concentration by more than 1 $\mu g/m^3$ (24-hour average) in a Class I area. This value is the annual-average significant impact level for SO_2, PM_{10}, and NO_2. Applying this rationale, the annual average SIL for $PM_{2.5}$ of 0.3 µg/m3 will be used for that pollutant to determine whether an AQRV impact analysis will be required. This analysis is based on the impacts of the proposed project.

If impacts from the proposed project are determined to be in excess of these levels, and if, after consultation with the FLMs, a determination is made that additional analysis is needed, impacts will be quantified using the CALPUFF Modeling System operated in a screening mode. The modeling will follow guidance provided by the FLMs' AQRV Workgroup (FLAG) Phase I report[27] and the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report.[28] A separate protocol will be submitted if this analysis is performed.

PSD Increments in the Class I Area

If an analysis of Class I area impacts is required, maximum 3-hour, 24-hour and annual SO_2 emission rates, maximum 24-hour and annual PM_{10} emission rates, maximum 24-hour $PM_{2.5}$ emission rates, and maximum hourly and annual NOx emission rates will be used for modeling potential increment consumption in the Class I area.

14. Rule 1200 Analysis

District Rule 1200 analysis requires a health risk assessment (HRA) performed according to the California Air Toxics Hot Spots guidelines[29] and SDAPCD supplemental guidelines[30] for Health Risk Assessments (HRAs). The HRA modeling will be prepared using the ARB's Hotspots Analysis and Reporting Program (HARP) computer program (Version 1.4b, August 2010). The HARP model will be used to assess cancer risk as well as non-cancer chronic and acute health hazards. The HRA will include the four following pathways: inhalation, dermal absorption, soil ingestion, and mother's milk ingestion.

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[27] USDA Forest Service Air Quality Program, National Park Service Air Resource Division, US Fish and Wildlife Service - Air Quality Branch, *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report*. December 2000.

[28] IWAQM, *Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*, EPA-454/R-98-019, December 1998.

[29] Office of Environmental Health Hazard Analysis, *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*, August 2003.

[30] SDAPCD, *Supplemental Guidelines for Submission of Air Toxics "Hot Spots" Program Health Risk Assessments (HRAs)*, Version 1.0, March 1, 2005.

Because the HARP model incorporates the ISCST3 model no longer approved by EPA, a special methodology will be employed to be consistent with using AERMOD for the air dispersion modeling and retain the health values and risk computations provided by HARP Version 1.4b. The OEHHA/ARB-approved methodology used to prepare the HRA has been described by the ARB[31] and is summarized below. Its use has also been approved by both the CEC and the District on previous power plant projects.[32]

Modeling Inputs

The risk assessment module of the HARP model will be run using unit ground-level impacts to obtain derived cancer risks for each toxic air contaminant (TAC). As requested by the District, only the cancer risks obtained for the derived (adjusted) method and derived (OEHHA) method for worker exposure will be used in the analysis. The HARP model output is cancer risk by TAC and pathway for each type of analysis, based on an exposure of 1.0 $\mu g/m^3$. Individual cancer risks are expressed in units of risk per $\mu g/m^3$ of exposure. To calculate the weighted risk for each source, the annual average emission rate in grams per second for each TAC will be multiplied by the individual cancer risk for that TAC in units of $(\mu g/m^3)^{-1}$. The resulting weighted cancer risks for each TAC will then be summed for the source. The same approach will be used to determine the non-cancer acute and chronic health hazards associated with the Project.

Health risk from exposure to a carcinogenic TAC is the product of the exposure concentration multiplied by a factor representing the risk per unit concentration (i.e., unit risk) for the TAC. In the case of cancer risk, the risk per unit concentration depends on breathing rate, the cancer potency factor of the TAC, dimensional factors, and other terms involving non-inhalation pathways, when relevant. In the case of chronic and acute non-cancer impacts, the unit impact or health hazard per unit concentration is normally calculated as 1 divided by the Reference Exposure Level (REL, expressed as a concentration in $\mu g/m^3$) for the TAC.

Exposure concentration is calculated as the product of the actual emission rate (in grams per second) of the TAC times the concentration per unit of emission (i.e., an emission rate of 1 g/s), which is the output from the AERMOD air dispersion modeling calculation. This exposure concentration is the "Unit Concentration."

The way that HARP usually works is for the program to automatically pass the "Unit Concentration" for a given source and receptor into its risk module, where it is multiplied by the actual emission rate (in g/s) for each TAC and the "Unit Risk" for the TAC to produce the calculated risk for the TAC. This is done for all the TACs emitted by a source and the summed cancer risk, or non-cancer health impact for common toxic endpoints in the case of chronic and acute risk, is the total risk or non-cancer health impact at that receptor from that source. The total cancer risk or non-cancer health impact at a receptor is the sum of the risks or health impacts from all of the sources.

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[31] ARB. *Part B of Topic 8 of the HARP How-To Guides: How to Perform Health Analyses Using a Ground Level Concentration.*

[32] This approach is also used because the HARP On-ramp does not address new 8-hour average RELs.

Because HARP is not designed to pass AERMOD "Unit Concentration" outputs to its Risk Module, an alternative procedure can be used. The calculation of cancer risk or non-cancer health impact does not require the variables to be multiplied in any particular order. Therefore, the final result will be the same if, for a given source, the "Unit Risk" for a TAC is multiplied by the actual emissions (g/s) for the TAC, and these products are added together to give a "Source Strength" for the source. The "Source Strength" is then used as the source emission rate in AERMOD.

This special methodology thus uses HARP to calculate the "Unit Risks" for all carcinogenic TACs and unit chronic and acute health impacts for all non-carcinogenic TACs, including all required exposure pathways and toxic end points as well as receptor types, including residents and workers. The unit risk or unit health impact for each TAC from a source is multiplied by the emission rate of that TAC from the source. These products are summed for all the TACs emitted by the source. This is done for each source. Finally, the resulting "Source Strengths" for each source are used as emission rates in an AERMOD calculation. The resulting risks are reported in the AERMOD output.

The HRA analysis is not a part of the PSD application.

Construction Impact Analysis

Emissions due to the construction of the project will be estimated, including an assessment of emissions from vehicle and equipment exhaust and the fugitive dust generated from material handling. Construction emissions from the project will then be modeled for potential air quality impacts, using the AERMOD Gaussian air dispersion model. Combustion Diesel PM_{10} emission impacts from delivery trucks and other construction equipment will be evaluated to demonstrate that the cancer risk from construction activities will be below ten in one million at all receptors. This analysis is not a part of the PSD application.

15. Final Modeling Submittal

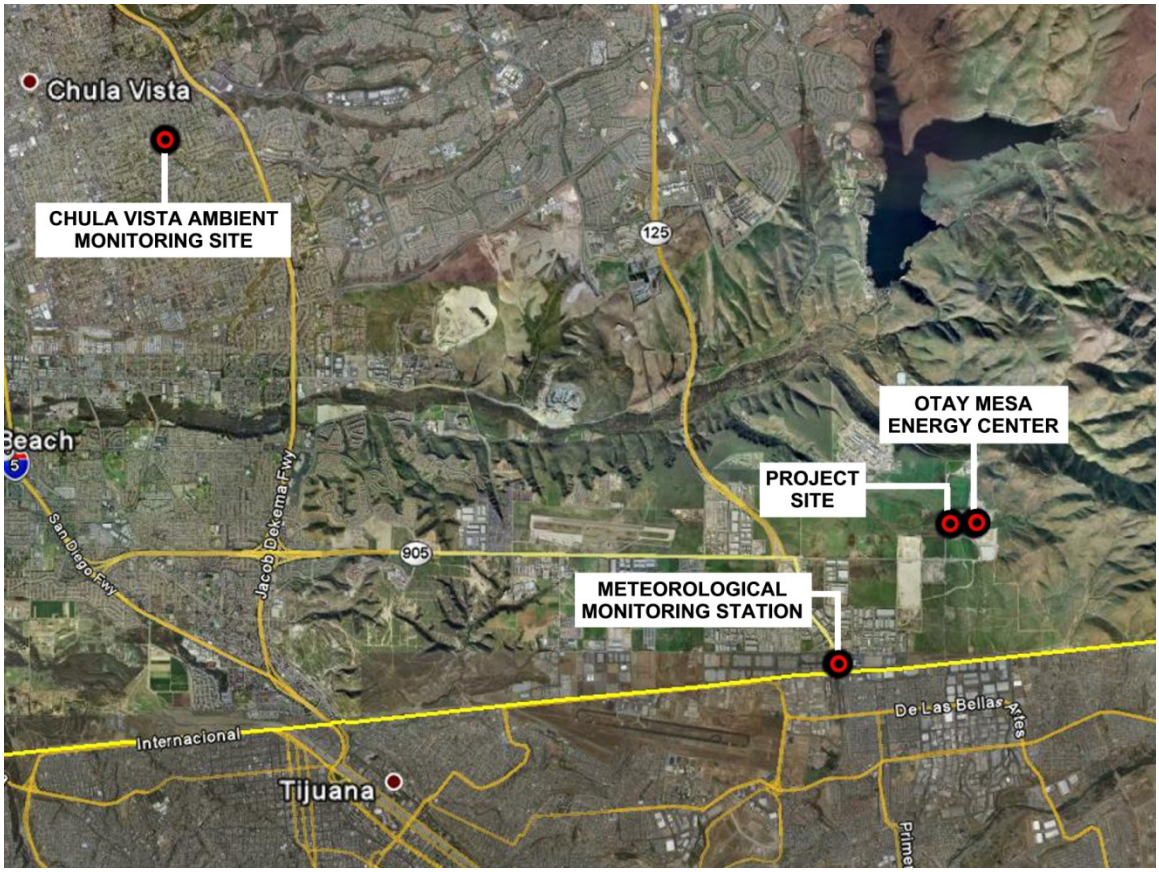
The final modeling analyses will include the following materials:

- Turbine load, heat input, and stack exhaust O_2 content, pollution emission rates, temperature and velocity, and SCR temperature;
- Summaries of maximum modeled impacts for each air quality scenario showing meteorological conditions and receptor location and elevation;
- All modeling inputs and outputs (including BPIP-PRIME and meteorological files) in electronic format, together with a description of all filenames;
- Plot plan showing emission points, nearby buildings (including dimensions), cross-section lines, property lines, fencelines, roads, and UTM coordinates;

- A table showing building heights used in the modeling analysis; and
- Concentration isopleths maps for each criteria pollutant and averaging time combination.

The HRA results will include AERMOD output plot files, spreadsheets that relate the computed risks with UTM coordinates, and textual discussion that explains the methodology to the lay public.

Figure 1
Locations of Project and Surface Meteorological Monitoring Station
Pio Pico Energy Center Project



Appendix A

Information on CTDMPLUS Model

The CTDMPLUS and CTSCREEN Models

Complex terrain impacts may need to be modeled with more accuracy than that provided by AERMOD. The use of more refined modeling techniques is specifically addressed in EPA's Appendix W[1] modeling guidance, as follows:

> *Since AERMOD treats dispersion in complex terrain, we have merged sections 4 and 5 of appendix W, as proposed in the April 2000 NPR [Notice of Proposed Rulemaking]. And while AERMOD produces acceptable regulatory design concentrations in complex terrain, it does not replace CTDMPLUS for detailed or receptor-oriented complex terrain analysis, as we have made clear in Guideline section 4.2.2. CTDMPLUS remains available for use in complex terrain. [p. 68225]*
>
> *4.2.2 Refined Analytical Techniques*
>
> *d. If the modeling application involves a well defined hill or ridge and a detailed dispersion analysis of the spatial pattern of plume impacts is of interest, CTDMPLUS, listed in Appendix A, is available. CTDMPLUS provides greater resolution of concentrations about the contour of the hill feature than does AERMOD through a different plume-terrain interaction algorithm. [p. 68233]*

CTSCREEN is the same basic model as CTDMPLUS, except that meteorological data are handled internally in a simplified manner. As discussed in the CTSCREEN users guide[2],

> *Since [CTDMPLUS] accounts for the three-dimensional nature of plume and terrain interaction, it requires detailed terrain and meteorological data that are representative of the modeling domain. Although the terrain data may be readily obtained from topographic maps and digitized for use in the CTDMPLUS, the required meteorological data may not be as readily available.*
>
> *Since the meteorological input requirements of the CTDMPLUS can limit its application, the EPA's Complex-Terrain-Modeling, Technology-Transfer Workgroup developed a methodology to use the advanced techniques of CTDMPLUS in situations where on-site meteorological measurements are limited or unavailable. This approach uses*

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[1] 40 CFR 51 Subpart W, as amended November 9, 2005 at 70 FR 68218, "Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions."

[2] USEPA, EPA-600/8-90-087, "User's Guide to CTDMPLUS: Volume 2. The Screening Mode (CTSCREEN)," October 1990.

CTDMPLUS in a "screening" mode--actual source and terrain characteristics are modeled with an extensive array of predetermined meteorological conditions. This CTDMPLUS screening mode (CTSCREEN) serves several purposes in regulatory applications. When meteorological data are unavailable, CTSCREEN can be used to obtain conservative (safely above those of refined models), yet realistic, impact estimates for particular sources.

Therefore, the use of the CTSCREEN version of CTDMPLUS is consistent with EPA guidance.

Meteorological Data for CTDMPLUS

The discussion in Section 6 of the text focused on meteorological data needed to run AERMOD. As discussed in a later section, an additional model, Complex Terrain Dispersion Model PLUS (CTDMPLUS), may be used in lieu of the model Complex Terrain Screening Model (CTSCREEN) for receptors in the terrain above stack-top height. CTDMPLUS is an EPA-approved air dispersion model, and is fully supported with user guidance documentation.[3]

CTDMPLUS requires an extensive suite of meteorological data composed of not only wind speed, direction, and temperature, but also horizontal and vertical wind direction standard deviations (sigma theta and sigma phi, respectively), and vertical wind speed standard deviation (sigma w). The AERMOD-compatible meteorological data set provided by the District, derived from measurements taken at the Chula Vista monitoring station, does not include these non-standard measurements.

It is possible to develop conservative values for the standard deviation parameters sigma theta, sigma phi, and sigma w that are consistent with the available meteorological data, and use them to prepare a meteorological data set that is usable in CTDMPLUS and yields conservative (i.e., high) ground-level concentrations.

If modeling with CTDMPLUS is required, the District will be requested to develop ISCST3-compatible meteorological data sets for the baseline period. The ISCST3 meteorological data set would be used to create the CTDMPLUS-compatible meteorological data set. Because all three of these Gaussian dispersion models—ISCST3, AERMOD, and CTDMPLUS—require upper air data as well as surface data, the upper air data from the MCAS Miramar would be used as discussed earlier.

The following meteorological parameters are needed for CTDMPLUS and would be taken directly from the AERMET files:

- Observed mixing height, provided as the height of the convective or planetary boundary layer (PBL);

[3] USEPA. Technology Transfer Network, Support Center for Regulatory Atmospheric Modeling, *http://www.epa.gov/scram001/dispersion_prefrec.htm#ctdmplus*

- Calculated mixing height, provided as the height of the mechanical, or surface, boundary layer (SBL);
- Friction velocity (USTAR);
- Monin-Obukhov length (L); and
- Roughness length (Z_O).

The remaining standard deviations (sigma values) are not available from AERMOD and must be obtained from ISCST3-compatible files that would be developed from the meteorological data.

Stability classes determined by MPRM4 or PCRAMMET[5] from the measured meteorological data would be used to select the most conservative values from the following ranges recommended in EPA's Meteorological Monitoring Guidance document:[6]

Stability Category	Sigma Phi (σ_Φ)/ Regulatory Range (degrees)	Sigma Theta (σ_θ)/ Regulatory Range (degrees)
A	11.5	22.5
B	10.0 – 11.5	17.5 – 22.5
C	7.8 – 10.0	12.5 – 17.5
D	5.0 – 7.8	7.5 – 12.5
E	2.4 – 5.0	3.8 – 7.5
F	< 2.4	< 3.8

The most conservative values (that is, the values that produce the highest modeled impacts) for sigma theta and sigma phi within each range would be determined by conducting a sensitivity analysis for all combinations of stack conditions to be modeled using CTDMPLUS and receptor locations for which CTDMPLUS would be used (that is, receptors above stack height). The sensitivity analysis would use the upper and lower values of each range for each stability category. For example, for stability category D, four combinations would be evaluated as follows:

[4] The Meteorological Processor for Regulatory Models
[5] EPA meteorological preprocessor
[6] Tables 6-8a and 6-9a in Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005, US EPA Office of Air and Radiation, Office of Air Quality Planning and Standards, February 2000.

σ_Φ	σ_θ
5.0	7.5
5.0	12.5
7.8	7.5
7.8	12.5

For stability category A, maximum values for σ_Φ and σ_θ of 15.0 and 27.0, respectively, would be evaluated. For stability category F, minimum values for σ_Φ and σ_θ of 1.0 and 2.0, respectively, would be evaluated.

Sigma-w would be estimated by multiplying sigma-phi (after conversion from degrees to radians) by the horizontal wind speed.