Appendix D

Technical Air Quality Appendix

Table D-1
EMT Facilities Current and Project Emisisons Summary

Facility	NOx	ROC	CO	SO_2	PM
Current	**Tons/yr**	**Tons/yr**	**Tons/yr**	**Tons/yr**	**Tons/yr**
EMT	5.00	1.19	0.56	0.06	0.30
Barge	1.56	1.93	0.37	0.03	0.12
TOTAL	**6.56**	**3.12**	**0.94**	**0.09**	**0.41**
Project					
EMT	19.13	3.11	2.15	0.24	1.14
Barge	5.97	7.60	1.43	0.10	0.44
TOTAL	**25.10**	**10.72**	**3.58**	**0.34**	**1.58**
Increase w/ Project					
EMT	14.13	1.92	1.59	0.18	0.84
Barge	4.41	5.68	1.06	0.08	0.33
TOTAL	**18.54**	**7.60**	**2.65**	**0.25**	**1.17**
Threshold	15.00	15.00	na	na	15.00
Significant?	**YES**	**NO**			**NO**

Notes

EMT inlcudes the following emission sources:
(1) Oil storage tanks,
(2) tug and assis vessels' engines
(3) fugitive emission sources such as valves, pump seals connectors
(4) emergency response vessel engine

Barge Jovalan includes the following emission sources:
(1) Vapor Recovery System engines
(2) Fugitive emission sources such as valves
(3) Sump

Assumptions

(1) Worst Case Project fugitive emissions are 24/7 per year for pump seals, valves and connections this is because most of the time piping pipeline pumps and connectors are field with oil.

(2) Project fuel use by tug, assist and ER boats would increase proportionately to the number of loadings from 23 per year to 88 per year

(3) Project fuel use by the barge VRU would increase proportionately to the number of loadings from 23 in 2003 to 88 per year for the worst case

(4) Currently the tug and assist boats shut down the engines and do not produce emissions during most of the loading. It is assumed that this will continue in the future.

(5) Hourly and Daily emissions do not change with the project

Table D-2
Estimated and Reported Fuel Use and Barge Trips

Emissions Source	Reported Annual Fuel Use			Estimate
	2003	2002	2001	Project
	Gallons per year			
EMT				
Tug - Main Engine	12,130	7,054	12,800	46,410
Tug - Generator engine	3,060	1,575	2,450	11,708
Tug - Bow thruster or Aux.	560	214	447	2,143
Assist - Main Engine	1,630	1,445	1,270	6,237
Assist - Generator Engine	-	-	-	-
ER Boat - Main Engine	210	382	-	803
Barge Jovalan				
Detroit Diesel 6V-71T	4,170	4,200	4,434	15,955
Exempt Detroit Diesel	2,650	2,700	2,556	10,139
Cummins Pump prime mover	400	400	317	1,530
TOTAL Fuel Use	**24,810**	**17,970**	**24,274**	**94,925**

Destination	Barge Trips, Reported			Estimate
Trips to Long Beach area	23	22	15	88
Trips to Shores Terminal	0	2	8	0
TOTAL trips	**23**	**24**	**23**	**88**

Table D-3
Oil Throughput through the Project Tanks
Data from the APCD and Projected

				Estimate
	2003	2002	2001	Project
	Gallons per year			
Tank 8264	22,343,000	27,638,000	25,585,000	99,645,000
Tank 8265	28,142,000	28,142,000	25,585,000	99,645,000
TOTAL	50,485,000	55,780,000	51,170,000	199,290,000
TOTAL, bbls	1,202,024	1,328,095	1,218,333	4,745,000

Assumptions:

(1) The fuel use is proportionate to the number of trips

(2) The reported fuel use within the County is higher when oil is transported to the Port of Long Beach (POLB). It is assumed therefore that all trips in the future would be done to POLB

(3) Daily fuel use or emissions do not change with the Project

(4) Project daily crude oil throughput would be 13,000 bbls per day

Table D-4
EQUIPMENT EMISSION FACTORS, from PTOs Nos. 8232-R5 and 8233-R5

Equipment Category	Description	NOx	ROC	CO	SOx	PM10	Units
			EMT				
Tug Boat	Main Engines	558.00	32.80	41.40	7.05	31.68	lb/1000 gal
	Generator Engines	617.40	42.00	133.00	7.05	42.00	lb/1000 gal
	Auxiliary Engines	617.40	42.00	133.00	7.05	42.00	lb/1000 gal
Assist Boat	Main Engines	582.00	16.80	78.30	7.05	31.68	lb/1000 gal
	Generator Engines	617.00	42.00	133.00	7.05	42.00	lb/1000 gal
ER Boat	Main Engine	220.46	22.05	58.50	7.05	31.68	lb/1000 gal
Tank	Crude Storage #8264	-	0.62	-	-	-	lb/1000 bbls loaded
Tank	Crude Storage #8265	-	0.62	-	-	-	lb/1000 bbls loaded
Sumps	Sump	-	0.0058	-	-	-	lb/ft2-day
	Connectors	-	0.0011	-	-	-	lb/clp-day
Fugitive	Pressure Relief Valves	-	0.1495	-	-	-	lb/clp-day
Components	Pump Seals	-	0.0022	-	-	-	lb/clp-day
	Valves	-	0.0023	-	-	-	lb/clp-day
			Barge Jovalan				
VRU IC Engines	Detroit Diesel (6V-71T)	335.9	see VRU	102.1	7.1	32.2	lb/1000 gal
	Cummins QSM11-P385*	215.2	14.34	124.8	7.05	28.68	lb/1000 gal
Exempt ->	Detroit Diesel (4V-71T)**	617.0	32.9	103.1	8.1	32.0	lb/1000 gal
	VRU Loading		0.0730				lb/1000 gal loaded
	Crude Loading Sump		0.0041	-	-	-	lb/ft2-hr
	Valves & Connections (Acc)		0.0009	-	-	-	lb ROC/lp-day
	Valves & Connections (Unsafe)		0.0044	-	-	-	lb ROC/lp-day

Notes to the Table

** The source for these E.F.s is PTO 8233-R5 p. 49, Section 10.1 (January 2004)*

*** The source for these E.F.s is the old PTO 8233 (August 2000)*

Table D-5
OPERATING EQUIPMENT DESCRIPTION, from PTOs Nos. 8232-R5 and 8233-R5

Equipment Category	Description	Fuel	%S	Size	Units	Cap.	Units
Tug Boat	Main Engines	D2	0.05	4500	bhp-total	0.055	gal/bhp-hr
	Generator Engines	D2	0.05	500	bhp-total	0.055	gal/bhp-hr
	Auxiliary Engines	D2	0.05	500	bhp-total	0.055	gal/bhp-hr
Assist Boat	Main Engines	D2	0.05	2504	bhp-total	0.053	gal/bhp-hr
	Generator Engines	D2	0.05	250	bhp-total	0.055	gal/bhp-hr
ER Boat	Main Engine	D2	0.05	315	bhp-total	0.055	gal/bhp-hr
Tank	Crude Storage #8264			65,000	barrels	500	bbls/hr
Tank	Crude Storage #8265			65,000	barrels	500	bbls/hr
	Sump			144	sq ft		
	Connectors			226	comp-leak-paths		
Fugitive	Pressure Relief Valves			6	comp-leak-paths		
Components	Pump Seals			24	comp-leak-paths		
	Valves			379	comp-leak-paths		
Barge	Detroit Diesel (6V-71T)	D#2	0.05	245	bhp-total	0.0551	gal/bhp-hr
	Cummins QSM11-P385	D#2	0.05	385	bhp-total	6454	Btu/hp-hr
Not used at EMT ->	Cummins QSM11-P385	D#2	0.05	385	bhp-total	6454	Btu/hp-hr
Exempt ->	Detroit Diesel (4V-71T)*	F.1.e	0.05	89	bhp-total	0.0551	gal/bhp-hr
	VRU: Crude Loading			56,000	barrels		
	Crude Load-Line Sump			32	ft2		
	Valves and Connections (Acc.&Inacc)			374	comp-leak-paths		
	Valves and Connections (Unsafe)			0	comp-leak-paths		

Table D-6 Current And Project Annual Emissions

Annual Emissions		Current Emissions, tons/yr					Project Estimated Emissions, tons/yr				
Equipment Category	**Description**	**NOx**	**ROC**	**CO**	**SOx**	**PM_{10}**	**NOx**	**ROC**	**CO**	**SOx**	**PM_{10}**
Ellwood Marine Terminal											
Tug Boat	Main Engines	3.3843	0.1989	0.2511	0.0428	0.1921	12.9485	0.7611	0.9607	0.1636	0.7351
	Generator Engines	0.9446	0.0643	0.2035	0.0108	0.0643	3.6142	0.2459	0.7786	0.0413	0.2459
	Auxiliary Engines	0.1729	0.0118	0.0372	0.0020	0.0118	0.6614	0.0450	0.1425	0.0076	0.0450
Assist Boat	Main Engines	0.4743	0.0137	0.0638	0.0057	0.0258	1.8148	0.0524	0.2442	0.0220	0.0988
	Generator Engines	-	-	-	-	-	-	-	-	-	-
ER Boat	Main Engine	0.0231	0.0023	0.0061	0.0007	0.0033	0.0886	0.0089	0.0235	0.0028	0.0127
Tank	Crude Storage #8264	-	0.1649	-	-	-	-	0.7355	-	-	-
Tank	Crude Storage #8265	-	0.2077	-	-	-	-	0.7355	-	-	-
Sumps	Sump	-	0.1524	-	-	-	-	0.1524	-	-	-
Fugitive Compnts	Connectors	-	0.0454	-	-	-	-	0.0454	-	-	-
	Pressure Relief Valves	-	0.1637	-	-	-	-	0.1637	-	-	-
	Pump Seals	-	0.0096	-	-	-	-	0.0096	-	-	-
	Valves	-	0.1591	-	-	-	-	0.1591	-	-	-
	TOTAL EMT	**4.9992**	**1.1938**	**0.5618**	**0.0620**	**0.2973**	**19.1275**	**3.1144**	**2.1494**	**0.2372**	**1.1375**
Barge Jovalan											
VRU IC Engines	Detroit Diesel (6V-71T)	0.7003	-	0.2128	0.0148	0.0671	2.6793	-	0.8142	0.0566	0.2569
	Cummins QSM11-P385	0.0430	0.0029	0.0250	0.0014	0.0057	0.1647	0.0110	0.0955	0.0054	0.0219
Not used at EMT->	Cummins QSM11-P385										
Exempt ->	Detroit Diesel (4V-71T)*	0.8175	0.0436	0.1366	0.0107	0.0424	3.1279	0.1668	0.5227	0.0411	0.1622
Fugitives	VRU Loading	-	1.8427	-	-	-	-	7.2741	-	-	-
	Crude Loading Sump	-	0.0362	-	-	-	-	0.1385	-	-	-
	Valves & Connections (Acc)	-	0.0038	-	-	-	-	0.0145	-	-	-
	Valves & Connections (Unsafe)	-	0.0000	-	-	-	-	0.0000	-	-	-
	TOTAL Barge	**1.5608**	**1.9292**	**0.3744**	**0.0269**	**0.1153**	**5.9719**	**7.6049**	**1.4323**	**0.1031**	**0.4410**
	TOTAL EMT+Barge	**6.5601**	**3.1230**	**0.9361**	**0.0890**	**0.4126**	**25.0994**	**10.7193**	**3.5818**	**0.3403**	**1.5786**

Peak Day Emissions		Current Emissions, lbs/day					Project Estimated Emissions, lbs/day				
Equipment Category	**Description**	**NOx**	**ROC**	**CO**	**SOx**	**PM_{10}**	**NOx**	**ROC**	**CO**	**SOx**	**PM_{10}**
Ellwood Marine Terminal											
Tug Boat	Main Engines	294.28	17.30	21.83	3.72	16.71	294.28	17.30	21.83	3.72	16.71
	Generator Engines	82.14	5.59	17.69	0.94	5.59	82.14	5.59	17.69	0.94	5.59
	Auxiliary Engines	15.03	1.02	3.24	0.17	1.02	15.03	1.02	3.24	0.17	1.02
Assist Boat	Main Engines	41.25	1.19	5.55	0.50	2.25	41.25	1.19	5.55	0.50	2.25
	Generator Engines	-	-	-	-	-	-	-	-	-	-
ER Boat	Main Engine	2.01	0.20	0.53	0.06	0.29	2.01	0.20	0.53	0.06	0.29
Tank	Crude Storage #8264	-	0.90	-	-	-	-	4.03	-	-	-
Tank	Crude Storage #8265	-	1.14	-	-	-	-	4.03	-	-	-
Sumps	Sump	-	0.84	-	-	-	-	0.84	-	-	-
Fugitive Compnts	Connectors	-	0.25	-	-	-	-	0.25	-	-	-
	Pressure Relief Valves	-	0.90	-	-	-	-	0.90	-	-	-
	Pump Seals	-	0.05	-	-	-	-	0.05	-	-	-
	Valves	-	0.87	-	-	-	-	0.87	-	-	-
	TOTAL EMT	**434.72**	**30.25**	**48.85**	**5.39**	**25.85**	**434.72**	**36.27**	**48.85**	**5.39**	**25.85**
Barge Jovalan											
VRU IC Engines	Detroit Diesel (6V-71T)	60.89	-	18.50	1.29	5.84	60.89	-	18.50	1.29	5.84
	Cummins QSM11-P385	3.74	0.25	2.17	0.12	0.50	3.74	0.25	2.17	0.12	0.50
Not used at EMT->	Cummins QSM11-P385										
Exempt ->	Detroit Diesel (4V-71T)*	71.09	3.79	11.88	0.93	3.69	71.09	3.79	11.88	0.93	3.69
Fugitives	VRU Loading	-	160.24	-	-	-	-	165.32	-	-	-
	Crude Loading Sump	-	3.15	-	-	-	-	3.15	-	-	-
	Valves & Connections (Acc)	-	0.33	-	-	-	-	0.33	-	-	-
	Valves & Connections (Unsafe)	-	0.00	-	-	-	-	0.00	-	-	-
	TOTAL Barge	**135.72**	**167.75**	**32.55**	**2.34**	**10.02**	**135.72**	**172.84**	**32.55**	**2.34**	**10.02**
	TOTAL EMT+Barge	**570.44**	**198.00**	**81.40**	**7.73**	**35.88**	**570.44**	**209.10**	**81.40**	**7.73**	**35.88**

Truck Transporation Alternative - Trucking Oil to Venoco Carpinteria Facility

Table D-7 Summary of Emissions from Trucks

	Daily Emissions					Annual Emissions				
Emissions Source	**NO_x lbs/day**	**ROC lbs/day**	**CO lbs/day**	**SO_x lbs/day**	**PM_{10} lbs/day**	**NO_x tons/yr**	**ROC tons/yr**	**CO tons/yr**	**SO_x tons/yr**	**PM_{10} tons/yr**
Emissions from Alternative	126.74	29.05	134.36	0.58	9.27	23.13	5.30	24.52	0.11	1.69
Current Emissions	570.44	198.00	81.40	7.73	35.88	6.56	3.12	0.94	0.09	0.41
Increase (decrease) w/ Alternative	-443.70	-168.95	52.96	-7.16	-26.61	16.57	2.18	23.59	0.02	1.28
Threshold	80.00	80.00	na	na	80.00	15.00	15.00	na	na	15.00
Exceeds Threshold?	**No**	**No**	—	—	**No**	**Yes**	**No**	—	—	**No**
Emissions from motor vehicles Threshold	25.00	25.00	na	na	na	na	na	na	na	na
Exceeds Motor Vehicles Threshold?	**Yes**	**Yes**	—	—	—	—	—	—	—	—

Assumptions

Each oil transportatin truck has a limit of	160	bbls/load (truck load capacity)	At 160 bbls/truck load, there will be	81	trucks per day
Worst Case daily oil transportation need	13,000	bpd (permitted daily throughput)	OR	163	one-way trips
Worst Case daily oil transportation need	546,000	gal/day (permitted throughput)			

Table D-8 Emissions from Trucks Calculation Details

Parameters for transportation by 160 bbls/load trucks									Peak Day Emissions, lbs/day					Annual Emissions, Tons				
Engine Type	**Emission Factor Code**	**Include in Peak Day? 1-yes, 0-no**	**Number of Vehicles per Day**	**Daily Trips (one way)**	**No. of days per year**	**Distance One Way (miles)**	**Speed (mph)**	**Time of Trip (min)**	**CO**	**ROC**	**NOx**	**SO_2**	**PM_{10}**	**CO**	**ROC**	**NOx**	**SO_2**	**PM_{10}**
Diesel	102	1	81	163	365	27	50	32	134.4	29.1	126.7	0.6	9.3	24.52	5.30	23.13	0.11	1.69

Table D-9 Disel Trucks Emission Factors

NOx		CO		ROC					SO_2	PM_{10}
Exhaust Emission Factor (g/mile)	Continuous Start EF (g/trip)	Exhaust Emission Factor (g/mile)	Continuous Start EF (g/trip)	Exhaust Emission Factor (g/mile)	Continuous Start EF (g/trip)	Hot Soak Factor (g/trip)	Diurnal (g/vehicle-day)	Evap Running Losses, (g/mile)	Emission Factor (g/mile)	Emission Factor* (g/mile)
13.13	0.00	13.92	0.00	3.01	0.00	0.00	0.00	0.00	0.06	0.96

Pipeline Transportation Alternative

Table D-10 Pipeline Construction - Emissions Summary

	Peak Daily Emission (lbs/day)					Total (Yearly) Emissions (tons)				
	CO	ROC	NO_x	SO_2	PM_{10}	CO	ROC	NO_x	SO_2	PM_{10}
Onsite Machinery	248.28	17.51	180.18	18.52	13.81	11.79	0.83	8.56	0.88	0.66
Offsite	25.13	5.91	11.22	0.15	0.75	1.19	0.28	0.53	0.01	0.04
Fugitive Dust					21.08					1.00
Total*	***273.40***	***23.42***	***191.40***	***18.67***	***35.65***	***12.99***	***1.11***	***9.09***	***0.89***	***1.69***

The APCD does not have a significance threshold for consturction emissions

Table D-11 Pipeline Construction - Onsite Construction Equipment Emissions

Construction Equipment	Peak Day No.	Daily Usage	Daily Hours	Dura-tion, days	Emission Factors (lb/hr)					Hourly Emissions (lbs/hr)					Peak Daily Emission (lbs/day)					Total (Yearly) Emissions (tons)				
					CO	ROC	NO_x	SO_2	PM_{10}	CO	ROC	NO_x	SO_2	PM_{10}	CO	ROC	NO_x	SO_2	PM_{10}	CO	ROC	NO_x	SO_2	PM_{10}
Backhoe	2	0.8	8	95	0.35	0.12	1.26	0.14	0.11	0.69	0.24	2.52	0.27	0.22	4.43	1.55	16.13	1.75	1.43	0.21	0.07	0.77	0.08	0.07
Bending Machine	1	0.2	8	95	0.24	0.04	0.40	0.04	0.02	0.24	0.04	0.40	0.04	0.02	0.39	0.07	0.63	0.07	0.04	0.02	0.00	0.03	0.00	0.00
Compressor	1	0.4	8	95	0.68	0.15	1.70	0.14	0.14	0.68	0.15	1.70	0.14	0.14	2.16	0.48	5.44	0.46	0.45	0.10	0.02	0.26	0.02	0.02
Excavator/Dozer	1	0.4	8	95	0.68	0.15	1.69	0.14	0.14	0.68	0.15	1.69	0.14	0.14	2.16	0.49	5.41	0.46	0.44	0.10	0.02	0.26	0.02	0.02
Dump truck	2	0.3	8	95	1.79	0.19	4.17	0.45	0.26	3.59	0.38	8.33	0.91	0.51	8.61	0.92	20.00	2.18	1.23	0.41	0.04	0.95	0.10	0.06
Grader	1	0.5	8	95	0.15	0.04	0.71	0.09	0.06	0.15	0.04	0.71	0.09	0.06	0.60	0.16	2.85	0.34	0.24	0.03	0.01	0.14	0.02	0.01
Hydro Crane	1	0.2	8	95	1.17	0.39	2.99	0.26	0.39	1.17	0.39	2.99	0.26	0.39	1.87	0.62	4.78	0.42	0.62	0.09	0.03	0.23	0.02	0.03
Hydrotest Pump Unit	1	0.4	8	10	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.04	0.01	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Pickup Truck	3	0.3	8	95	17.02	0.54	0.41	0.02	0.03	51.06	1.63	1.24	0.07	0.08	122.54	3.91	2.97	0.17	0.19	5.82	0.19	0.14	0.01	0.01
Side Boom Truck	2	0.5	8	95	1.17	0.39	2.99	0.26	0.39	2.34	0.78	5.98	0.52	0.78	9.36	3.12	23.92	2.08	3.12	0.44	0.15	1.14	0.10	0.15
Tractor/Trailer	1	0.4	8	95	1.80	0.19	4.17	0.45	0.26	1.80	0.19	4.17	0.45	0.26	5.76	0.61	13.34	1.44	0.83	0.27	0.03	0.63	0.07	0.04
Utility Tool Truck	2	0.2	8	95	17.02	0.54	0.41	0.02	0.03	34.04	1.09	0.82	0.05	0.05	54.46	1.74	1.32	0.07	0.08	2.59	0.08	0.06	0.00	0.00
Vacuum Truck	1	0.2	8	95	1.80	0.19	4.17	0.45	0.26	1.80	0.19	4.17	0.45	0.26	2.88	0.30	6.67	0.72	0.42	0.14	0.01	0.32	0.03	0.02
Water truck	1	0.3	8	95	1.79	0.19	4.17	0.45	0.26	1.79	0.19	4.17	0.45	0.26	4.31	0.46	10.00	1.09	0.61	0.20	0.02	0.47	0.05	0.03
Welding truck	4	0.5	8	95	1.79	0.19	4.17	0.45	0.26	7.18	0.77	16.66	1.82	1.02	28.70	3.07	66.66	7.26	4.10	1.36	0.15	3.17	0.35	0.19
Total										**107.21**	**6.24**	**55.57**	**5.67**	**4.20**	**248.28**	**17.51**	**180.18**	**18.52**	**13.81**	**11.79**	**0.83**	**8.56**	**0.88**	**0.66**

Pipeline Transportation Alternative (Continued)

Pipeline Construction - Fugitive Dust Emissions (PM_{10})

Table D-12 Emission factors for travel on unpaved roads are based on the following inputs

Inputs		Assumptions	Data Sources
Surface silt loading in percent	28		*Site debris clearing based on CEQA SCAQMD Tables 9-9 & 9-9-f*
Dust reduction due to watering,%	38		
Mean vehicle speed in mph	15		*Graded surface based on SCAQMD Table 9-9*
Mean vehicle weight in tons	3		
Mean number of wheels/vehicle	4		
Mean number of rain days/year	40		
Soil density, tons/yd^3	1.01		
Silt content of soil	7	Overburden	
PM_{10} grading emission factor	50	PM_{10} lbs/acre-day	*SLOC APCD CEQA Handbook*
		Cut and fill piles would be a third of all graded/disturbed area	

Assumptions		
Average number of vehicles per day	10	assumed
Travel distance (each vehicle) on site	500	feet, assumed
Site disturbed area, acres/year	55	9 miles x 50 feet wide
Total days of excavation/year	95	9 miles @ 500 feet/day
Total fill excavated/delivered, yd^3/yr	21,120	trench: 9 miles x 2ft wide x 6ft deep

Table D-13 Particulate Emissions - Calculation Details

Construction Activity	Source	Source Units	Number of Days per year	Emission Factor	Emission Factor Units	Mitigation Reduction %	Peak Day Emissions, lbs/day	Quarterly Emissions, tons	Total PM_{10} Emissions, tons
Site grading/Disturbed Area	0.57	acres/day	95	26.4	lbs/acre-day	38	9.39	0.11	0.446
Fill dumping	21,384	tons of soil	95	0.009075	lbs/ton	38	1.27	0.02	0.060
Travel on dirt roads - estimate	0.95	vehicle-miles	95	2.18	lbs/vehicle-miles	38	0.01	0.00	0.001
Fill Storage Piles - estimate	0.57	acres	95	29.26	lbs/day/acre	38	10.41	0.12	0.495
Total							**21.08**	**0.25**	**1.00**

Note: Some segments are bored under roadways and there would be less soil handling and less emissions

Pipeline Transportation Alternative (Continued)

Table D-14 Pipeline Construction - Offsite Mobile Emissions

	Trip Parameters								Peak Day Emissions, lbs/day					Annual Emissions, Tons				
Source	**Vehicle Type**	**Include in Peak Day? 1-yes, 0-no**	**No. per Day**	**Daily Trips (one way)**	**No. of days per year**	**Distance One Way (miles)**	**Speed (mph)**	**Time of Trip (min)**	**CO**	**ROC**	**NOx**	**SO_2**	**PM_{10}**	**CO**	**ROC**	**NOx**	**SO_2**	**PM_{10}**
Workers Commuting	Gasoline	1	40	80	95	10	35	17	14.71	3.66	1.40	0.11	0.04	0.699	0.174	0.066	0.005	0.002
Truck Travel	Diesel	1	11	22	95	10	35	17	6.74	1.46	6.35	0.03	0.46	0.320	0.069	0.302	0.001	0.022
Construction Equipment Delivery	Diesel	0	2	4	5	20	35	34	2.45	0.53	2.31	0.01	0.17	0.006	0.001	0.006	0.000	0.000
Construction Equipment Removal	Diesel	0	2	4	5	20	35	34	2.45	0.53	2.31	0.01	0.17	0.006	0.001	0.006	0.000	0.000
Construction Materials Delivery	Diesel	1	3	6	95	20	35	34	3.67	0.79	3.47	0.02	0.25	0.175	0.038	0.165	0.001	0.012
Total									***25.1***	***5.9***	***11.2***	***0.2***	***0.8***	***1.2***	***0.3***	***0.5***	***0.0***	***0.0***

Emissions calculations based on EMFAC7G. See Emission Factors spreadsheet

Table D-15 Emission Factors

	NOx		CO		ROC					SO_2	PM_{10}
Vehicle Type	Exhaust Emission Factor (g/mile)	Continuous Start EF (g/trip)	Exhaust Emission Factor (g/mile)	Continuous Start EF (g/trip)	Exhaust Emission Factor (g/mile)	Continuous Start EF (g/trip)	Hot Soak Factor (g/trip)	Diurnal (g/vehicle-day)	Evap Running Losses, (g/mile)	Emission Factor (g/mile)	Emission Factor* (g/mile)
Gasoline	0.61	1.84	6.09	22.70	0.40	2.44	0.51	7.10	1.03	0.06	0.02
Diesel	13.13	0.00	13.92	0.00	3.01	0.00	0.00	0.00	0.00	0.06	0.96

Table D-16 Equipment Emission Factors Used for Estimating the Pipeline Construction Emissions

Equipment	Hp	Type	Load Factor, %	Emission Factors (lb/hr)					Reference
				CO	ROG	NO_x	SO_2	PM_{10}	
Air Compressor (400 ACFM)	150	Diesel	na	0.675	0.15	1.7	0.143	0.14	1) for misc. equip
Backhoe/Loader (510C)	86	Diesel	na	0.572	0.23	1.9	0.182	0.17	1) for wheeled loader
Broom				0.151	0.04	0.713	0.086	0.061	3)
Concrete Pump Truck (65 CY/hr)	90	Diesel	na	1.8	0.19	4.17	0.45	0.26	1) for off-highway truck
Compactor				0.675	0.152	1.691	0.143	0.139	3)
Crane (20 ton)	130	Diesel	100	1.17	0.39	2.99	0.26	0.39	2) for cranes
Dozer	95	Diesel	100	0.95	0.19	1.995	0.19	0.095	2) for rubber tired dozer
Drill Rig				0.675	0.152	1.691	0.143	0.139	3)
Dump Truck (16 CY)	250	Diesel	na	1.8	0.19	4.17	0.45	0.26	1) for off-highway truck
Excavator				0.675	0.152	1.691	0.143	0.139	3)
Fork Lift (7 ton)	100	Diesel	na	0.52	0.17	1.54	0.143	0.093	1) for 175 hp fork lift
Front End Loader (3 CY)	140	Diesel	na	0.572	0.23	1.9	0.182	0.17	1) for wheeled loader
Grader - SCAQMD	150	Diesel	na	1.25	0.27	3.84	0.46	0.41	1) for scraper
Hydro Crane (18 ton)	130	Diesel	100	1.17	0.39	2.99	0.26	0.39	2) for cranes
Hydro Crane (30 ton)	130	Diesel	100	1.17	0.39	2.99	0.26	0.39	2) for cranes
Jack and Boring Machine				0.675	0.152	1.691	0.143	0.139	3)
Loader				0.572	0.25	1.89	0.182	0.172	3)
Misc. Equipment	50	Diesel	na	0.675	0.15	1.7	0.143	0.14	1) for misc. equip
Motor Grader	-	Diesel	na	0.151	0.039	0.713	0.086	0.061	1) for motor grader
Motor/Generator				0.675	0.152	1.691	0.143	0.139	3)
Pick-up Truck (3/4 ton)	250	Gasoline	na	17.02	0.543	0.412	0.023	0.026	1) for misc. equip
Pumps	20	Diesel	na	0.011	0.002	0.018	0.002	0.002	2) for pumps
Shovel/Breaker	128	Diesel	na	0.675	0.15	1.7	0.143	0.14	1) for misc. equip
Tractor/Trailer (60 ton, 40 ft)	225	Diesel	na	1.8	0.19	4.17	0.45	0.26	1) for off-highway truck
Truck Crane (65 ton)	400	Diesel	na	1.8	0.19	4.17	0.45	0.26	1) for off-highway truck
Vibro Roller	42	Diesel	na	0.3	0.065	0.87	0.067	0.05	1) for rollers
Water Truck (4,000 gal)	200	Diesel	na	1.8	0.19	4.17	0.45	0.26	1) for off-highway truck
Welding Machine	50	Diesel	100	0.55	0.1	0.9	0.1	0.1	2) for welders
Generator sets <50HP	22	Diesel	100	0.242	0.044	0.396	0.044	0.022	1) for generator sets <50 HP

References

1) Emission factors taken from SCAQMD CEQA Air Quality Handbook, Table 9-8-A.

2) Emission factors taken from SCAQMD CEQA Air Quality Handbook, Table 9-8-C. Pounds/hour calculated from load factor and hp rating.

3) US EPA 1985.

Health Risk Assessment

Table D-17 Annual Emissions of Hazardous Air Pollutants - for Health Risk Assessment - Current (Baseline)

Current Annual HAPs Emissions, lbs/yr (fuel consumption and oil throughput values for 2003)

Emission Sources	Benzene	Cresols	H_2S	Phenol	Toluene	Xylene	Acet-alde-hyde	Acrolein	Arsenic	Beryl-lium	1,3-Butadi-ene	Cadmi-um	Chloro-benzene
EMT													
Tank 1	2.60E-01	6.53E-05	6.20E-01	2.39E-04	1.33E+00	9.76E-02	-	-	-	-	-	-	-
Tank 2	3.28E-01	8.23E-05	7.81E-01	3.01E-04	1.68E+00	1.23E-01	-	-	-	-	-	-	-
Valves	5.09E-01	1.28E-04	1.21E+00	4.67E-04	2.61E+00	1.91E-01	-	-	-	-	-	-	-
Connectors	7.16E-02	1.80E-05	1.71E-01	6.57E-05	3.67E-01	2.69E-02	-	-	-	-	-	-	-
Pump Seals	1.52E-02	3.82E-06	3.62E-02	1.40E-05	7.79E-02	5.70E-03	-	-	-	-	-	-	-
Sump	2.41E-01	6.04E-05	5.73E-01	2.21E-04	1.23E+00	9.02E-02	-	-	-	-	-	-	-
Tug Boat	2.93E+00	-	-	-	1.66E+00	6.68E-01	1.23E+01	5.34E-01	2.52E-02	2.52E-02	3.42E+00	2.36E-02	3.15E-03
Assist Boat	3.04E-01	-	-	-	1.72E-01	6.91E-02	1.28E+00	5.53E-02	2.61E-03	2.61E-03	3.54E-01	2.45E-03	3.26E-04
ER Boat	3.91E-02	-	-	-	2.21E-02	8.90E-03	1.64E-01	7.12E-03	3.36E-04	3.36E-04	4.57E-02	3.15E-04	4.20E-05
Barge Jovalan													
Compressor	7.77E-01	-	-	-	4.40E-01	1.77E-01	3.27E+00	1.41E-01	6.67E-03	6.67E-03	9.07E-01	6.26E-03	8.34E-04
Generator	4.94E-01	-	-	-	2.79E-01	1.12E-01	2.08E+00	8.98E-02	4.24E-03	4.24E-03	5.76E-01	3.98E-03	5.30E-04
Hydrualic	7.45E-02	-	-	-	4.22E-02	1.70E-02	3.13E-01	1.36E-02	6.40E-04	6.40E-04	8.70E-02	6.00E-04	8.00E-05
Valves	5.97E-03	1.50E-06	1.42E-02	5.48E-06	3.06E-02	2.24E-03	-	-	-	-	-	-	-
Sump	5.71E-02	1.43E-05	1.36E-01	5.24E-05	2.93E-01	2.14E-02	-	-	-	-	-	-	-
TOTAL	*6.11E+00*	*3.73E-04*	*3.55E+00*	*1.37E-03*	*1.02E+01*	*1.61E+00*	*1.94E+01*	*8.41E-01*	*3.97E-02*	*3.97E-02*	*5.39E+00*	*3.72E-02*	*4.96E-03*

Emission Sources	Chromi-um VI	Copper	Diesel Exhaust (PM)	Diesel Exhaust (HC)	Form-alde-hyde	Lead	Manga-nese	Mercury	Naph-thalene	Nickel	PAH (non-naphtha-lene)	Pro-pylene	Slenium	Zinc
EMT														
Tank 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tank 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Connectors	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pump Seals	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sump	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tug Boat	1.58E-03	6.46E-02	5.28E+02	5.91E+02	2.72E+01	1.31E-01	4.88E-02	3.15E-02	3.10E-01	6.14E-02	5.70E-01	7.36E+00	3.47E-02	3.53E-01
Assist Boat	1.63E-04	6.68E-03	5.46E+01	6.11E+01	2.81E+00	1.35E-02	5.05E-03	3.26E-03	3.21E-02	6.36E-03	5.90E-02	7.61E-01	3.59E-03	3.65E-02
ER Boat	2.10E-05	8.61E-04	7.04E+00	7.88E+00	3.62E-01	1.74E-03	6.51E-04	4.20E-04	4.14E-03	8.19E-04	7.60E-03	9.81E-02	4.62E-04	4.70E-03
Barge Jovalan														
Compressor	4.17E-04	1.71E-02	1.40E+02	1.56E+02	7.20E+00	3.46E-02	1.29E-02	8.34E-03	8.21E-02	1.63E-02	1.51E-01	1.95E+00	9.17E-03	9.34E-02
Generator	2.65E-04	1.09E-02	8.88E+01	9.94E+01	4.57E+00	2.20E-02	8.22E-03	5.30E-03	5.22E-02	1.03E-02	9.59E-02	1.24E+00	5.83E-03	5.94E-02
Hydrualic	4.00E-05	1.64E-03	1.34E+01	1.50E+01	6.90E-01	3.32E-03	1.24E-03	8.00E-04	7.88E-03	1.56E-03	1.45E-02	1.87E-01	8.80E-04	8.96E-03
Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sump	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	*2.48E-03*	*1.02E-01*	*8.31E+02*	*9.30E+02*	*4.28E+01*	*2.06E-01*	*7.69E-02*	*4.96E-02*	*4.89E-01*	*9.68E-02*	*8.98E-01*	*1.16E+01*	*5.46E-02*	*5.56E-01*

Health Risk Assessment

Table D-18 Peak Hour Emissions of Hazardous Air Pollutants - for Health Risk Assessment - Current (Baseline)

Current Peak Hour HAPs Emissions, lbs/hr (fuel consumption and oil throughput values for 2003)													
Emission Sources	**Benzene**	**Cresols**	**H_2S**	**Phenol**	**Toluene**	**Xylene**	**Acet-alde-hyde**	**Acrolein**	**Arsenic**	**Beryl-lium**	**1,3-Butadi-ene**	**Cadmi-um**	**Chloro-benzene**
EMT													
Tank 1	3.00E-05	7.53E-09	7.15E-05	2.75E-08	1.54E-04	1.13E-05	-	-	-	-	-	-	-
Tank 2	3.78E-05	9.49E-09	9.01E-05	3.47E-08	1.94E-04	1.42E-05	-	-	-	-	-	-	-
Valves	5.87E-05	1.47E-08	1.40E-04	5.39E-08	3.01E-04	2.20E-05	-	-	-	-	-	-	-
Connectors	8.26E-06	2.07E-09	1.97E-05	7.58E-09	4.23E-05	3.10E-06	-	-	-	-	-	-	-
Pump Seals	1.75E-06	4.40E-10	4.18E-06	1.61E-09	8.98E-06	6.58E-07	-	-	-	-	-	-	-
Sump	2.77E-05	6.96E-09	6.61E-05	2.55E-08	1.42E-04	1.04E-05	-	-	-	-	-	-	-
Tug Boat	6.38E-03	-	-	-	3.61E-03	1.45E-03	2.68E-02	1.16E-03	5.48E-05	5.48E-05	7.44E-03	5.14E-05	6.85E-06
Assist Boat	6.60E-04	-	-	-	3.73E-04	1.50E-04	2.78E-03	1.20E-04	5.67E-06	5.67E-06	7.70E-04	5.32E-06	7.09E-07
ER Boat	8.51E-04	-	-	-	4.81E-04	1.94E-04	3.58E-03	1.55E-04	7.30E-06	7.30E-06	9.92E-04	6.85E-06	9.13E-07
Barge Jovalan													
Compressor	1.69E-03	-	-	-	9.55E-04	3.84E-04	7.10E-03	3.07E-04	1.45E-05	1.45E-05	1.97E-03	1.36E-05	1.81E-06
Generator	1.07E-03	-	-	-	6.07E-04	2.44E-04	4.51E-03	1.95E-04	9.22E-06	9.22E-06	1.25E-03	8.64E-06	1.15E-06
Hydrualic	8.10E-04	-	-	-	4.58E-04	1.84E-04	3.41E-03	1.47E-04	6.96E-06	6.96E-06	9.45E-04	6.52E-06	8.70E-07
Valves	1.30E-05	3.26E-09	3.09E-05	1.19E-08	6.65E-05	4.87E-06	-	-	-	-	-	-	-
Sump	1.24E-04	3.12E-08	2.96E-04	1.14E-07	6.36E-04	4.66E-05	-	-	-	-	-	-	-
TOTAL	*1.18E-02*	*7.57E-08*	*7.18E-04*	*2.77E-07*	*8.03E-03*	*2.72E-03*	*4.82E-02*	*2.09E-03*	*9.84E-05*	*9.84E-05*	*1.34E-02*	*9.23E-05*	*1.23E-05*

Emission Sources	**Chromi-um VI**	**Copper**	**Diesel Exhaust (PM)**	**Diesel Exhaust (HC)**	**Form-alde-hyde**	**Lead**	**Manga-nese**	**Mercury**	**Naph-thalene**	**Nickel**	**PAH (non-naphtha-lene)**	**Pro-pylene**	**Slenium**	**Zinc**
EMT														
Tank 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tank 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Connectors	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pump Seals	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sump	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tug Boat	3.42E-06	1.40E-04	1.15E+00	1.28E+00	5.91E-02	2.84E-04	1.06E-04	6.85E-05	6.75E-04	1.34E-04	1.24E-03	1.60E-02	7.53E-05	7.67E-04
Assist Boat	3.54E-07	1.45E-05	1.19E-01	1.33E-01	6.12E-03	2.94E-05	1.10E-05	7.09E-06	6.98E-05	1.38E-05	1.28E-04	1.65E-03	7.80E-06	7.94E-05
ER Boat	4.57E-07	1.87E-05	1.53E-01	1.71E-01	7.88E-03	3.79E-05	1.42E-05	9.13E-06	8.99E-05	1.78E-05	1.65E-04	2.13E-03	1.00E-05	1.02E-04
Barge Jovalan														
Compressor	9.07E-07	3.72E-05	3.04E-01	3.40E-01	1.56E-02	7.52E-05	2.81E-05	1.81E-05	1.79E-04	3.54E-05	3.28E-04	4.23E-03	1.99E-05	2.03E-04
Generator	5.76E-07	2.36E-05	1.93E-01	2.16E-01	9.94E-03	4.78E-05	1.79E-05	1.15E-05	1.13E-04	2.25E-05	2.09E-04	2.69E-03	1.27E-05	1.29E-04
Hydrualic	4.35E-07	1.78E-05	1.46E-01	1.63E-01	7.50E-03	3.61E-05	1.35E-05	8.70E-06	8.57E-05	1.70E-05	1.57E-04	2.03E-03	9.57E-06	9.74E-05
Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sump	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	*6.15E-06*	*2.52E-04*	*2.06E+00*	*2.31E+00*	*1.06E-01*	*5.11E-04*	*1.91E-04*	*1.23E-04*	*1.21E-03*	*2.40E-04*	*2.23E-03*	*2.87E-02*	*1.35E-04*	*1.38E-03*

Health Risk Assessment (Continued)

Table D-19 Emissions of Hazardous Air Pollutants - for Health Risk Assessment - Proposed Project

Project Annual HAPs Emissions, lbs/yr (projected fuel consumption and oil throughput values for 88 barge trips/loadings)

Emission Sources	Benzene	Cresols	H_2S	Phenol	Toluene	Xylene	Acet-alde-hyde	Acrolein	Arsenic	Beryl-lium	1,3-Butadi-ene	Cadmi-um	Chloro-benzene
EMT													
Tank 1	1.16E+00	2.91E-04	2.77E+00	1.06E-03	5.94E+00	4.35E-01	-	-	-	-	-	-	-
Tank 2	1.16E+00	2.91E-04	2.77E+00	1.06E-03	5.94E+00	4.35E-01	-	-	-	-	-	-	-
Valves	5.09E-01	1.28E-04	1.21E+00	4.67E-04	2.61E+00	1.91E-01	-	-	-	-	-	-	-
Connectors	7.16E-02	1.80E-05	1.71E-01	6.57E-05	3.67E-01	2.69E-02	-	-	-	-	-	-	-
Pump Seals	1.52E-02	3.82E-06	3.62E-02	1.40E-05	7.79E-02	5.70E-03	-	-	-	-	-	-	-
Sump	2.41E-01	6.04E-05	5.73E-01	2.21E-04	1.23E+00	9.02E-02	-	-	-	-	-	-	-
Tug Boat	1.12E+01	-	-	-	6.35E+00	2.56E+00	4.72E+01	2.04E+00	9.64E-02	9.64E-02	1.31E+01	9.04E-02	1.21E-02
Assist Boat	1.16E+00	-	-	-	6.57E-01	2.64E-01	4.89E+00	2.11E-01	9.98E-03	9.98E-03	1.36E+00	9.35E-03	1.25E-03
ER Boat	1.50E-01	-	-	-	8.47E-02	3.41E-02	6.29E-01	2.72E-02	1.29E-03	1.29E-03	1.75E-01	1.21E-03	1.61E-04
Barge Jovalan													
Compressor	2.97E+00	-	-	-	1.68E+00	6.76E-01	1.25E+01	5.41E-01	2.55E-02	2.55E-02	3.47E+00	2.39E-02	3.19E-03
Generator	1.89E+00	-	-	-	1.07E+00	4.30E-01	7.94E+00	3.44E-01	1.62E-02	1.62E-02	2.20E+00	1.52E-02	2.03E-03
Hydrualic	2.85E-01	-	-	-	1.61E-01	6.49E-02	1.20E+00	5.19E-02	2.45E-03	2.45E-03	3.33E-01	2.30E-03	3.06E-04
Valves	2.29E-02	5.73E-06	5.44E-02	2.10E-05	1.17E-01	8.57E-03	-	-	-	-	-	-	-
Sump	2.19E-01	5.49E-05	5.21E-01	2.01E-04	1.12E+00	8.20E-02	-	-	-	-	-	-	-
TOTAL	*2.11E+01*	*8.53E-04*	*8.10E+00*	*3.12E-03*	*2.74E+01*	*5.30E+00*	*7.44E+01*	*3.22E+00*	*1.52E-01*	*1.52E-01*	*2.06E+01*	*1.42E-01*	*1.90E-02*

Emission Sources	Chromi-um VI	Copper	Diesel Exhaust (PM)	Diesel Exhaust (HC)	Form-alde-hyde	Lead	Manga-nese	Mercury	Naph-thalene	Nickel	PAH (non-naphtha-lene)	Pro-pylene	Slenium	Zinc
EMT														
Tank 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tank 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Connectors	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pump Seals	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sump	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tug Boat	6.03E-03	2.47E-01	2.02E+03	2.26E+03	1.04E+02	5.00E-01	1.87E-01	1.21E-01	1.19E+00	2.35E-01	2.18E+00	2.81E+01	1.33E-01	1.35E+00
Assist Boat	6.24E-04	2.56E-02	2.09E+02	2.34E+02	1.08E+01	5.18E-02	1.93E-02	1.25E-02	1.23E-01	2.43E-02	2.26E-01	2.91E+00	1.37E-02	1.40E-01
ER Boat	8.03E-05	3.29E-03	2.69E+01	3.01E+01	1.39E+00	6.67E-03	2.49E-03	1.61E-03	1.58E-02	3.13E-03	2.91E-02	3.75E-01	1.77E-03	1.80E-02
Barge Jovalan														
Compressor	1.60E-03	6.54E-02	5.34E+02	5.98E+02	2.75E+01	1.32E-01	4.95E-02	3.19E-02	3.14E-01	6.22E-02	5.78E-01	7.45E+00	3.51E-02	3.57E-01
Generator	1.01E-03	4.16E-02	3.40E+02	3.80E+02	1.75E+01	8.42E-02	3.14E-02	2.03E-02	2.00E-01	3.95E-02	3.67E-01	4.73E+00	2.23E-02	2.27E-01
Hydrualic	1.53E-04	6.27E-03	5.13E+01	5.74E+01	2.64E+00	1.27E-02	4.74E-03	3.06E-03	3.01E-02	5.97E-03	5.54E-02	7.15E-01	3.37E-03	3.43E-02
Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sump	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	*9.49E-03*	*3.89E-01*	*3.18E+03*	*3.56E+03*	*1.64E+02*	*7.88E-01*	*2.94E-01*	*1.90E-01*	*1.87E+00*	*3.70E-01*	*3.44E+00*	*4.43E+01*	*2.09E-01*	*2.13E+00*

Table D-20 EMISSION FACTORS (From the 1994 HRA, except for Cr (VI))

Tug boats, fuel burnt while at terminal only
Internal combustion - Diesel. E.F. are [lb/kgal of diesel combusted]

Emission Factors, lb/1000 gal	Acetaldehyde	Acrolein	Arsenic	Benzene	Berryllium	1,3-Butadiene	Cadmium	Chlorbenzene	Chromium VI	Copper	Diesel Exhaust (PM)	Diesel Exhaust (HC)
Tugs	0.7833	0.0339	0.0016	1.86E-01	1.60E-03	2.17E-01	1.50E-03	2.00E-04	1.00E-04	4.10E-03	3.35E+01	3.75E+01
Assist/ER	0.7833	0.0339	0.0016	1.86E-01	1.60E-03	2.17E-01	1.50E-03	2.00E-04	1.00E-04	4.10E-03	3.35E+01	3.75E+01
Barge Engines	0.7833	0.0339	0.0016	1.86E-01	1.60E-03	2.17E-01	1.50E-03	2.00E-04	1.00E-04	4.10E-03	3.35E+01	3.75E+01

Emission Factors, lb/1000 gal	Formaldehyde	Lead	Manganese	Mercury	Naphthalene	Nickel	PHA (non-naphthalene)	Propylene	Slenium	Toluene	Xylenes	Zinc
Tugs	1.73E+00	8.30E-03	3.10E-03	2.00E-03	1.97E-02	3.90E-03	3.62E-02	4.67E-01	2.20E-03	1.05E-01	4.24E-02	2.24E-02
Assist/ER	1.73E+00	8.30E-03	3.10E-03	2.00E-03	1.97E-02	3.90E-03	3.62E-02	4.67E-01	2.20E-03	1.05E-01	4.24E-02	2.24E-02
Barge Engines	1.73E+00	8.30E-03	3.10E-03	2.00E-03	1.97E-02	3.90E-03	3.62E-02	4.67E-01	2.20E-03	1.05E-01	4.24E-02	2.24E-02

Table D-21
EMISSION FACTORS - FUGITIVE EMISSIONS (Weight Fraction in Vapor)

Benzene	Cresols	H_2S	Phenol	Toluene	Xylene
Units - lb toxic compound per lb of ROC emission					
7.89E-04	1.98E-07	1.88E-03	7.24E-07	4.04E-03	2.96E-04
7.89E-04	1.98E-07	1.88E-03	7.24E-07	4.04E-03	2.96E-04

Source: 1991-1994 HRA, SCBAPCD

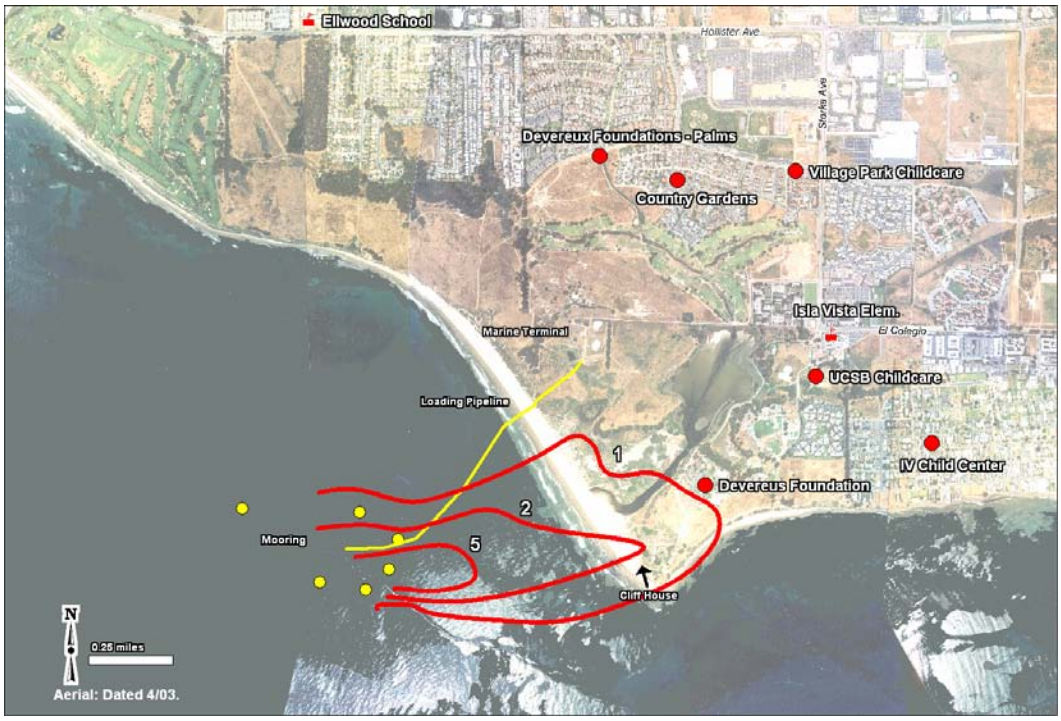
Health Risk Assessment (Continued)

Table D-22
Combustion Emission Factors for the HRA

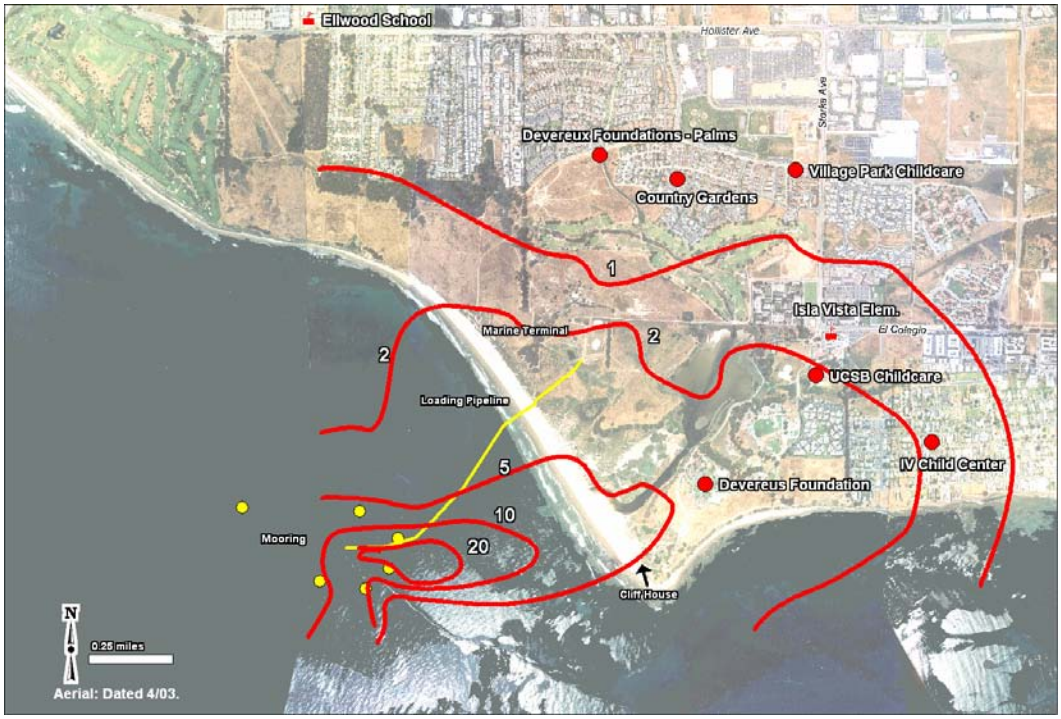
Pollutant	Lbs/1000 gallons of Diesel	
	external combustion	internal combustion
benzene	4.40E-03	1.86E-01
formaldehyde	3.51E-01	1.73E+00
PAH's (including naphthalene)	4.98E-02	5.59E-02
PAH's (non-naphthalene) *		3.62E-02
naphthalene	5.30E-03	1.97E-02
acetaldehyde	3.51E-01	7.83E-01
acrolein	3.51E-01	3.39E-02
1,3-butadiene	1.48E-02	2.17E-01
chlorobenzene	2.00E-04	2.00E-04
dioxins	ND	ND
furans	ND	ND
propylene	1.00E-02	4.67E-01
hexane	3.50E-03	2.69E-02
toluene	4.40E-03	1.05E-01
xylenes	1.60E-03	4.24E-02
ethyl benzene	2.00E-04	1.09E-02
hydrogen chloride	1.86E-01	1.86E-01
arsenic	1.60E-03	1.60E-03
beryllium *	ND	1.60E-03
cadmium	1.50E-03	1.50E-03
total chromium	6.00E-04	6.00E-04
hexavalent chromium **	1.00E-04	1.00E-04
copper	4.10E-03	4.10E-03
lead	8.30E-03	8.30E-03
manganese	3.10E-03	3.10E-03
mercury	2.00E-03	2.00E-03
nickel	3.90E-03	3.90E-03
selenium	2.20E-03	2.20E-03
zinc	2.24E-02	2.24E-02
Diesel exhaust (PM10) *	-	3.35E+01
Diesel exhaust (HC) *	-	3.75E+01

Source: http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf
ND - not detected
* Source: SBCAPCD. 1994. EMT Health Risk Assessment.
** SBCAPCD used 2.00E-04 as Emission Factor for Cr (VI), but here we used the latest factor of 1.00E-04 lb/1000 gal of diesel combusted.

Figure D-1
Cancer Risk Isopleths – Increased Cancer Cases Per Million

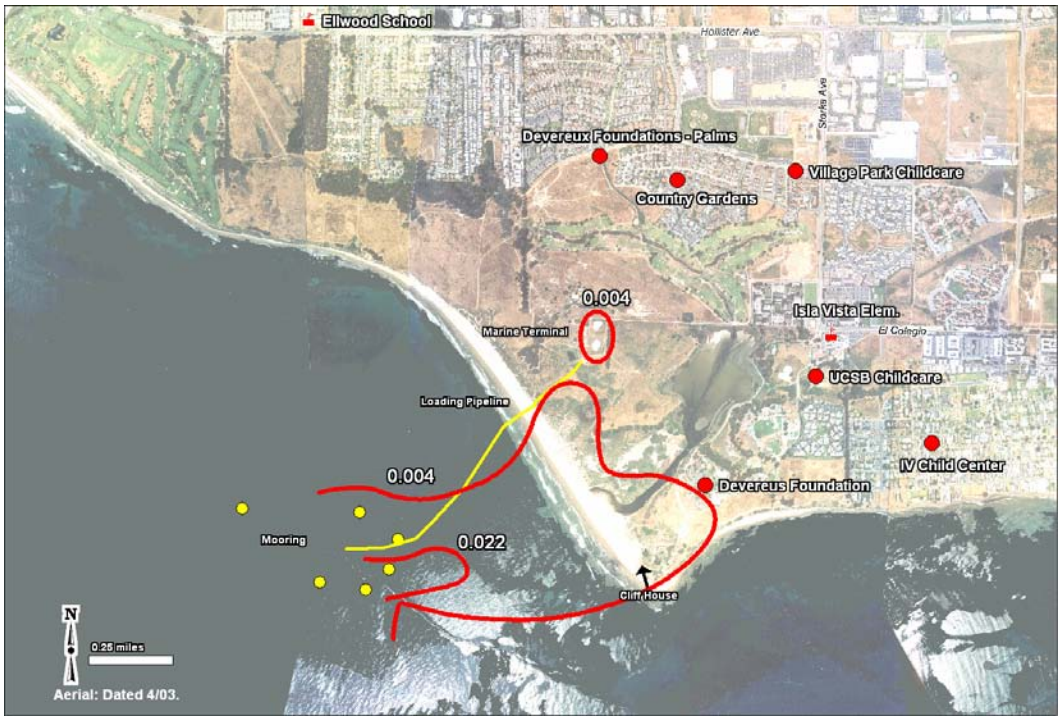


a. Current Operations

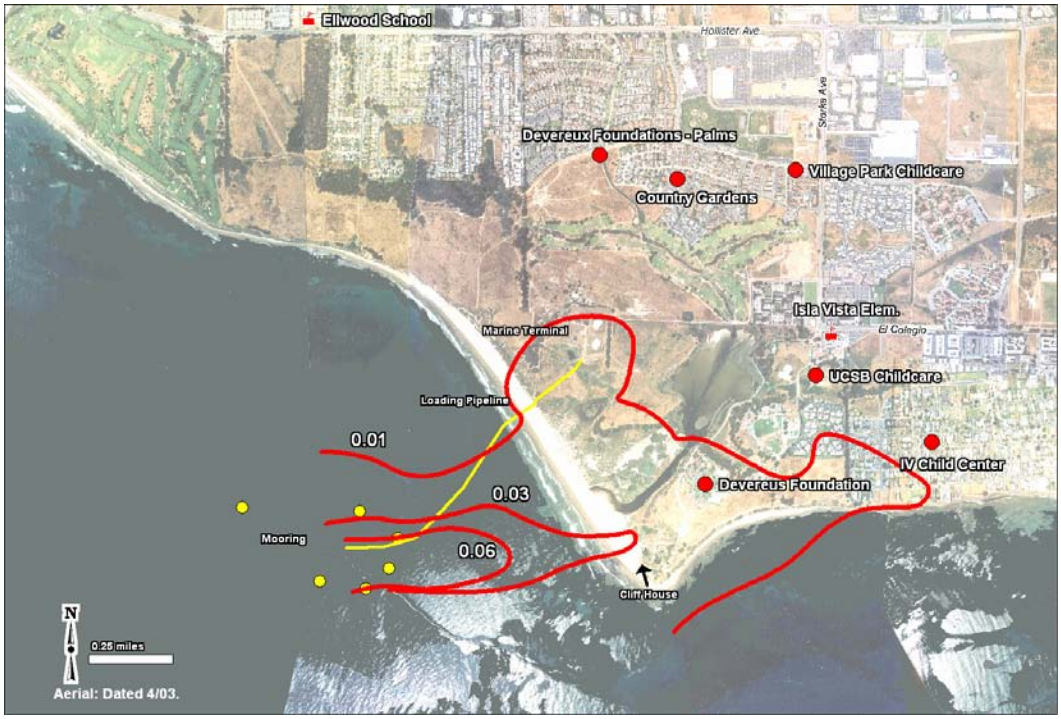


b. Proposed Project

Figure D-2
Chronic Health Index Isopleths

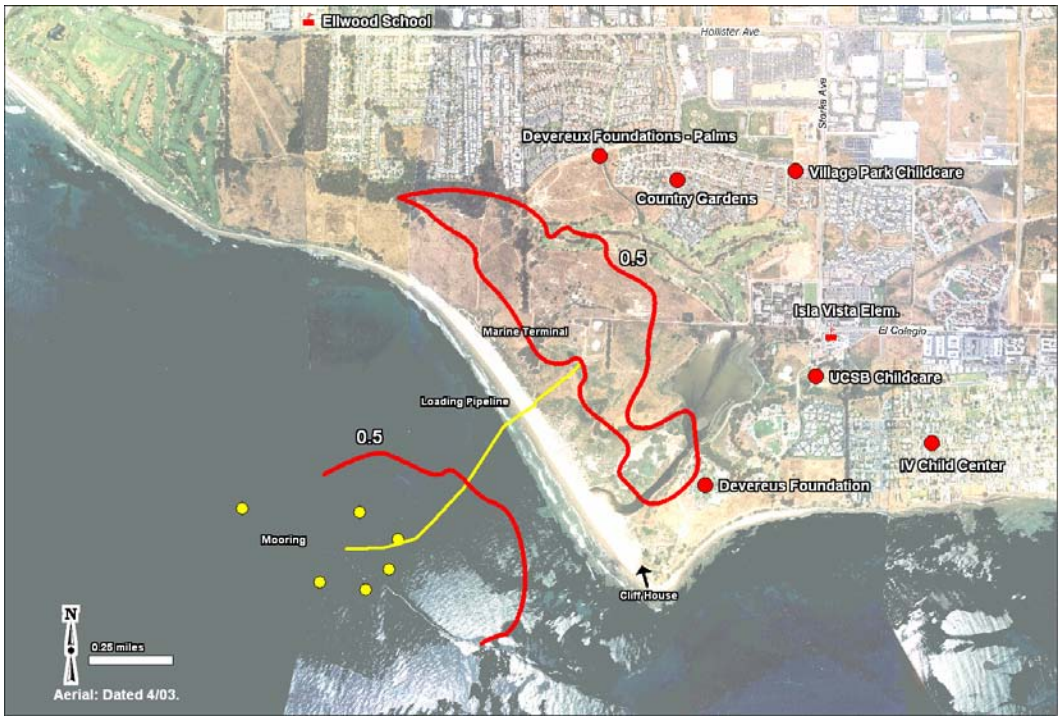


a. Current Operations



b. Proposed Project

Figure D-3
Acute Health Index Isopleths

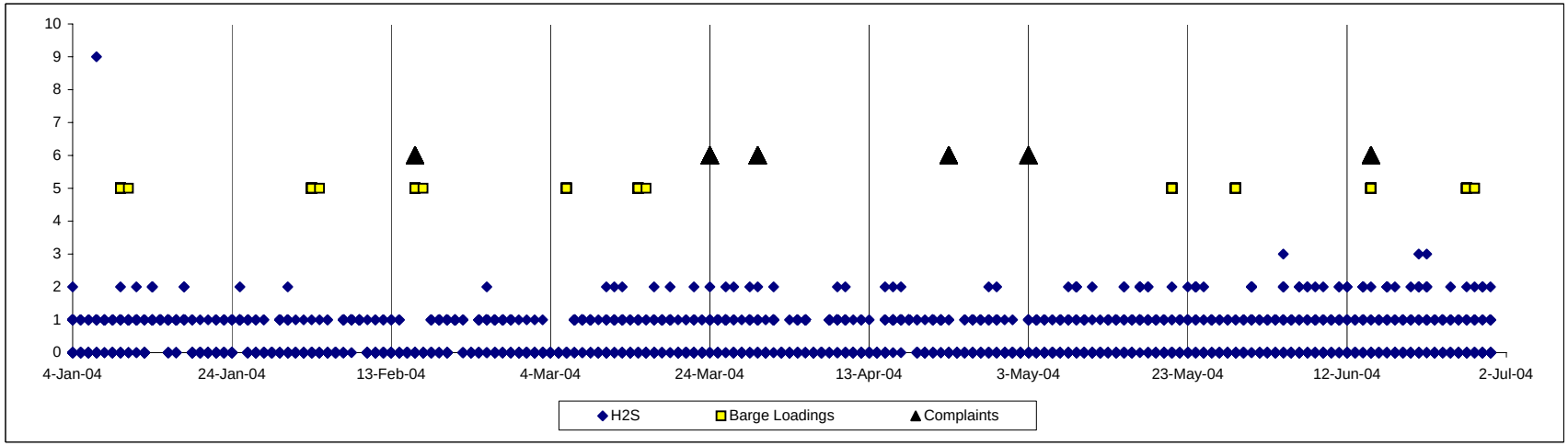
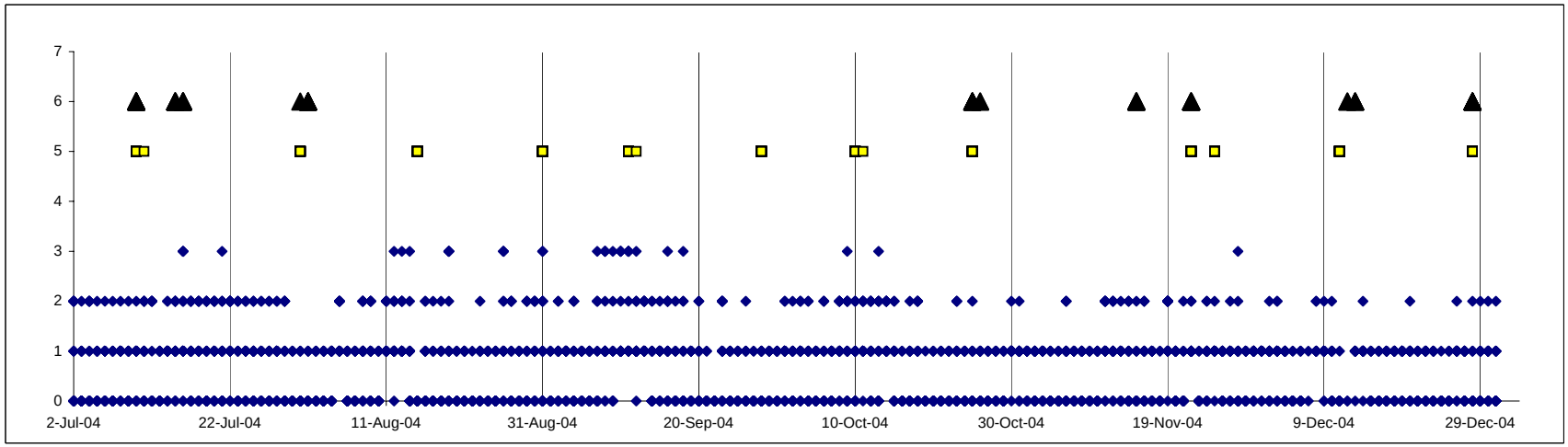


Current and Proposed Project

Figure D-4

Hydrogen Sulfide (H_2S) Concentrations as Measured at West Campus Met Station and Barge Jovalan Loadings vs. Recorded Odor Complaints for 2004

January through end of June 2004



July through end of December 2004