APPENDIX B.1

AIR QUALITY INFORMATION

APPENDIX 4.3A

EMISSIONS AND OPERATING PARAMETERS

Operating Parameters

Tables 4.3A-1 through 4.3 A-6 list the operating parameters for each of the emission units that make up the project. These are the parameters that affect emissions and their dispersion, and are the basis for the calculations that follow.

TABLE 4.3A-1
Natural Gas Storage Parameters

Component Counts	
Compressors	5
Pumps (light liquid)	15
Valves	235
Flanges	700
Natural Gas Composition (wt %)	
Methane	86%
VOC	3.7%

TABLE 4.3A-2
Process Heater Parameters

Capacity, MMBtu/hour (each)	8.6
Fuel	Natural Gas
Fuel sulfur content, gr/100 scf	0.25
Exhaust flow, acfm	867
Stack velocity, m/sec	4.3
Exhaust Temperature, °F	500
Exhaust Pipe Diameter, in	24
Exhaust Stack Height, ft	25
Annual operation, hours	4320
Emissions	
NOx, ppm	9
CO, ppm	50
VOC, ppm	30
PM10, lb/MMBTU	0.0075
PM2.5, lb/MMBTU	0.0075
SO2, lb/MMBTU	0.0028

SO2 emissions based on fuel sulfur content = 1 gr/100 dscf
NOx, CO emissions based on SJVAPCD BACT for oil field steam generators
VOC, PM emissions based on AP-42

TABLE 4.3A-3
Dehydrator Reboiler Parameters

Capacity, MMBtu/hour	4,5
Fuel	Natural Gas
Fuel sulfur content, gr/100 scf	0.25
Exhaust flow, acfm	454
Stack velocity, ft/sec	4.3
Exhaust Temperature, °F	500
Exhaust Pipe Diameter, in	18
Exhaust Stack Height, ft	25
Annual operation, hours	4320
Emissions	
NOx, ppm	9
CO, ppm	100
VOC, ppm	30
PM10, lb/MMBTU	0.0075
PM2.5, lb/MMBTU	0.0075
SO2, lb/MMBTU	0.0028

SO2 emissions based on fuel sulfur content = 1 gr/100 dscf.

TABLE 4.3A-4
Dehydrator Thermal Oxidizer Parameters

Capacity, MMBtu/hour	
Fuel	Natural Gas
Fuel sulfur content, gr/100 scf	0.25
Exhaust flow, acfm	454
Stack velocity, ft/sec	4.3
Exhaust Temperature, °F	500
Exhaust Pipe Diameter, in	18
Exhaust Stack Height, ft	25
Annual operation, hours	4320
Maximum VOC loading, lb/hr	38
VOC Destruction efficiency, %	98%
Emissions from fuel combustion	
NOx, ppm	9
CO, ppm	100
VOC, ppm	30
PM10, lb/MMBTU	0.007
SO2, lb/MMBTU	0.0028

SO2 emissions based on fuel sulfur content = 1 gr/100 dscf.

TABLE 4.3A-5
Methanol Storage Parameters

Tank diameter, inches	96
Tank length, feet	16
Storage volume, gallons	6,540
Annual throughput, gallons	12,690
Storage temperature	Ambient
Material Stored	Methanol
Vapor Pressure, psi	1.71
Liquid Density, lb/gal	6.604
Molecular Weight	32

TABLE 4.3A-6
Corrosion Inhibitor Parameters (assumed same as methanol)

Tank diameter, inches	48
Tank length, feet	6
Storage volume, gallons	620
Annual throughput, gallons	1,260
Storage temperature	Ambient
Material Stored	Methanol
Vapor Pressure, psi	1.71
Liquid Density, lb/gal	6.604
Molecular Weight	32

Emission Calculations

Gas Storage

Fitting leaks were calculated using AP-42 factors for Oil and Gas Production (EPA, "Protocol for Equipment Leak Emission Estimates," 1995, Table 2-4). All fittings are gas fittings, except for the methanol injection pumps.

The tables in the Protocol are based on industry averages for Oil and Gas Production. Leak detection and repair (LDAR) program reduces emissions substantially from the average, because leaking components are detected and repaired. The degree of emission reduction is a function of inspection frequency and the action level for leak repair. An emission reduction factor of 85% was used, based upon a monthly inspection and a leak definition of 10,000 ppm. Emissions are presented in Table 4.3A-7

Emissions of methane, a greenhouse gas, have also been quantified.

TABLE 4.3A-7
Natural Gas Storage Emissions – Fitting Leaks

	Count	Controlled Emission factor (lb/hr/item)	Lb/hr	Lb/day	TPY
Valves	235	1.49E-03	0.35	8.39	1.53
Pumps	15	7.94E-04	0.01	0.29	0.05
Compressors	5	2.91E-03	0.01	0.35	0.06
Flanges	700	1.29E-04	0.09	2.17	0.4
	TOTAL		0.47	11.2	2.04
	CH4	91 wt%	0.43	10.26	1.87
	VOC	3.7 wt%	0.02	0.38	0.07

Emission factors from AP-42.

In addition to fugitive emissions from equipment leaks, natural gas is released by the pneumatic pumps that inject methanol/corrosion inhibitor into the gas being withdrawn from storage. Emissions from the operation of these pumps are presented in Table 4.3A-8.

Emissions of methane, a greenhouse gas, have also been quantified.

TABLE 4.3A-8
Natural Gas Storage Emissions – Methanol/Corrosion Inhibitor Injection

	Natural gas emissions (SCF/Day)		Lb/hr	Lb/day	TPY
Methanol Injection	3750	CH_4 (93.1 vol%)	6.30	151.19	13.61
		VOC (1.0 vol%)	0.04	0.94	0.08
Corrosion Inhibitor Injection	1000	CH_4 (93.1 vol%)	1.68	40.32	3.63
		VOC (1.0 vol%)	0.01	0.25	0.02

Annual emissions based on 180 days/year of operation.

The natural gas that is released contains small amounts of Hazardous Air Pollutants. Emission estimates in Table 4.3A-9 are based on speciation provided by the applicant.

TABLE 4.3A-9
Toxic Emissions—Natural Gas Releases

	Concentration in natural gas, ppmv	Natural Gas Emissions, SCF/day	Lb/hr	Lb/day	TPY
Benzene	<1	4995	3.32E-05	7.96E-04	1.45E-04
Hexane	40	4995	1.33E-03	3.18E-02	5.81E-03
Toluene	2	4995	1.02E-04	2.44E-03	4.46E-04
Ethyl benzene	<1	4995	5.87E-05	1.41E-03	2.57E-04
Xylene	3	4995	1.76E-04	4.23E-03	7.71E-04

Process Heaters

Six 8.6 MMBtu/hr heaters will be used to heat natural gas being withdrawn from the storage facility. Although it is anticipated that process gas heaters will be required for approximately 11 days during each withdrawal cycle of the storage facility, the emissions in Table 4.3A-10 have been calculated assuming that the heaters are used at capacity for 6 months.

TABLE 4.3A-10
Process Heater Emissions (each)

	Capacity, MMBTU/hr	Emission Factor (lb/MMBtu)	Lb/hr	Lb/day	TPY
NOx	8.6	0.0108	0.09	2.23	0.20
CO	8.6	0.0366	0.31	7.55	0.68
VOC	8.6	0.0108	0.09	2.23	0.20
PM10	8.6	0.0075	0.06	1.55	0.14
PM2.5	8.6	0.0075	0.06	1.55	0.14
SO2	8.6	0.0028	0.02	0.58	05
CO2	8.6	119	1022	24,518	2,207

Annual emissions based on 180 days/year of operation.

Hazardous air pollutants from the combustion of natural gas were estimated using emission factors from AP-42, and are presented in Table 4.3A-11.

TABLE 4.3A-11
Toxic emissions—process heater (per heater)

	Emission Factor, lb/MMBTU	Maximum Firing Rate, MMBTU/hr	Lb/hr	Lb/day	TPY
Benzene	2.03E-06	8.6	1.75E-05	4.20E-04	3.78E-05
Formaldehyde	7.26E-05	8.6	6.24E-04	1.50E-02	1.35E-03
Hexane	1.74E-03	8.6	1.50E-02	3.60E-01	3.24E-02
Naphthalene	5.91E-07	8.6	5.08E-06	1.22E-04	1.10E-05
PAHs – Total	9.68E-08	8.6	8.33E-07	2.00E-05	1.80E-06
Benzo(a)anthracene					
Benzo(a)pyrene					
Benzo(b)fluoranthene					
Benzo(k)fluoranthene					
Chrysene					
Dibenzo(a,h)anthrancene					
Indeno(1,2,3-cd)pyrene					
Toluene	3.29E-06	8.6	2.83E-05	6.79E-04	6.11E-05

Dehydrators

Two dehydrators will remove water (and some hydrocarbons) from the gas stream. There are two sources of emissions: the reboiler (combustion emissions), and the thermal oxidizer (combustion emissions plus the fraction of hydrocarbons that is not completely combusted in the thermal oxidizer).

Reboiler emissions from Table 4.3A-12 are based on AP-42 factors for combustion of natural gas.

TABLE 4.3A-12
Dehydrator Reboiler Emissions (each)

	Capacity, MMBTU/hr	Emission Factor (lb/MMBtu)	Lb/hr	Lb/day	TPY
NOx	4.5	0.0108	0.05	1.17	0.10
CO	4.5	0.0732	0.33	7.91	0.71
VOC	4.5	0.0108	0.05	1.17	0.10
PM10	4.5	0.0075	0.03	0.81	0.07
PM2.5	4.5	0.0075	0.03	0.81	0.07
SO2	4.5	0.0028	0.01	0.30	0.03
CO2	4.5	119	535	12,830	1,155

Annual emissions based on 180 days/year of operation.

Hazardous air pollutants from the combustion of natural gas were estimated using emission factors from AP-42, and are presented in Table 4.3A-13.

TABLE 4.3A-13
Toxic Emissions—Dehydrator Reboiler (per reboiler)

	Emission Factor, lb/MMBTU	Maximum Firing Rate, MMBTU/hr	Lb/hr	Lb/day	TPY
Benzene	2.03E-06	4.5	9.15E-06	2.20E-04	1.98E-05
Formaldehyde	7.26E-05	4.5	3.27E-04	7.84E-03	7.06E-04
Hexane	1.74E-03	4.5	7.84E-03	1.88E-01	1.69E-02
Naphthalene	5.91E-07	4.5	2.66E-06	6.38E-05	5.74E-06
PAHs – Total	9.68E-08	4.5	4.36E-07	1.05E-05	9.41E-07
Benzo(a)anthracene					
Benzo(a)pyrene					
Benzo(b)fluoranthene					
Benzo(k)fluoranthene					
Chrysene					
Dibenzo(a,h)anthrancene					
Indeno(1,2,3-cd)pyrene					
Toluene	3.29E-06	4.5	1.48E-05	3.55E-04	3.20E-05

Thermal oxidizer emissions presented in Table 4.3A-14 are based on a similar installation documented in the Oklahoma Department of Environmental Quality Title V permit for the ONEOK gas storage facility in Logan County, Oklahoma (Permit 2006-191-TVR).

TABLE 4.3A-14
Thermal Oxidizer Emissions (each)

	Capacity, MMSCFD	Emission Factor (lb/MMSCFD)	Lb/hr	Lb/day	TPY
NOx	358	0.0135	0.20	4.83	0.43
CO	358	0.0888	1.32	31.79	2.86
VOC	358	0.0507	0.76	18.24	1.64
PM10	358	0.0033	0.03	0.81	0.07
PM2.5	358	0.0023	0.03	0.81	0.07
SO2	358	0.0008	0.01	0.30	0.03
CO2	4.5 MMBtu/hr	119 lb/MMBtu	535	12,830	1,155

Annual emissions based on 180 days/year of operation.

Toxic air contaminant emissions, presented in Table 4.3A-15, are also calculated using emission factors developed for a similar installation documented in the Oklahoma Department of Environmental Quality Title V permit for the ONEOK gas storage facility in Logan County, Oklahoma (Permit 2006-191-TVR). The Oklahoma permit did not include methanol emissions. The emission factor for methanol in the Table 4.3A-15 assumes that all of the VOC unaccounted for by the other HAPs is methanol.

TABLE 4.3A-15
Toxic emissions—Dehydrator Thermal Oxidizer (per oxidizer)

	Maximum throughput, MMSCFD	Emission Factor, lb/MMSCF	Lb/hr	Lb/day	TPY
Benzene	358	0.0027	0.04	0.97	0.09
Ethylbenzene	358	0.0024	0.04	0.86	0.08
Hexane	358	0.0006	0.01	0.21	0.02
Methanol	358	0.0201	0.30	7.20	0.65
Toluene	358	0.0099	0.15	3.54	0.32
Xylenes	358	0.0150	0.22	5.37	0.48

VOC Storage

Methanol and a corrosion inhibitor will be stored in horizontal cylindrical tanks. Organic compounds are emitted when the tanks are filled. EPA's TANKS program was used to calculate tank emissions presented in Table 4.3A-16.

The final decision about which corrosion inhibitor to use, or even whether any corrosion inhibitor will be used, has not yet been made. For the purposes of this analysis, it has been assumed that the corrosion inhibitor will have the same properties as methanol.

TABLE 4.3A-16
Methanol and Corrosion Inhibitor Storage Emissions (per tank)

		Lb/hr	Lb/day	TPY
Methanol	VOC	0.00	0.00	0.08
Corrosion Inhibitor	VOC	0.00	0.00	0.01

All of the VOC emitted from storage of methanol and corrosion inhibitor is presumed to be methanol. The HAP emissions from this source are presented in Table 4.3A-17.

TABLE 4.3A-17
Toxic emissions—Methanol and Corrosion Inhibitor Storage Emissions (per tank)

		Lb/hr	Lb/day	TPY
Methanol Storage	Methanol	0.00	0.00	0.08
Corrosion Inhibitor Storage	Methanol	0.00	0.00	0.01

Emission Summary

Total emissions from the facility are presented in the following tables. Table 4.3A-18 summarizes criteria pollutant emissions. Table 4.3A-19 summarizes emissions of Hazardous Air Pollutants. Table 4.3A-20 summarizes emissions of greenhouse gases.

TABLE 4.3A-18

Emissions from Project Equipment

Emissions/Equipment	NOx	SO_2	CO	VOC	PM_{10}
Maximum Hourly Emissions					
Natural Gas Storage Facility	0.00	0.00	0.00	0.10	0.00
Heaters (6)	0.56	0.14	1.89	0.56	0.39
Dehydration Units (reboiler plus thermal oxidizer) (2)	0.50	0.05	3.31	1.62	0.14
VOC Storage (8)	0.00	0.00	0.00	0.00	0.00
Total, pounds per hour	**1.06**	**0.19**	**5.20**	**2.24**	**0.52**
Maximum Daily Emissions					
Natural Gas Storage Facility	0.00	0.00	0.00	1.57	0.00
Heaters (6)	13.37	3.43	45.33	13.37	9.29
Dehydration Units (reboiler plus thermal oxidizer) (2)	12.00	1.19	79.39	38.81	3.24
VOC Storage (8)	0.00	0.00	0.00	0.00	0.00
Total, pounds per day	**25.37**	**4.62**	**124.72**	**53.76**	**12.53**
Maximum Annual Emissions, tpy					
Natural Gas Storage Facility	0.00	0.00	0.00	0.18	0.00
Heaters (6)	1.20	0.31	4.08	1.20	0.84
Dehydration Units (reboiler plus thermal oxidizer) (2)	1.08	0.11	7.15	3.49	0.29
VOC Storage (8)	0.00	0.00	0.00	0.34	0.00
Total, tons per year	**2.28**	**0.42**	**11.22**	**5.21**	**1.13**

TABLE 4.3A-19
Total Greenhouse Gases

Source	GHG emissions		
	Pollutant	Tons/year	MTCO2eq/year
Natural Gas Storage	Methane	17.2	361
Process Heaters	CO2	13,242	13,242
Dehydrator Reboilers	CO2	2.310	2,310
Dehydrator Thermal Oxidizers	CO2	2,310	2,310
		TOTAL	18,225

TABLE 4.3A-20
Total Toxic Emissions

	Lb/hr	Lb/day	TPY
Benzene	8.07E-02	1.94E+00	1.74E-01
Ethylbenzene	7.17E-02	1.72E+00	1.55E-01
Formaldehyde	4.40E-03	1.06E-01	9.50E-03
Hexane	1.25E-01	3.00E+00	2.73E-01
Methanol	6.00E-01	1.44E+01	1.38E+00
Naphthalene	3.58E-05	8.59E-04	7.73E-05
PAHs – Total	5.87E-06	1.41E-04	1.27E-05
Benzo(a)anthracene			
Benzo(a)pyrene			
Benzo(b)fluoranthene			
Benzo(k)fluoranthene			
Chrysene			
Dibenzo(a,h)anthrancene			
Indeno(1,2,3-cd)pyrene			
Toluene	2.96E-01	7.10E+00	6.39E-01
Xylenes	4.48E-01	1.07E+01	9.67E-01
HAP Total			3.60

APPENDIX 4.3B

SCREENING HEALTH RISK ASSESSMENT

The screening level health risk assessment has been prepared using CARB's Hotspots Analysis and Reporting Program (HARP) computer program and associated guidance in the OEHHA's *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (August 2003). The HARP model was used to assess cancer risk as well as chronic and acute risk impacts. The following paragraphs describe the procedures used to prepare this risk assessment.

Modeling Inputs

The risk assessment module of the HARP model was run using unit ground level impacts to obtain derived cancer risks for each toxic chemical of interest.[1] Cancer risks were obtained for the derived (OEHHA) method, the derived (adjusted) method, average point estimate and high-end point estimate options. The HARP model output was cancer risk by pollutant and route for each type of analysis, based on an exposure of 1.0 ug/m^3. These values are called Unit Risks.

HARP uses the toxicity values developed by OEHAA for use in risk assessments. The values for chemicals included in this analysis are shown in Table 4.3B-1. Dispersion of pollutants from the thermal oxidizers was determined using AERMOD. The results of the dispersion analysis were then combined with the HARP unit values to determine final actual cancer risk and hazard indices. The unit values derived from the HARP model output showing the unit values are shown in Table 4.3B-2. Individual cancer risks are expressed in units of risk per ug/m^3 of exposure.

A similar factor for health hazard index is developed by simple taking the inverse of the REL. This value gives the hazard index when multipled by the exposure concentration in ug/m$^{3.}$

TABLE 4.3B-1
Toxicity Values Used to Characterize Health Risks

Compound	Inhalation Cancer Potency Factor (mg/kg-d)$^{-1}$	Chronic Reference Exposure Level (μg/m^3)	Acute Reference Exposure Level (μg/m^3)
Benzene	0.10	60	1,300
Diesel PM	1.1	5.0	--
Ethylbenzene	--	2,000	--
Formaldehyde	0.021	3.0	94
0Hexane	--	7,000	--
Naphthalene	0.12	9.0	--
PAHs (as BaP for HRA)	3.9	--	--
Toluene	--	300	37,000

Source: CARB, 2005.

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

Table 4.3B-2 Unit Risk and Health Hazard Index (from HARP)							
Toxic Air Contaminant	**Unit Risk**					**Health Hazard Index**	
	Derived (OEHHA) Method	**Average Point Estimate**	**High-End Point Estimate**	**Derived (Adjusted) Method**	**Worker Exposure: Derived (OEHHA) Method**	**Acute**	**Chronic**
	(per ug/m3)						
Benzene	3.77E-05	2.60E-05	3.77E-05	2.90E-05	5.72E-06	7.69E-04	1.67E-02
Ethylbenzene	--	--	--	--	--	--	5.00E-04
Formaldehyde	7.91E-06	5.46E-06	7.91E-06	6.08E-06	1.20E-06	1.06E-02	3.33E-01
Hexane	--	--	--	--	--	--	1.43E-04
Methanol	--	--	--	--	--	3.57E-05	2.50E-04
Naphthalene	4.52E-05	3.12E-05	4.52E-05	3.48E-05	6.86E-06	--	1.11E-01
Polycyclic Aromatic Hydrocarbons	3.98E-02	8.05E-03	4.02E-02	3.98E-02	1.47E-02	--	--
Toluene	--	--	--	--	--	2.70E-05	3.33E-03
Xylene	--	--	--	--	--	4.55E-05	1.43E-03

Risk Analysis Method

To simplify the screening analysis, the risks were calculated as if all toxic air contaminants from the entire facility were emitted by a single source: one of the thermal oxidizers. This screening approach is conservative, because collocating all of the emissions maximizes the combined impact.

Using AERMOD, the maximum offsite ground level concentration of each toxic pollutant was determined. The resulting cancer risk was calculated by applying unit risk factors to the ground level concentration for each pollutant. An identical approach was used to determine the acute and chronic health impacts associated with the proposed project. The detailed calculations are shown in Table 4.3B-3

Evaluation of potential non-carcinogenic health effects from exposure to short-term and long-term concentrations in air was performed by comparing modeled concentrations in air with the RELs. A REL is a concentration in air at or below which no adverse health effects are anticipated. RELs are based on the most sensitive adverse effects reported in the medical and toxicological literature. Potential non-carcinogenic effects were evaluated by calculating a ratio of the modeled concentration in air and the REL. This ratio is referred to as a hazard quotient. The unit risk values and RELs used to characterize health risks associated with modeled concentrations in air were obtained from the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values (CARB, 2005), and are presented in Table 4.3B-2.

Table 4.3B-3 Cancer Risk and Health Hazard Index (from HARP)											
Toxic Air Contaminant	Max hourly emission Rate (g/sec)	Annual Average Emission Rate (g/sec)	Max Hourly Ground Level Concentration (uq/cu m)[a]	Max Annual Average Ground Level Concentration (ug/cu m)[b]	Cancer Risk					Health Hazard Index	
					Derived (OEHHA) Method	Average Point Estimate	High-End Point Estimate	Derived (Adjusted) Method	Worker Exposure: Derived (OEHHA) Method	Acute	Chronic
Benzene	1.02E-02	5.02E-03	1.02E+00	7.30E-03	2.75E-07	1.90E-07	2.75E-07	2.12E-07	4.17E-08	7.83E-04	1.22E-04
Ethylbenzene	9.03E-03	4.46E-03	9.04E-01	6.48E-03	--	--	--	--	--	--	3.24E-06
Formaldehyde	5.54E-04	2.73E-04	5.55E-02	3.98E-04	3.15E-09	2.17E-09	3.15E-09	2.42E-09	4.77E-10	5.88E-04	1.32E-04
Hexane	1.57E-02	7.84E-03	1.57E+00	1.14E-02	--	--	--	--	--	--	1.63E-06
Methanol	7.55E-02	3.97E-02	7.56E+00	5.77E-02	--	--	--	--	--	2.70E-04	1.44E-05
Naphthalene	4.51E-06	2.22E-06	4.51E-04	3.23E-06	1.46E-10	1.01E-10	1.46E-10	1.12E-10	2.22E-11	--	3.59E-07
Polycyclic Aromatic Hydrocarbons	7.39E-07	3.64E-07	7.40E-05	5.30E-07	2.11E-08	4.27E-09	2.13E-08	2.11E-08	7.80E-09	--	--
Toluene	3.72E-02	1.84E-02	3.73E+00	2.67E-02	--	--	--	--	--	1.01E-04	8.90E-05
Xylene	5.64E-02	2.78E-02	5.64E+00	4.05E-02	--	--	--	--	--	2.57E-04	5.79E-05
TOTAL					**3.00E-07**	**1.96E-07**	**3.00E-07**	**2.35E-07**	**5.00E-08**	**2.00E-03**	**4.21E-04**

[a]Hourly xi/q (ug/cu m per g/sec) = 100.0929
[b]Annual xi/q (ug/cu m per g/sec) = 1.45503

Summary of Results

The results of the screening level health risk assessment are summarized in Table 4.3B-4.

TABLE 4.3B-4

Screening Level Risk Assessment Results

Risk Methodology	Thermal Oxidizers
Modeled Residential Cancer Risk (in one million)	
Residential: Derived (OEHHA) Method	0.3
Residential: Average Point Estimate	0.2
Residential: High-end Point Estimate	0.3
Residential: Derived (adjusted) Method	0.2
Modeled Worker Cancer Risk (in one million)	
Worker Exposure: Derived (OEHHA) Method	0.05
Modeled Acute and Chronic Impacts	
Acute HHI	0.002
Chronic HHI	0.0004

As shown in Table 4.3B-4, the cancer risk from the project is well below the SJVAPCD significance level of 10 in one million. In addition, the acute and chronic health impacts are well below the SJVAPCD significance level of one. Consequently, there are no significant toxic air contaminant impacts issues associated with the proposed project.

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APPENDIX 4.3C

CONSTRUCTION EMISSIONS AND IMPACT ANALYSIS

4.3C-1 Onsite Construction

Construction of the onsite portions of the project is expected to last approximately 6 months. Construction activities will include clearing, grading, excavation of footings and foundations, and backfilling operations. Up to 15 injection/withdrawal wells and 7 monitoring wells will be drilled.

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

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

Combustion emissions during construction will result from:

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

To determine the potential worst-case daily construction impacts, exhaust and dust emission rates have been evaluated for each source of emissions. Maximum short-term impacts are calculated assuming that all equipment is operating simultaneously with the peak workforce (123persons) on-site. Annual emissions are based on the average equipment mix during the 6-month construction period.

4.3C-2 Linear Facilities

Offsite construction will include a natural gas pipeline. Emissions from these construction activities are not included in this analysis.

4.3C-3 Available Emission Reduction Measures

The following reduction measures are proposed to control exhaust emissions from the Diesel heavy equipment used during construction of the project:

- Operational measures, such as limiting time spent with the engine idling by shutting down equipment when not in use;

- Regular preventive maintenance to prevent emission increases due to engine problems;
- Use of low sulfur and low aromatic fuel meeting California standards for motor vehicle Diesel fuel; and
- Use of low-emitting Diesel engines meeting federal emissions standards for construction equipment.
- Use of low-emitting Diesel engines meeting federal emissions standards (Tier 2) for drilling equipment.

The following measures are proposed to control fugitive dust emissions during construction of the project:

- Use either water application or chemical dust suppressant application to control dust emissions from unpaved road travel and unpaved parking areas;
- Use vacuum sweeping and/or water flushing of paved road surface to remove buildup of loose material to control dust emissions from travel on the paved access road (including adjacent public streets impacted by construction activities) and paved parking areas;
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard;
- Limit traffic speeds on unpaved roads to 15 mph;
- Install sandbags or other erosion control measures to prevent silt runoff to roadways;
- Replant vegetation in disturbed areas as quickly as possible;
- Use wheel washers or wash off tires of all trucks exiting construction site that carry track-out dirt from unpaved roads; and
- Mitigate fugitive dust emissions from wind erosion of areas disturbed from construction activities (including storage piles) by application of either water or chemical dust suppressant.

4.3C-4 Estimation of Emissions with Emission Reduction Measures

4.3C-4.1 Onsite Construction

Tables 4.3C-1 and 4.3C-2 show the estimated maximum daily and annual heavy equipment exhaust and fugitive dust emissions with recommended mitigation measures for onsite construction activities. Detailed emission calculations are included as Attachment 4.3C-1.

Table 4.3C-1
Maximum Daily Emissions During Onsite Construction, Pounds Per Day

	NOx	CO	POC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	119.9	47.9	9.3	0.1	5.0	6.0
Drilling Rigs	52.8	11.8	2.1	.1	1.7	1.7
Fugitive Dust	--	--	--	--	63.6	10.6
Offsite						
Worker Travel, Truck Deliveries	8.28	66.49	7.63	0.06	0.06	0.06
Total Emissions						
Total	181.0	126.3	18.7	0.2	17.3	70.3

Table 4.3C-2
Annual Emissions During Construction, Tons Per Year

	NOx	CO	POC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	6.1	2.3	0.5	0.01	0.2	0.2
Drilling Rigs	29.4	6.1	1.2	0.0	0.9	0.9
Fugitive Dust	--	--	--	--	2.5	0.6
Offsite						
Worker Travel, Truck Deliveries	0.2	1.5	0.2	0.0	0.0	0.0
Total Emissions						
Total	35.7	9.9	1.8	0.0	1.7	4.2

4.3C-4 Analysis of Ambient Impacts from Onsite Construction

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

4.3C-4.1 Existing Ambient Levels

Data from several ambient air monitoring stations were used to characterize air quality at the project site. They were chosen because of their proximity to the site and because they record area-wide ambient conditions rather than the localized impacts of any particular facility. All ambient air quality data presented in this section were taken from CARB publications and data sources or USEPA air quality data tables. Ambient concentrations of ozone and nitrogen dioxide (NO_2) are recorded at the Madera-Pump Yard monitoring station in Madera, about 12 miles from the project site. Monitoring of lead ended in 2003 at Madera-Pump Yard. Respirable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) are recorded at the Fresno-First Street in Fresno, about 25 miles from the project site. The nearest monitoring station for sulfur dioxide (SO_2) is at Bethel Island, about 112 miles from the project site (a new SO_2 monitor has been established at Fresno-First Street, but the only available data are from 2007). The nearest carbon monoxide (CO) monitor is Fresno-Skypark in Fresno and the nearest sulfates monitor is in Bakersfield. The Madera-Pump Yard and Fresno-First Street station are operated by the California Air Resources Board and the Fresno-Skypark station is operated by San Joaquin Valley APCD (SJVAPCD). The Bethel Island station is operated by the Bay Area Air Quality Management District (BAAQMD).

The maximum concentrations of NOx, SO_2, CO, and PM_{10} recorded for 2005 through 2007 at those monitoring stations are listed in the background column of Table 4.3C-4.

4.3C-4.2 Dispersion Model

As in the analysis of project operating impacts, the EPA-approved AERMOD model was used to estimate ambient impacts from construction activities. A detailed discussion of the AERMOD dispersion model is included in Section 4.3.5.6.1.

The emission sources for the construction site were grouped into three categories: exhaust emissions, construction dust emissions, and windblown dust emissions. For the volume sources, the vertical dimension was set to 6 meters. For combustion sources in the construction area, the area covers the entire construction/laydown area.

For the windblown dust sources, the area covers the entire construction/laydown area. An effective plume height of 0.5 meters was used in the modeling analysis. The exhaust and dust emissions were modeled as a single area source that covered the total area of the construction site. The construction impacts modeling analysis used the same receptor locations as used for the project operating impact analysis. A detailed discussion of the receptor locations is included in Section 4.3.5.3.1.

To determine the construction impacts on short-term ambient standards (24 hours and less), the worst-case daily onsite construction emission levels shown in Table 4.3C-1 were used. For pollutants with annual average ambient standards, the annual onsite emission levels shown in Table 4.3C-2 were used. The meteorological data set used for the construction emission impacts analysis is the ambient data collected at the nearby Fresno monitoring station between 2000 and 2002.

4.3C-4.3 Modeling Results

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

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

The modeling analysis results are shown in Table 4.3C-4. Also included in the table are the maximum background levels that have occurred in the last 3 years and the resulting total ambient impacts. Construction impacts alone for all modeled pollutants are expected to be below the most stringent state and national standards. Construction activities are not expected to cause the violation of any state or federal ambient air quality standard. However, the state 24-hour and annual average PM_{10} standards are exceeded in the absence of the construction emissions for the project.

The dust mitigation measures already proposed by the applicant are expected to be very effective in minimizing fugitive dust emissions.

Table 4.3C-3

Modeled Maximum Onsite Construction Impacts

Pollutant	Averaging Time	Maximum Construction Impacts (μg/m³)	Background (μg/m³)	Total Impact (μg/m³)	Standard (μg/m³)	Federal Standard (μg/m³)
NO_2[a]	1-hour	176	107	283	339	--
	Annual	1	19	20	--	100
SO_2	1-hour	10	47	57	650	--
	24-hour	1	18	19	109	365
	Annual	0	5	5	--	80
CO	1-hour	56	4,370	4,426	23,000	40,000
	8-hour	26	2,420	2,446	10,000	10,000
PM_{10}	24-hour	12	122	134	50	150
	Annual	0	38	38	20	50
$PM_{2.5}$	24-hour	2	104	106	--	65
	Annual	0.1	19.8	19.9	12	15

Notes:

a. Ozone limiting method applied for 1-hour average, using concurrent O_3 data (1992). ARM applied for annual average, using national default 0.75 ratio. Uncorrected 1-hour NOx concentration is 236 μg/m³.

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

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

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

The following tables provide details of the emission calculations for construction emissions.

Daily Construction Emissions (Peak Month), lb/day

	NOx	CO	VOC	SOx	PM10	PM2.5
Onsite						
Construction Equipment (Combustion)	119.9	47.9	9.2	0.1	5.0	5.0
Drilling Rig	52.8	11.8	2.1	0.1	1.7	1.7
Fugitive Dust					10.6	63.6
Subtotal =	172.7	59.8	11.4	0.2	17.3	70.3
Offsite						
Worker Travel (combustion)	6.4	65.8	7.2	0.1	0.1	0.1
Truck Deliveries (combustion)	1.9	0.6	0.2	0.0	0.0	0.0
Dust from travel on dirt roads					0.0	0.0
Subtotal =	8.3	66.5	7.4	0.1	0.1	0.1
Total =	181.0	126.3	18.7	0.2	17.3	70.3

Annual Construction Emissions, Ton/year

	NOx	CO	VOC	SOx	PM10	P2.5
Onsite						
Construction Equipment (Combustion)	6.1	2.3	0.5	0.0	0.2	0.2
Drilling Rig	29.4	6.1	1.2	0.0	0.9	0.9
Fugitive Dust					3.1	0.5
Subtotal =	35.5	8.5	1.6	0.0	4.2	1.7
Offsite						
Worker Travel (combustion)	0.1	1.4	0.2	0.0	0.0	0.0
Truck Deliveries (combustion)	0.0	0.0	0.0	0.0	0.0	0.0
Dust from travel on dirt roads					0.0	0.0
Subtotal =	0.2	1.5	0.2	0.0	0.0	0.0
Total =	35.7	9.9	1.8	0.0	1.7	4.2

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
1	50	50	0.0375	0.0129	0.0032	0.0000	0.0015	1.87	0.64	0.16	0.00	0.08
Idle exhaust (2)												0.0042

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

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
50	50	2500.00	0.0375	0.0129	0.0032	0.0000	0.0015	0.05	0.02	0.00	0.00	0.00
Idle exhaust (2,3)												0.00011

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.

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
123	1	123	50	6,150	0.0010	0.0107	0.0012	0.0000	0.0001	6.40	65.85	7.21	0.05	0.51

Notes:
(1) See notes for combustion emissions.

Worker Travel Annual Emissions															
Average Number of Workers Per Day	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Days per Year	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
						NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
45	1	45	50	120	270,500	0.0010	0.0107	0.0012	0.0000	0.0001	0.14	1.45	0.16	0.00	0.01

Notes:
(1) See notes for combustion emissions.

Onsite Combustion Emissions

Equipment	Tier	Adjusted factors lbs/1000 gallon (4) NOx	CO	VOC	SOx	PM10	Daily Emissions Fuel Use(5) (Gals/day)	Lbs/day NOx	CO	VOC	SOx	PM10	Total Annual Fuel Use(6) (Gals/yr)	Annual Emissions Lbs/yr NOx	CO	VOC	SOx	PM10
Dozer	1	226.75	56.00	15.00	0.21	10.88	0.00	0.00	0.00	0.00	0.00	0.00	528	119.72	29.57	7.92	0.11	5.74
Scraper	1	223.74	48.29	13.68	0.21	9.43	0.00	0.00	0.00	0.00	0.00	0.00	990	221.50	47.81	13.54	0.21	9.34
Blade	1	223.74	48.29	13.68	0.21	9.43	45.00	10.07	2.17	0.62	0.01	0.42	4,950	1107.50	239.06	67.71	1.03	46.69
Backhoe	1	224.73	80.51	28.01	0.21	16.27	27.00	6.07	2.17	0.76	0.01	0.44	2,970	667.44	239.11	83.19	0.62	48.32
Water truck	Onroad	200.40	68.99	16.92	0.20	8.14	12.52	2.51	0.86	0.21	0.00	0.10	1,377	275.99	95.01	23.30	0.27	11.21
Crane (51-99 ton)	1	256.55	55.70	8.64	0.21	4.90	96.00	24.63	5.35	0.83	0.02	0.47	8,448	2167.36	470.56	72.96	1.76	41.41
Crane (51-99 ton)	1	256.55	55.70	8.64	0.21	4.90	48.00	12.31	2.67	0.41	0.01	0.24	5,280	1354.60	294.10	45.60	1.10	25.88
Welder (Diesel)	1	160.21	125.59	17.47	0.21	8.79	81.28	13.02	10.21	1.42	0.02	0.71	8,941	1432.44	1122.86	156.19	1.86	78.58
Diesel generator (small)	1	160.21	125.59	17.47	0.21	8.79	30.48	4.88	3.83	0.53	0.01	0.27	3,018	483.45	378.97	52.71	0.63	26.52
Air compressor (Diesel)	1	160.21	125.59	17.47	0.21	8.79	7.62	1.22	0.96	0.13	0.00	0.07	671	107.43	84.21	11.71	0.14	5.89
Pickup/Crew Truck	Onroad	200.40	68.99	16.92	0.20	8.14	162.00	32.47	11.18	2.74	0.03	1.32	16,764	3359.54	1156.56	283.59	3.29	136.45
Boom Truck	Onroad	200.40	68.99	16.92	0.20	8.14	12.52	2.51	0.86	0.21	0.00	0.10	1,377	275.99	95.01	23.30	0.27	11.21
Tractor/Trailer	Onroad	200.40	68.99	16.92	0.20	8.14	12.52	2.51	0.86	0.21	0.00	0.10	1,377	275.99	95.01	23.30	0.27	11.21
Man lift	1	200.23	197.65	38.81	0.21	26.63	19.93	3.99	3.94	0.77	0.00	0.53	438	87.79	86.66	17.02	0.09	11.68
Misc. tools	1	160.21	125.59	17.47	0.21	8.79	22.86	3.66	2.87	0.40	0.00	0.20	2,012	322.30	252.64	35.14	0.42	17.68
Total =							577.73	119.85	47.94	9.25	0.12	4.97	59,140.59	12,259.05	4,687.16	917.18	12.04	487.83
														6.13	2.34	0.46	0.01	0.24

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

Daily Fugitive Dust Emissions (peak month)					
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)
Dozer	0	6	0	hrs	2.31E-01
Scraper	0	6	0	hrs	2.31E-01
Blade	1	6	6	hrs	2.31E-01
Backhoe	2	756	1512	tons	5.30E-05
Water truck	1	12	12	vmt	4.35E-01
Crane (51-99 ton)	4	0	0	none	0.00E+00
Crane (51-99 ton)	2	0	0	none	0.00E+00
Welder (Diesel)	8	0	0	none	0.00E+00
Diesel generator (small)	4	0	0	none	0.00E+00
Air compressor (Diesel)	1	0	0	none	0.00E+00
Pickup/Crew Truck	27	18	486	vmt	1.53E-01
Boom Truck	1	12	12	vmt	4.57E-01
Tractor/Trailer	1	12	12	vmt	4.57E-01
Man lift	2	0	0	none	0.00E+00
Misc. tools	3	0	0	none	0.00E+00
Windblown Dust (active construction area)	N/A	400000	400000	sq.ft.	6.73E-06
Worker Gravel Road Travel (onsite)	123	1	123	vmt	1.18E-01
Delivery Truck Gravel Road Travel (onsite)	1	1	1	vmt	3.54E-01
Worker Gravel Road Travel (offsite)	123	0.0	0.0	vmt	1.18E-01
Delivery Truck Gravel Road Travel (offsite)	1	0.0	0.0	vmt	3.54E-01

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	4.22	25.58	240	0.51	3.07E+00
Windblown Dust	0.09	0.23	365	0.02	4.23E-02
Total =				0.52	3.11E+00

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

Offsite traffic emissions	0.00	0.00	240	0.00	0.00E+00

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

Equipment	Average number of units per day Total Construction Period	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)
Dozer	0.03	0.08	6	4.00	264	176	528
Scraper	0.03	0.08	6	7.50	264	330	990
Blade	0.14	0.42	6	7.50	264	1,650	4,950
Backhoe	0.28	0.83	6	2.25	264	990	2,970
Water truck	0.14	0.42	4	3.13	264	459	1,377
Crane (51-99 ton)	0.44	1.33	6	4.00	264	2,816	8,448
Crane (51-99 ton)	0.28	0.83	6	4.00	264	1,760	5,280
Welder (Diesel)	1.11	3.33	8	1.27	264	2,980	8,941
Diesel generator (small)	0.50	1.50	6	1.27	264	1,006	3,018
Air compressor (Diesel)	0.11	0.33	6	1.27	264	224	671
Pickup/Crew Truck	3.53	10.58	6	1.00	264	5,588	16,764
Boom Truck	0.14	0.42	4	3.13	264	459	1,377
Tractor/Trailer	0.14	0.42	4	3.13	264	459	1,377
Man lift	0.06	0.17	4	2.49	264	146	438
Misc. tools	0.33	1.00	6	1.27	264	671	2,012
Total =						19,714	59,141

Construction Equipment Schedule				Construction Period:		6	months
Construction Equipment	**HP**	**Month 1**	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Month 6**
Dozer	150	1	0	0	0	0	0
Scraper	0	1	0	0	0	0	0
Blade	0	1	1	1	1	1	0
Backhoe	100	2	1	2	2	2	1
Water truck	225	1	1	1	1	1	0
Crane (51-99 ton)	450	1	3	4	3	3	2
Crane (51-99 ton)	450	0	2	2	2	2	2
Welder (Diesel)	22	0	8	8	8	8	8
Diesel generator (small)	22	1	1	4	4	4	4
Air compressor (Diesel)	22	0	0	1	1	1	1
Pickup/Crew Truck	250	12	21	27	25	25	17
Boom Truck	250	1	1	1	1	1	0
Tractor/Trailer	250	1	1	1	1	1	0
Man lift	85	0	0	2	0	0	0
Misc. tools	22	0	0	3	3	3	3
Worker Gravel Road Travel (onsite)		44	76	123	106	106	86
Delivery Truck Gravel Road Travel (onsite)		20	20	20	20	20	20

Notes - Fugitive Dust Emission Calculations

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

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

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

E = (k)(0.0032)[(U/5)^1.3]/[(M/2)^1.4]			
k = particle size constant =		0.35	for PM10
k = particle size constant =		0.11	for PM2.5
U = average wind speed =		1.40	m/sec (based on project area wind data)
	=	3.13	mph
M = moisture content =		15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1, moist soil)
E = PM10 emission factor =		0.0000	lb/ton
E = PM2.5 emission factor =		0.00001	lb/ton

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

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

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = surface silt content =	8.50	(AP-42, Table 13.2.2-1, 12/03, construction haul

		route)
W = avg. vehicle weight =	10.35	tons (avg. of loaded and unloaded weights, 966F loader, Caterpillar Performance Handbook, 10/97)
E = PM10 emission factor =	1.92	lb PM10/VMT
E = PM2.5 emission factor =	0.29	lb PM2.5/VMT
Soil Density =	1.05	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Loader Bucket Capacity =	5	yd3 (966F loader, Caterpillar Performance Handbook, 10/97)
=	5.25	ton/load
Daily Soil Transfer Rate =	735	ton/day (operating 7 hrs/day)
Daily Loader Trips =	140	loading trips/day
Loading Travel Distance =	50	ft/load (estimated)
Daily Loader Travel Distance =	7,000	ft/day
=	1.3	mi/day

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

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

d = drop height =	3	ft (estimated)
M = moisture content =	15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1, moist soil)
E = PM10 emission factor =	0.0015	PM10 lb/ton
E = PM2.5 emission factor =	0.0001	PM2.5 lb/ton
Backhoe Excavating Rate =	120.0	yd3/hr (based on 1 yd3 bucket on a 416C backhoe and a 30 sec.

Cycle time)

=	840	yd3/day for 1 backhoe @ 7 hrs/day of operation
Soil Density =	1.0500	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Daily Soil Transfer Rate =	882.0000	ton/day (estimated)

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

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

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = silt fraction =	8.50	(AP-42, Table 13.2.2-1, 12/03, construction haul route)
W = water truck avg. veh. weight =	10.0	tons empty (estimated)
=	39.4	tons loaded (estimated with 8,000 gallon water capacity)
=	24.7	tons average
W = dump truck avg. veh. weight =	15.0	tons (for heavy duty Diesel trucks)
=	40.0	tons (for heavy duty Diesel trucks)
=	27.5	tons (for heavy duty Diesel trucks)
W = forklift avg. veh. weight =	8.0	tons empty (estimated)

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

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

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

W = auto/pickup avg. vehicle weight =	2.4	tons (CARB Area Source Manual, 9/97)
W = delivery truck avg. veh. wt. =	27.5	tons (for heavy duty Diesel trucks)
W = 3 ton truck avg. veh. Wt =	5.4	tons (estimate)
W = scraper avg. veh. wt. =	28.2	tons empty (615 scraper, Caterpillar Performance Handbook, 10/89)
	48.6	tons loaded (615 scraper, Caterpillar Performance Handbook, 10/89)
	38.4	tons mean weight
W = fuel truck avg. veh. weight =	8.0	tons empty (estimated)
=	18.2	tons loaded (estimated with 3,000 gallons Diesel fuel capacity)
=	13.1	tons average

W = auto/pickup avg. vehicle weight =	2.4	tons (CARB Area Source Manual, 9/97)
W = delivery truck avg. veh. wt. =	27.5	tons (for heavy duty Diesel trucks)

E = water truck emission factor =	2.84	lb PM10/VMT
E = dump truck emission factor =	2.98	lb PM10/VMT
E = forklift emiss. factor =	1.71	lb PM10/VMT
E = auto/pickup emiss. factor =	0.99	lb PM10/VMT
E = delivery truck emiss. factor =	2.98	lb PM10/VMT
E = 3-ton truck emiss. factor =	1.43	lb PM10/VMT
E = scraper emiss. factor =	3.46	lb PM10/VMT
E = fuel truck emiss. factor =	2.13	lb PM10/VMT
E = water truck emission factor =	0.44	lb PM2.5/VMT
E = dump truck emission factor =	0.46	lb PM2.5/VMT
E = forklift emiss. factor =	0.26	lb PM2.5/VMT
E = auto/pickup emiss. factor =	0.15	lb PM2.5/VMT
E = delivery truck emiss. factor =	0.46	lb PM2.5/VMT

E = auto/pickup emiss. factor =	0.77	lb PM10/VMT
E = delivery truck emiss. factor =	2.31	lb PM10/VMT
E = auto/pickup emiss. factor =	0.12	lb PM2.5/VMT
E = delivery truck emiss. factor =	0.35	lb PM2.5/VMT

E = 3-ton truck emiss. factor =	0.22	lb PM2.5/VMT
E = scraper emiss. factor =	0.53	lb PM2.5/VMT
E = fuel truck emiss. factor =	0.33	lb PM2.5/VMT

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

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

p = potential average hourly daytime		
evaporation rate =	0.39	mm/hr (EPA document, Figure 3-2, summer)
evaporation rate =	0.294	mm/hr (EPA document, Figure 3-2, annual)
d = average hourly daytime traffic rate =	37.0	vehicles/hr (estimated)
t = time between watering applications =	1.00	hr/application (estimated)
i = application intensity =	1.4	L/m2 (typical level in EPA document, page 3-23)
C = average summer watering control efficiency =	91.5%	
C = average annual watering control efficiency =	93.6%	

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

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

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

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

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

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

Scraper Travel

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

Daily Scraper Hauling Distance =	0.08	miles/load (estimated)
Daily Scraper Travel =	11.36	miles/day

Excavator - pipeline construction

Excavating Rate =	90.0	yd3/hr (based on 0.5 yd3 bucket on a Cat. 307 excavator backhoe and a 20 sec. cycle time)
	630	yd3/day for 1 excavator @ 7 hrs/day of operation
Soil Density =	1.05	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Daily Soil Transfer Rate =	662	ton/day (estimated)

Notes - Combustion Emissions

(1) For Construction Equipment

For Diesel construction equipment, emission factors based on equipment meeting EPA Tier I off-road Diesel standards and use of CARB ultra low-sulfur fuel.

For trucks, depending on size of truck, emissions factors based on EMFAC 2002 v.2.3 for heavy-heavy duty or medium duty Diesel trucks, fleet average for calendar year 2009.

(2) For Delivery Trucks

From EMFAC 2002 v.2.3, heavy-heavy duty Diesel trucks, fleet average for calendar year 2009, Fresno County.

(3) For Worker Travel

From EMFAC 2002 v.2.3, average of light duty automobiles and light duty trucks, fleet average for calendar year 2009.

	Emission Factors (1)				
	NOx	CO	VOC	SOx	PM10
Truck Hauling (lbs/vmt)	0.03746	0.01290	0.00316	0.00004	0.00152
Truck Hauling (lbs/1000 gals)	200.40208	68.99088	16.91674	0.19614	8.13965

Notes:
(1) From EMFAC 2007 V.2.3, heavy-heavy duty Diesel trucks, fleet average for calendar year 2009, Fresno County.

	Emission Factors				
	NOx	CO	POC	SOx	PM10
Light Duty Trucks/Cars (lbs/vmt)(1)	0.00104	0.01071	0.00117	0.00001	0.00008
Light Duty Trucks (lbs/1000 gals)(2)	26.50670	241.01563	25.50223	0.16741	1.78571
Medium Duty Trucks (lbs/1000 gals)(3)	25.34	201.44	19.01	0.22	1.42

Notes:
(1) From EMFAC 2007 V.2.3, average of light duty automobiles and light duty trucks, fleet average for calendar year 2009.
(2) From EMFAC 2007 V.2.3, light duty trucks (gasoline and Diesel), fleet average for calendar year 2009.
(3) From EMFAC EMFAC 2007 V.2.3, medium duty trucks (gasoline and Diesel), fleet average for calendar year 2009.

4.3C-4.4 Greenhouse Gases

Emission of greenhouse gases from combustion of fuel by construction equipment is estimated using procedures in the CARB AB-32 reporting regulation. CARB indicates that the emission factor for CA Low Sulfur Diesel is 9.96 kg CO2/gallon. The estimated fuel consumption by construction equipment, including drilling rigs, is 136,027 gallons. Therefore the estimated CO_2 emissions from construction equipment is 1,355 MT CO_2eq.

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APPENDIX 4.3D

EVALUATION OF BEST AVAILABLE CONTROL TECHNOLOGY

Under District regulations and federal PSD regulations, Best Available Control Technology (BACT) will be required for the natural gas storage facility (VOC); the process heaters (VOC, NOx) ; and the dehydrators (VOC and NOx). The emission rates determined to be BACT for this project are summarized below. The information considered in making these determinations is discussed in detail in the following sections.

- NOx emission limit of 9.0 ppmv @ 3% O_2 constitutes BACT for natural gas-fired heaters (i.e., process heaters and dehydrator reboilers). At a design exhaust NOx concentration of 9.0 ppmv at 3% O_2, the proposed project will comply with the BACT NOx emission limit.
- VOC minimization by good combustion control is BACT for all combustion devices.
- VOC BACT control for the thermal oxidizers is 98% destruction efficiency.
- VOC BACT control for fugitive leaks is a Leak Detection and Repair (LDAR) program with monthly inspections and a 10,000 ppm leak definition.

The SJVUAPCD defines BACT as the most stringent emission limitation or control technique that consist of at least one of the following:

- Has been achieved in practice for such emissions unit and class of source.
- Is contained in any SIP approved by the USEPA for such emissions unit category and class of source. A specific limitation or control technique shall not apply if the owner or operator of the proposed emissions unit demonstrates to the satisfaction of the Air Pollution Control Officer (APCO) that such limitation or control technique is not presently achievable.
- Is any other emission limitation or control technique, including process and equipment changes of basic and control equipment, found by the APCO to be technologically feasible for such class or category of sources or for a specific source, and cost-effective as determined by the APCO.

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

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

Natural Gas Storage Facility Fugitive Leaks: BACT for VOC

Achieved in practice: Clearinghouse Review

CARB clearinghouse:

No determinations.

BAAQMD BACT guidelines:

Leak definition of 500 ppm (compressors, valves) and 100 ppm (flanges).

SCAQMD BACT guidelines:

No determinations.

SJVAPCD BACT clearinghouse:

No determinations.

Regulations applicable to this source catergory:

Federal NSPS

Subpart KKK—Standards of Performance for Equipment Leaks of VOC From Onshore Natural Gas Processing Plants (constructed after January 20, 1984) is applicable to any processing site engaged in the extraction of natural gas liquids from field gas, fractionation of mixed natural gas liquids to natural gas products, or both. Because this is a storage facility for processed gas, the facility is not subject to Subpart KKK. However, the requirements of the rule can be used as a basis for a BACT determination. This standard requires monthly inspection of some components, and uses a leak definition of 10,000 ppm VOC.

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SJVUAPCD, and SCAQMD were reviewed to identify the VOC standards that govern existing natural gas processing facilities.

- The BAAQMD adopted Rule 8-18 (Equipment Leaks) to limit VOC emissions from these devices. The rule requires quarterly inspections, and defines a leak as 500 ppm VOC for most components (100 ppm for valves and flanges).
- The SJVUAPCD adopted Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities) to limit VOC emissions from these devices. The rule requires annual inspections, and defines a leak as 2000 ppm VOC.
- The SCAQMD adopted Rule 466 (Pumps and Compressors) to limit VOC emissions from these devices. The rule requires quarterly inspections, and defines a leak as 10,000 ppm VOC.
  Rule 466.1 (Valves and Flanges) limits VOC emissions from these fittings. The rule requires annual inspections, and defines a leak as 2000 ppm. The rule requires annual inspections, and defines a leak as 10,000 ppm.

Conclusions

BACT must be at least as stringent as the most stringent level achieved in practice, federal NSPS or NESHAPS, or district prohibitory rule.

The BAAQMD BACT determination has the most stringent leak definition (100 ppm VOC). Because natural gas is more than 95% non-VOC, the 100 ppm VOC leak definition is equivalent to a 2,000 ppm natural gas leak. The BACT determination does not specify an inspection frequency; however, the applicable District prohibitory rule requires quarterly inspections.

The federal NSPS standard requires monthly inspections, but defines a leak as 10,000 ppm.

The applicant proposes to conduct monthly inspections and to define a leak as 2,000 ppm. This exceeds the requirements of all relevant standards.

Process Heaters: BACT for VOC and NOx

Achieved in practice: Clearinghouse Review

CARB clearinghouse:

> 20 ppm NOx. The source is a 6.5 MMBH hot oil heater controlled by low-NOx burner with flue gas recirculation. Date of determination: 8/18/1999. SCAQMD.

BAAQMD BACT guidelines:

> 10 ppm NOx. The category is refinery process heaters < 50 MMBH. Emission level achievable using Low-NOx burners or SCR.

SCAQMD BACT guidelines:

> 12 ppm NOx. The source is a 16 MMBH hot oil heater controlled by Ultra Low-NOx burner with flue gas recirculation. Date of determination: 10/23/2001. SCAQMD.

SJVUAPCD BACT clearinghouse:

> 12 ppm NOx (.029 lb/mmbtu). The source is a non-refinery process heater < 20 MMBH. Date of determination: 1/24/2006. The District has determined that 9 ppm is technologically feasible, which means that a cost effectiveness demonstration is required to utilize the 12 ppm level.

Regulations applicable to this source category:

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SJVUAPCD, and SCAQMD were reviewed to identify the NOx and VOC standards that govern existing small process heaters.

- The SJVUAPCD adopted Rule 4306 (Boilers, Steam Generators, and Process Heaters – Phase 3) to limit NOx emissions from these devices. The Rule limits NOx emissions to 15 ppm when firing gaseous fuels.

Conclusions

The most stringent NOx limit applicable to heaters of this size is the 9 ppm determination by SJVUAPCD. Because the limit is not achieved in practice, it may be removed from consideration as BACT by a showing that it is not cost effective. However, the applicant proposes to meet the 9 ppm standard. As a result, 9 ppm is accepted as BACT for this project.

BACT for VOC is not specified in any of the guidelines as a ppm limit. Instead, it is characterized as good combustion practices. The applicant proposes to meet a 25 ppm limit for this source.

Dehydrator Reboilers: BACT for VOC and NOx

Achieved in practice: Clearinghouse Review

CARB clearinghouse:

> 20 ppm NOx. The source is a 6.5 MMBH hot oil heater controlled by low-NOx burner with flue gas recirculation. Date of determination: 8/18/1999. SCAQMD.

BAAQMD BACT guidelines:

> 10 ppm NOx. The category is refinery process heaters < 50 MMBH. Emission level is achievable using Low-NOx burners or SCR.

SCAQMD BACT guidelines:

> 12 ppm NOx. The source is a 16 MMBH hot oil heater controlled by Ultra Low-NOx burner with flue gas recirculation. Date of determination: 10/23/2001. SCAQMD.

SJVUAPCD BACT clearinghouse:

> 12 ppm NOx. The source is a non-refinery process heater < 20 MMBH. Date of determination: 1/24/2006.

> 30 ppm NOx. The source is a glycol reboiler. Date of determination: 7/4/1996.

Regulations applicable to this source category:

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SJVUAPCD, and SCAQMD were reviewed to identify the NOx and VOC standards that govern existing small process heaters.

- The SJVUAPCD adopted Rule 4307 (Boilers, Steam Generators, and Process Heaters – 2.0 MMBtu/hr to 5.0 MMBtu/hr) to limit NOx emissions from these devices. The Rule limits NOx emissions to 30 ppm when firing gaseous fuels.

Conclusions

The most stringent NOx limit applicable to heaters of this size is the 10 ppm determination by BAAQMD. This is therefore BACT for this application. The applicant proposes to meet 9 ppm.

BACT for VOC is not specified in any of the guidelines as a ppm limit. Instead, it is characterized as good combustion practices. The applicant proposes to meet a 30 ppm limit for this sourc.

Dehydrator Thermal Oxidizers: BACT for VOC and NOx

Achieved in practice: Clearinghouse Review

CARB clearinghouse:

No determinations.

BAAQMD BACT guidelines:

No determinations.

SCAQMD BACT guidelines:

No determinations.

SJVUAPCD BACT clearinghouse:

95% VOC abatement efficiency. The source is a glycol reboiler still column combustor. Date of determination: 7/4/1996.

Regulations applicable to this source category:

Federal NESHAPS

The NESHAPS standard applicable to TEG Dehydrators located at facilities that are major for toxics is located at Title 40 CFR Part 63 Subpart HH. As discussed in Section 4.3.4.2.2 of the application, this regulation is not applicable to the Project. However, emission limits contained in the regulation may be applied to a new source as BACT.

The NESHAPS requires 95% control efficiency.

District Prohibitory Rules

Published prohibitory rules from the BAAQMD, SJVUAPCD, and SCAQMD were reviewed to identify the NOx and VOC standards that govern existing small process heaters.

- The SJVUAPCD adopted Rule 4408 (Glycol Dehydration Systems) to limit VOC emissions from these devices. The Rule requires 95% control efficiency.

Conclusions

Both the relevant federal control requirement and the published SJVAPCD BACT guideline for this source require 95% control. This level is therefore BACT. The applicant proposes to meet a 98% control level.

Summary

The criteria that constitute BACT for the sources subject to BACT are summarized in Table 4.3D-4 and compared against the design criteria for the proposed combustion gas turbine.

Table 4.3D-1
Summary of Emission Limits and BACT Requirements

Equipment	Pollutant	BACT	Proposed Control Level
Natural Gas Storage Facility	VOC	LDAR program with monthly inspections & 10,000 ppm action lvl	LDAR program with monthly inspections & 2,000 ppm action lvl
Process Heaters	NOx	9 ppmv @ 3% O_2	Design Exhaust Concentration = 9 ppmv @ 3% O_2
Process Heaters	VOC	Good combustion control	Design Exhaust Concentration = 25 ppmv @ 3% O_2
Dehydrator Reboiler	NOx	10 ppmv @ 3% O_2	Design Exhaust Concentration = 9 ppmv @ 3% O_2
Dehydrator Reboiler	VOC	Good combustion control	Design Exhaust Concentration = 30 ppmv @ 3% O_2
Dehydrator Thermal Oxidizer	NOx	No determinations	Design Exhaust Concentration = 9 ppmv @ 3% O_2
Dehydrator Thermal Oxidizer	VOC	95% destruction efficiency	Design destruction efficiency =98%